Individual Adjustment to Information-Driven Technologies: A Critical Review

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Abstract

Little is currently known about the process of individual adjustment to information technology innovations. This article reports the results of a critical review of the literature, using an interactional psychology framework. In the past, researchers have focused on the limited themes of stress and attitudes. The indicators of individual adjustment emphasized in past research are strain symptoms and general job satisfaction. The proposed interactional framework represents a more comprehensive approach incorporating organizational, work group, and job factors that affect individual adjustment. The range of individual adjustment indicators should be broadened to include facets of satisfaction, organizational commitment, job involvement, and performance. By adopting this framework and refining the process used by researchers in studying individual adjustment, a better match between research issues and problems faced by managers will be achieved.

Keywords: Computing technology, stress, productivity, satisfaction, individual adjustment

ACM Categories: H.1.2, K.4.2

Introduction

The adoption of new information technology in the workplace has become a transition experience common to most organizations. The success of these endeavors depends as much upon the nature of the individuals within the organization as on the technology itself. Technological innovation is not solely a technical change; rather, it is social change affecting the behaviors of individuals and groups within the organization, and it is structural change that alters the information flows and work designs of the organization (Mumford, 1983; Tichy, 1982). The complexity of introducing new information technology in the workplace thus requires that organizations manage the change in the technical, social, and structural subsystems. Because the technical aspects of innovation are engineering-related problems, managers and designers tend to focus more readily on technical aspects than the social or structural dimensions of change (Mayer, 1982).

Interestingly, the current state of the literature indicates that we know relatively little about the ways in which individuals adjust to information-related innovations. The purpose of this article is to review and critically analyze our knowledge of individual adjustment. Specifically, the review focuses on the identification of personal and situational factors that affect individual adjustment to new workplace technologies. The identification of these factors is important to managers, who must create a work environment that is conducive to individual implementation of innovation. To accomplish this critical review, a framework must be adopted to evaluate previous research.

Many studies have called for such a comprehensive framework: "To achieve productivity gains, and to improve the quality of working life, it may therefore be more appropriate to consider the application of new technology in the wider context of organizational design" (Buchanan and Boddy, 1982, p. 10). Information-related innovations demand "increased attention to the influence of job design, training, and work organization on the performance of such systems" (Buchanan and Bessant, 1985, p. 307). New technology must not be considered in isolation; "it has to be treated as part of the total psychological working environment" (Agervold, 1978, p. 152).
Both researchers and practitioners have expressed disappointment with the "simple impact models," which do not capture the complexities of the innovation process (Turner, 1984). Previous research, while calling for a comprehensive framework, has not undertaken the task of developing a model for organizing research efforts. Perhaps the most compatible approaches are the web models of computing proposed by Kling and Scacchi (1982), which make clear connections between a technology and its social and political environments, and the molar approach suggested by Frese (1989). While such models do yield richer representations of socially complex technologies, they are macro in focus.

Interactional psychology provides an appropriate conceptual and theoretical basis for examining the literature on individual adjustment. It approaches the explanation of behavior by emphasizing a continuous, multidirectional interaction between persons and situations (Terborg, 1981). Thus, persons and situations are joint determinants of attitudes and behavior, and both objective situations and subjective interpretations of the situation by the individual are important (Schneider, 1983). Situations vary in terms of cues, rewards, and opportunities, and individuals vary in cognitions, abilities, and motivation. Terborg (1981) states four basic propositions of interactional psychology:

1. Behavior is a function of a continuous process of multidirectional interaction between the individual and the situation.
2. The individual is an intentional, active agent in the interaction process, being changed by both situations and changing situations.
3. On the individual side of the interaction, cognitive, affective, and motivational factors, along with abilities, are essential determinants of behavior.
4. On the situational side of the interaction, the determinants of behavior are the psychological meaning of the situation for the individual and the behavior potential of the situation for the individual.

Currently, much debate exists concerning the relative predictive power of dispositional versus situational variables (c.f. Davis-Blake and Pfefo, 1989; Gerhart, 1987; Staw and Ross, 1985). While the issue remains unresolved, it is generally accepted that both situational and personