THE IMPACTS OF COMPUTING ON THE WORK OF MANAGERS, DATA ANALYSTS AND CLERKS

by

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Abstract*

The impacts of computer use on the character of jobs were studied through a survey of 1200 managers, data analysts (e.g., urban planners), and clerks in 42 municipal governments. Most respondents use computer-based reports and attribute job enlarging influences to computer use. Respondents also attribute increases in job pressure, but not closeness of supervision, to computing. These effects increase with the centrality of computing in one's work. Computer use has perceptible, but not dominant effects on the jobs of many people who use the technology. Overall, respondents report that computer use enlarges their jobs, but does not profoundly alter the character of their jobs.

Key Words: Work, Social Impacts of Computing, MIS

CR Category: 2.11

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Introduction

One of the most important technological developments of the last two decades has been the introduction of computer-based information systems into a wide array of organizations. Almost every large firm (e.g., revenues exceeding $100 million/year) and city or county government in jurisdictions with over 100,000 population uses some computer-based information systems [8]. While the growth and social organization of computing is of substantive sociological interest in itself [17,18], it also means that an increasingly large fraction of the white collar work force are having direct contact with computer-based records and reports. Scholars interested in work life -- its quality, social organization, and the role of technology in it -- have attended to computing over the years. Nevertheless, the sociological accounts of computing in white collar work are weak and conflicting.

There is no paucity of images to portray the effects of computing on work life. Mills [23] and Braverman [5], for example, indicate that computing routinizes white collar work and weakens the power of lower level participants in an organization. In contrast, Bell [1] and Myers [26] provide enthusiastic accounts of computing as an aid to "knowledge work." In particular, they emphasize the extent to which computer-based technologies enlarge the range and speed at which data is available. Myers, for example, concludes that, "computing will help relieve 'specialists and professionals' of
the time-consuming and repetitive parts of their work."

Despite the influence of these theorists, these accounts are relatively remote from empirical studies of computing. Over the last two decades, scholars have undertaken a variety of empirical studies of computing in the workplace [22, 13, 25, 34, 32, 3]. These studies of clerks, supervisors and managers vary in their findings. The earliest studies [13, 21] suggest that computing has relatively constant, and sometimes deleterious effects upon workers whose jobs depend upon the preparation and use of computer-based reports. More recent studies indicate variable effects of computing on the job characteristics of computer users. For example Whisler [34] indicates that managers' jobs are enriched by computer use while clerical jobs are more constrained.

Unfortunately, many of these studies are both theoretically and methodologically weak. Most scholars report qualitative case studies of a handful of organizations [13, 32, 3]. Whisler's [34] important survey uses but one manager in each firm to report on the impacts of computer use for employees at all organizational levels. In addition, computer use is treated as a dichotomous variable. Variations in the extent to which individuals use computing are systematically neglected. Most of these studies were viewed as "exploratory" by their investigators, and none use an explicit theoretical scheme to characterize jobs.
Many important questions are also left unresolved. These studies emphasize the effects of computing upon the work of clerks, supervisors, and their managers in white collar organizations (e.g., banks, insurance companies). However, computer use is becoming widespread, not only in clerical work, but also in a variety of more complex occupational specialties such as urban planning and police work. Existing studies cannot tell us whether the effects of computing in the work of other occupational groups parallels that of clerks, or their managers, or is different. Moreover, previous studies generally confound the impacts of computing on some work characteristic (e.g., pressure) and the level of that same characteristic in a job [34]. Simply to say that computing increases the level of pressure in a clerical job does not mean that clerks who use computers have highly pressured jobs.

This study examines the impacts of computing in the work of data analysts such as urban planners and accountants as well as managers and clerks. Using earlier empirical studies as a convenient point of departure, this study investigates the salience of computing to workers, the extent to which computing is perceived as having favorable (or unfavorable) influences on their jobs, and the extent to which computing is problematic for its users. While it was not designed to test a particular theory of the work impacts of computing, it does characterize jobs by a theoretically grounded set of features. Computer use is treated as an individual, rather than a dichotomized, organization-level variable. Lastly, the characteristics of
our respondents' jobs and their perceptions of the impacts of computing upon their jobs are both measured separately. Thus it is possible to empirically examine the extent to which the influences of computer use on job characteristics (e.g., closeness of supervision) alter the overall character of one's work.

Based upon the data presented here, we find that managers, data analysts (e.g., urban planners), and clerks attribute job enlargement to computer use, but that the impacts of computing differ within and across occupations. However, computer users sometimes find computer work problematic. Lastly, while our respondents attribute positive impacts on their jobs to computing, the influences of computing do not markedly change the character of their work.

**Job Characteristics**

Many observers have noted important links between an organization's technology and the working life of its participants. Some scholars argue that an organization's technology strongly influences its social organization, which in turn affects the behavior and attitudes of its participants [4,6]. Other scholars argue that job characteristics mediate between the use of a technology in the workplace and its effects upon individual behavior such as motivation, social contact, and job satisfaction [2,28]. This study examines the impacts of computing on work through computer users'
perceptions of its effects upon the characteristics of their jobs.

The Job Diagnostic Survey (JDS) [12] was selected to characterize jobs since it is based upon an explicit theory of organizational behavior [11, 12], has been extensively tested in a wide variety of organizations, is shown to be related to employee motivation and satisfaction [12, 28, 33], and variants of it are used in studies of technology in the workplace [28, 29, 2]. The JDS is based upon a theory that three psychological states determine an individual's motivation and satisfaction in a job. These states are: knowledge of the results of one's efforts, experienced meaningfulness, and experienced responsibility [12]. The JDS characterizes jobs with five "core dimensions" and a sixth supplementary dimension:

1. Skill variety. The degree to which a job requires a variety of different activities in carrying out the work.

2. Task identity. The degree to which the job requires completion of a whole and identifiable piece of work.

3. Task significance. The degree to which the job has a substantial impact on the lives or work of other people.

4. Autonomy. The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out.

5. Feedback from the job itself. The degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance.
6. Dealing with others. The extent to which a job requires that a person work closely with other people.

There is some evidence that workers who seek to realize "higher order needs" in their work (e.g., feel a sense of accomplishment, have opportunities for personal growth) will be more satisfied and motivated with jobs that are high on the JDS dimensions [11, 12, 18, 53]. Knowing the impacts of computing upon the JDS dimensions of jobs can help us infer how well workers will be motivated or satisfied with computerized jobs. If computerized jobs are "constricted" on the JDS dimensions, they will be less attractive to workers with "high order growth needs."

The JDS was altered to fit the demands of this study*. We included those JDS dimensions which were most likely to be altered by computer use, based upon prior studies, our fieldwork, and pilot testing of the survey. Each JDS dimension was tapped with one question, and one specialized meaning was selected for each dimension. Our version of the JDS includes the following six job dimensions:

* Job pressure was added to the core dimensions of the JDS since it has been reported as a salient impact of computing in prior studies [21, 22, 3]. Task identity was excluded since preliminary fieldwork indicated that it was rarely altered in automated operations. Lastly, a worker's autonomy can be altered by many different means, including increasing the closeness of supervision. Since previous studies have emphasized increases in closeness of supervision that accompany computer use [34], we have tapped (diminished) autonomy by examining changes in closeness of supervision.
1. (Skill variety) the number of things done in a job;
2. (Job pressure) time pressures in a job;
3. (Feedback from the job itself) sense of accomplishment in work;
4. (Dealing with others) opportunities to work with other people;
5. (Closeness of supervision) work is closely supervised;
6. (Task significance) influence over the actions of others.

Methodology

The data reported here were collected as part of a larger study of the role of computing in local governments. 42 computer-using American municipal governments were selected for intensive investigation in 1976*. The sample cities had populations over 50,000 and had an average of 64 automated files. Most of these applications were stable at the time of our study.

In addition to managerial and clerical tasks which could be found in most organizations, we selected semi-professional jobs in which workers were likely to use computerized information systems. Jobs requiring data analysis were good candidates and we selected three analytical tasks often found in municipal governments for intensive study: monitoring budgetary expenditures (accountants), analyzing police patrol

* The 42 municipal governments were selected in a random sample stratified on several dimensions including the number of automated applications, the sophistication of automated applications, the extent to which computer users are involved in the design of applications, and the extent to which computer operations are decentralized. See Kraemer, et al.,[20] for the detailed sampling design.
deployments (manpower analysts), and analyzing urban demographic data (urban planners). We chose traffic ticket processing as a representative clerical job and selected department heads as a group of managers.

Within each city, self-administered questionnaires were given to a random sample of managers, data analysts, and clerks. 1558 questionnaires were distributed and 85% were returned completed. Of those who returned questionnaires, 96% said they receive computer-based reports. Only these computer users completed the portion of the questionnaire dealing with the impacts of computing.

The survey instrument was designed to collect data about many aspects of computer use, including the the ways in which respondents perceived its influences upon the characteristics of their jobs. Respondents were asked two sets of questions about their work. In one set of questions, respondents were asked about the extent to which computer use altered specific job characteristics (increased, decreased, or no change). In another, they rated their jobs as poor, average or excellent on each job characteristic.

The salience of computing in the work of our respondents is discussed in the next section, and is followed by a discussion of the reliability of our survey data. Then we introduce our hypotheses about the impacts of computing on the jobs of managers, data analysts, and clerks and test them with our data.
Salience

It might appear that the character of occupational activities will be profoundly affected by computerization, but not all observers agree. Simon [31] for example, notes that "the effects upon the nature of work were difficult to detect," in his summary of the findings of several studies of computing in the workplace. However, many studies have implied that the effects of computing on the character of jobs is noticeable to respondents [21,13,25]. Our first question is "how salient are the effects of computing on job characteristics?"

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PLACE TABLE #1 ABOUT HERE

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Table 1 describes the perceived effects of computing on job characteristics for each occupational group studied. Computing salience, the extent to which respondents attribute alterations in their job characteristics to computing, is operationalized by the number of job characteristics altered by computer use. The distribution of computing salience appears in Table 2. For all roles, the respondents attribute alterations in two to three job characteristics to computer use.
<table>
<thead>
<tr>
<th>Job Characteristics</th>
<th>All (N=1059)</th>
<th>Managers (N=518)</th>
<th>Data Analysts (N=400)</th>
<th>Traffic Clerks (N=204)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>NC</td>
<td>I</td>
<td>D</td>
</tr>
<tr>
<td>Skill Variety</td>
<td>8</td>
<td>44</td>
<td>48</td>
<td>7</td>
</tr>
<tr>
<td>Job Pressure</td>
<td>22</td>
<td>50</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>Feedback from the Job Itself</td>
<td>4</td>
<td>47</td>
<td>49</td>
<td>3</td>
</tr>
<tr>
<td>Dealing with Others</td>
<td>4</td>
<td>65</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>Closeness of Supervision</td>
<td>9</td>
<td>78</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Task Significance</td>
<td>3</td>
<td>62</td>
<td>35</td>
<td>4</td>
</tr>
</tbody>
</table>

"Based on six questions which ask "Has computer use increased or decreased this characteristic in your work?"

Codes are: D = Decreased, NC = No Change, I = Increased
Reliability of Perceptions of Computing Impacts

Over 60% of the respondents in our study receive computer-based reports at least "a few times a week" and 40% receive them daily. We could simply assume that people who work more closely with computer-based systems would be more likely to view computing as a salient technology in altering their work [2]. However, there is some evidence that many people attribute positive benefits to computer use, independently of the extent to which it is used in their organizations or the extent to which its use is essential [9]. If our respondents held such biases, they would perceive impacts of computing on the character of their jobs independently of the centrality of computing in their work. Thus, a positive relationship between centrality of computing and computing salience adds support for the reliability of our data.

An index of computing centrality was constructed by calculating the average frequency with which a worker receives computer-based data. A moderate positive correlation between computing centrality and computing salience was found ($R^2 = .36$, $p < .001$). This association
### TABLE 2

Computing Salience

Percent Indicating Number of Altered Job Characteristics

<table>
<thead>
<tr>
<th># Job characteristics changed</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>All (N=1133)</td>
<td>21</td>
<td>16</td>
<td>17</td>
<td>16</td>
<td>13</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

Mean (S. D.) of Computing Salience by Role

<table>
<thead>
<tr>
<th>All (N=1133)</th>
<th>Managers (N=544)</th>
<th>Data Analysts (N=423)</th>
<th>Traffic Clerks (N=166)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4(1.9)</td>
<td>2.3(1.9)</td>
<td>2.6(1.9)</td>
<td>2.4(1.8)</td>
</tr>
</tbody>
</table>
provides additional trust in the perceptions of computing reported by our respondents*.

**Hypotheses**

**Job Characteristics**

It is reasonable to assume that when computer systems supplement existing information systems, workers will characterize their jobs as being enlarged (e.g., increased skill variety). Skill variety would increase because using computer-based reports adds new content and skills to the job. Similarly, specifying, obtaining, and interpreting computer-based reports may require consultation with computer specialists or colleagues, increasing personal contact (i.e., dealing with others). When computer-based systems are supplemental, they provide an additional resource (new information) which can be used to increase the effective influence of municipal staff, and thus increase their task significance. In addition, workers using computer-based systems often receive a wider variety of information about their tasks on a more frequent basis than do workers using manual records. Thus, they should receive somewhat clearer and more timely information about the accuracy and quality of

* The centrality of computing in a job may differ from the rate at which our respondents receive computer-based reports. Managers often receive reports that they don't read immediately. In contrast data analysts may continually refer to a report which they receive infrequently. Thus, our computing centrality measure is imperfect and one should not expect a very large association between it and computing salience, even when the underlying relationship is strong.
their work, thereby increasing feedback from the job itself.

We summarize these suggestions that computer use should be job enlarging in the following hypothesis:

Hypothesis 1a: Respondents will attribute increases, more often than decreases, in task significance, dealing with others, skill variety, and feedback from the job itself, to computer use.

Because the collection and processing of data on a regular basis entails the coordination of several work groups sharing common equipment [19], computer use often imposes tight deadlines on data providers. Scheduling delays will occur if they fall behind or if the computing equipment is unreliable or overloaded. Thus, we might expect:

Hypothesis 1b: Respondents will attribute increases in job pressure to computer use.

It is often assumed that when automated information systems become available, that managers and line supervisors exploit them to enhance their control of the different resources, particularly their subordinates' activities [7,34]. Episodes illustrating such uses (or attempts) can be found in many computer-using organizations [14]. Both the image of computing as enhancing the rationalization of white collar work [23,13], and reports by managers that they were losing autonomy [25] support this intuition. We summarize this suggestion in the following hypothesis:

Hypothesis 1c: Respondents will attribute increases in closeness of supervision to computer use.
Turmoil

Computer use brings many workers into extended contact with the computing world of their own organizations, and with specialized service providing units. New computer users must learn what local systems can do, deal with computer specialists in designing new systems, get reports in a timely manner from the computer operations department, etc. [19]. These contacts are sometimes problematic when there are misunderstandings or when expectations are not met [15].

Hypothesis 2: Respondents will report frequent difficulties in utilizing computer-based systems.

Variations in the Perceived Effects of Computing

Whisler [34] has noted that managers report more positive experiences with computing than do clerks. Whisler's finding should not cause suprise, since managers usually have greater influence over the design and use of computer-based systems than do clerical workers. Thus they are in a stronger position to insure that computerized systems enhance their work styles. Despite its face validity, Whisler's data about the effects of computing on clerical work are based upon the perceptions of one manager in each of the insurance firms he studied. Thus, it is worthwhile to see if his findings are supported by contrast between the self-reports of managers and clerks.
Hypothesis 3a: Managers will attribute more positive alterations in job characteristics to computing than will clerks.

In addition, data analysts should perceive different effects of computing upon their jobs than would clerks or managers. For analysts, data is a particularly critical resource that can enhance their credibility and influence over others. Clerical workers usually receive little new information with computer-based systems, and work within narrowly circumscribed domains of authority. Managers, on the other hand, have relatively broad domains of authority which are less contingent upon their access to data. Within their own departments they can alter programmatic and staffing arrangements without necessarily having access to quantitative data. For analysts, access to faster or more comprehensive data sources is likely to be a more critical resource in extending their effective authority. Budget analysts are in better position to audit departments when they have up-to-date ledgers which breakdown expenditures into fine categories. Planners can present more convincing analyses to a city council by displaying quantitative data which is harder to contest, but hard to analyze without computerized files and programs [14].

Hypothesis 3b: Data analysts will attribute greater increases in task significance to computer use than will managers and clerks.

This hypothesized increase in task significance may not be an unalloyed blessing. Data analysts often prepare reports and special analyses for other municipal staff.
Beliefs that computer-based analyses should be easy to produce ("at the push of a button") lead to increased expectations of rapid reporting, and resultant increases in time pressure. Data analysts are often willing to respond to special requests, rather than forego them, because they increase their opportunities for influence. But they can be expected to suffer differentially greater increases in time pressures from computing as a result.

Hypothesis 3c: Data analysts will attribute greater increases in job pressure to computer use than will managers and clerks.

Dominance

Most investigators characterize computerized workplaces in terms of the alterations made by computing. When they describe workers who lose autonomy because of computer use, they imply that those workers have very constrained jobs [34]. These accounts implicitly treat computing as a dominant feature in the worklife in computerized organizations. Other observers suggest that computing often has negligible effects [32,31,3]. These conflicts can be resolved in our data by studying the correlations between the impacts attributed to computing on a given job dimension (e.g., task significance) and the level of of that same JDS dimension in our respondents jobs. If computing use dominates the jobs of our respondents, we would expect large positive correlations.
Hypothesis 4: Measures of the perceived impacts of computing on a given JDS dimension will be positively correlated with measures of that same JDS dimension in a given job.

Findings

Many of our hypotheses will be tested with marginals aggregated from the questionnaires. With our sample sizes that range between 200 traffic clerks and 500 managers, small differences between distributions will be statistically significant at acceptable levels. In comparing any two distributions of work impacts attributed to computing (e.g., Table #1), differences as small as 1% between the responses of two different occupational groups will lead us to accept the hypothesis that they are drawn from different distributions at the .01 level using Chi Square or Kolmogrov-Smirnov statistics. Most of the contrasts of interest in this study are thus easily accepted at the .01 level. In the following discussion, contrasts can be assumed to be statistically significant at the .01 level, unless otherwise noted. It is more important, and more difficult, to interpret the magnitude of the responses, than simply to accept or reject hypotheses about differences in distributions.
Computing and Job Characteristics

Over 40% of the managers, data analysts, and clerks attribute increases in skill variety and feedback from the job itself to computer use. Over 30% of managers and data analysts attribute increases in task significance and dealing with others to computing; about 20% of the clerks report similar effects of computer use. Few respondents report that computing diminishes these qualities in their jobs. One exception is 15% of the traffic clerks who attribute decreased skill variety to computer use. This data supports Hypothesis 1a that workers are more likely to attribute job enlarging, than job diminishing characteristics to computing.

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PLACE TABLE #3 ABOUT HERE

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Perceptions of computer impacts increase with the centrality of computing in one’s work (Table #3). Increases in skill variety, feedback from the job itself, dealing with others and task significance are consistently associated with increasing levels of computer use for managers and data analysts. For clerical workers, the same association between computing centrality and job enlargement holds, but the relationships are weak except for skill variety and dealing with others. In summary, workers attribute job enlarging influences to computing and more often under conditions of
TABLE 3

Associations between Computer Impacts on Job Characteristics and Computing Centrality

<table>
<thead>
<tr>
<th>Jobs</th>
<th>All (N=1079)</th>
<th>Managers (N=520)</th>
<th>Data Analysts (N=400)</th>
<th>Traffic Clerks (N=159)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skill Variety</td>
<td>.19***</td>
<td>.18***</td>
<td>.26***</td>
<td>.27***</td>
</tr>
<tr>
<td>Job Pressure</td>
<td>.11***</td>
<td>-.05</td>
<td>.32</td>
<td>.12</td>
</tr>
<tr>
<td>Feedback</td>
<td>.22***</td>
<td>.30***</td>
<td>.21***</td>
<td>.10</td>
</tr>
<tr>
<td>Dealing with others</td>
<td>.15***</td>
<td>.26**</td>
<td>.13**</td>
<td>.22**</td>
</tr>
<tr>
<td>Closeness of Supervision</td>
<td>-.01</td>
<td>.07</td>
<td>-.01</td>
<td>-.09</td>
</tr>
<tr>
<td>Task Significance</td>
<td>.13**</td>
<td>.24**</td>
<td>.16***</td>
<td>.13</td>
</tr>
</tbody>
</table>

*** ≦ .001  
** ≦ .01  

high computing centrality than under low computing centrality.

Attributions of increased job pressure to computer use (Table #1) support Hypothesis 1b (p<.01). However, many respondents, particularly managers and traffic clerks, attribute decreases in job pressure to computer use (Table #1). For data analysts we find a positive association (R=.32, p<.001) between computing centrality and job pressure (Table #3).

Earlier, we suggested that workers might attribute increases in job pressure to computing because of delays in acquiring data from other units or in the processing of data in the local computer center that would compromise their abilities to meet deadlines. These delays may increase job pressures.

Only 12% of our respondents attribute increases in their level of supervision to computer use (Table #1). Also, clerks are slightly more likely to attribute decreases in closeness of supervision to computing than increases! This finding may surprise. It clearly contradicts the literature on computing in the workplace which leads one to expect computing and closer supervision to develop together.

The contingencies of different jobs and the ways in which information systems are used help us understand these patterns. In some of our field studies, we found
computer-based reports used to monitor the workloads of detectives, property appraisers, and social workers. However, usually such data is available in manual records as well and is simply spun off as a by product of the computer-based systems (e.g., a client-tracking welfare system). First line supervisors often have some concept of the relative quantity and quality of the work produced by their staffs. Planners are assigned work on particular projects and their reports are reviewed by higher level staff; accountants work on particular projects or with particular accounts. Much of the work is carried out in small groups where supervision can be informal and close. Even when formal measures of worker productivity may help supervisors, their explicit use seemed to produce resentment, suspicion, and controversy over the meaning of the data on the few occasions we saw them used.

In addition, the information systems used by most of our non-clerical respondents are not well tailored to providing much information about their work style, or the quantity or quality of their work. Ledgers do not record the activity of an accountant, and demographic data bases do not record the activities of planners who use them.

Lastly, some of these automated systems do enhance the control of one group over another [14], but it is usually not the control of workers by their immediate supervisors. Rather, accountants in central budget units are surveilling
the expenditures of line departments, and traffic ticket systems help municipal staff catch scofflaws. While organizational control may be increased, it does not necessarily materialize as additional constraints placed upon the work life of the agents of control.

In summary, many of our respondents attribute alterations in their job characteristics to computer use, and most of these alterations are job enlarging. Increases in job pressure are also attributed to computer use. These alterations are also positively associated with computing centrality. Relatively few respondents report alterations in closeness of supervision to computer use.

Turmoil

Our account of computing presented to this point indicates that the technology has noticeable effects, and that these are often viewed as positive by a variety of white collar workers. In other survey questions, a majority of respondents indicated that computing helped improve the timeliness and range of data they could get.

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PLACE TABLE #4 ABOUT HERE

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<table>
<thead>
<tr>
<th>Problems</th>
<th>Disagree</th>
<th>Somewhat Disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data processing staff confuse our conversations with their technical</td>
<td>42</td>
<td>20</td>
<td>28</td>
<td>10</td>
</tr>
<tr>
<td>language (N=831)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foul-ups in day-to-day computer operations (N=824)</td>
<td>27</td>
<td>63</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Slow response of data processing to requests for information (N=877)</td>
<td>28</td>
<td>38</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>Difficulty in getting priority in using the computer (N=811)</td>
<td>33</td>
<td>33</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Difficulties in accessing computer-based data gathered or held by other</td>
<td>44</td>
<td>28</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>departments or agencies (N=699)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent technical and organizational changes in data processing</td>
<td>48</td>
<td>31</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>services (N=753)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*aNumbers indicate fraction of sample responding in each category.*
All this should make us think of computing as a graceful information processing instrument. Such a portrait is not in accord with the understandings of computer use we gained in interviews with our respondents, or with other data collected in the survey. Computer users report difficulties in their interactions with computer specialists, difficulties in getting access to data and finding reliable service (Table #4). No one problem is overwhelming. Only 20-35% of our respondents report frequent difficulty with any one problem, but most computer users face some difficulties.

The introduction of computing causes no difficulty only when (1) The automated system is designed to provide appropriate and timely data in a usable manner; (2) the data is in fact in the system, and is accurate; (3) the computer system is working; and (4) the staff responsible for computer operations handle the requests for information properly. Few of these conditions can be met continually given the complex work demands made upon the computer specialists responsible [15]. Automated systems are sometimes inappropriately designed. For example, there are purchase order processing systems which do not allow for discounts on early payments. And it is common for municipal accounting systems to organize transaction data so that it usable by a comptroller who is concerned that expenses be charged to appropriate accounts, but not by a municipal budget officer whose staff must insure that departments do not overspend their fiscal allotments which are derived from
many accounts. In addition, urban planners often have difficulty gaining appropriate computing support from the municipal computing staff who are skilled in data processing rather than demographic analysis.

Given the complex conditions required for computer systems to run smoothly, it should not be a surprise that sometimes they do not. The turmoils of computing are commonplace and salient to computer users, but do not dominate their work settings [19].

**Variations in Perceived Effects of Computing**

Of all workers, clerical workers are most likely to report that computer use has decreased their skill variety (15%), and their opportunities to work with people (10%). In addition, managers attribute more positive influences of computer use on their skill variety ($X^2=12.7$, $df=2$, $p<.01$), task significance ($X^2=31.7$, $df=2$, $p<.001$), and dealing with others ($X^2=26.3$, $df=2$, $p<.001$) than do clerks. These findings are consistent with those reported by Hoos [13] and Whisler[34] and support Hypothesis 3a.

However, more clerks report that computing enhances their work (e.g., increases their skill variety) than report that computing diminishes the richness of their work roles and opportunities (Table #1). Thus, while there are discernible differences between workers at different positions in the organizational hierarchy, clerks are not
badly served by computer use. They are simply not best served.

**Dominance**

Many scholars who have investigated the role of computing in work have tacitly implied that if computing altered some job characteristic (e.g., increased pressure), then the jobs were best characterized by that feature (e.g., highly pressured)[34]*. This reasoning is, of course, specious. Each respondent was asked about the level of each job characteristic in his own work (independent of computing) on a three point scale (poor, average, excellent)(Table #5).

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PLACE TABLE #5 ABOUT HERE

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To test Hypothesis 4, correlations were computed between each measure of work impact with each work environment characteristic. For all respondents as a group, the largest correlation is between the extent to which computing increases one's task significance and the extent to which one rates one's job as characterized by a high level of task significance (*R* = .22, *p* < .001). The next largest correlations are between alterations in job pressure and overall job pressure (*R* = .10, *p* < .001) and between alterations in feedback

* For an exception, see Stewart[32].
### TABLE 5

**Overall Job Characteristics**

<table>
<thead>
<tr>
<th>Opportunities to:</th>
<th>All (N=1268)</th>
<th>Managers (N=615)</th>
<th>Data Analysts (N=453)</th>
<th>Traffic Clerks (N=200)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P</td>
<td>A</td>
<td>E</td>
<td>P</td>
</tr>
<tr>
<td>Skill Variety</td>
<td>5</td>
<td>33</td>
<td>63</td>
<td>2</td>
</tr>
<tr>
<td>Job Pressure</td>
<td>32</td>
<td>55</td>
<td>14</td>
<td>38</td>
</tr>
<tr>
<td>Feedback from the job</td>
<td>6</td>
<td>38</td>
<td>56</td>
<td>4</td>
</tr>
<tr>
<td>Dealing with others</td>
<td>3</td>
<td>28</td>
<td>69</td>
<td>0</td>
</tr>
<tr>
<td>Closeness of supervision</td>
<td>4</td>
<td>46</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td>Task significance</td>
<td>7</td>
<td>43</td>
<td>50</td>
<td>2</td>
</tr>
</tbody>
</table>

*a Based on a series of questions asking "How well does your job provide each characteristic?"

*b Codes are: P = poor, A = average, E = excellent
from the job itself and overall feedback from the job itself ($R = .10$, $p < .001$). The other correlations between altered job characteristics and the overall level of the same characteristic in a job were all less than .06. Despite its salience, the repercussions of computer use do not dominate our respondent's jobs, aside from possibly altering their task significance, job pressure, and feedback from the job.

Such a conclusion need not surprise. There are many elements of work -- its contingencies and social organization -- which influence its punctuatable features such as job pressure and task significance. Job characteristics vary considerably with one's position in an organization. Managers report considerably more task significance, greater skill variety, and greater feedback from the job than do clerks (Table #5). Data analysts rate the quality of their jobs on these JDS dimensions intermediate between those of managers and clerks (Table #5).

While computing use often seems to have a beneficial role in the work life of our respondents, it is not a potent force in shaping their jobs. Some technologies, such as assembly lines, alter the character of jobs from craft fabrication to more routinized jobs in which workers lose control over the pace and style of their work. Such technologies are a potent social force since they give rise to new forms of work organization. In contrast, few of the jobs of our computer using respondents have been dramatically
Conclusions

This study shows that computing is viewed as a salient technology by managers, data analysts, and clerks who utilize it regularly. For some, computing has substantially increased the ease with which they can obtain valued information and made possible more complex data analysis. For others, it has had little utility. This study indicates that white collar workers in several different occupational specialties attribute clear, often positive, influences to computing in their jobs. Computing use also seems to moderately increase the level of task significance and job pressure in their work.

Our findings support those of Whisler [34] who indicates that managers are better served by computing than are clerks. But even traffic clerks in this study more often attribute job enlarging than job diminishing influences to computing. Our data lends no support for analysts who argue that the dominant effect of white collar computer use is to diminish the quality of working life. On the contrary, our data support claims that computer use often enlarges the jobs of workers who use the technology. And, the computer-based information systems studied here do not appear to be used to increase closeness of supervision. The detailed patterns and levels of impact vary from one occupational specialty to
another and can best be understood in terms of different work contingencies and information system designs. In addition, the technology is not always easily implemented -- difficulties in getting data, dealing with computer specialists, the computing services organization, and the technology itself all add minor and continual turmoil to the workplace. But overall, the technology does not dramatically change the character of work. Rather, it has a benign, and minor influence on the work of these computer users.

These findings differ from those reported by scholars such as Whisler[34] and Hoos[13] and they open up new avenues of research. This study indicates that computing and supervision do not necessarily go hand in hand, but little is known about the conditions under which computer-based systems are used to increase supervisory control. This study examined the impacts of computing on the job characteristics of data analysts. As computer use becomes more widespread, and is used routinely as an instrument in many occupational specialties, the utility of studies of managers and clerks for extrapolation to other occupational groups will diminish. Lastly, studies of the role of computing in the workplace have been remarkably atheoretical. Good theory building can benefit from descriptive studies of high quality. But it is not too early to begin developing theories of the role of computing in a broad array of work settings.
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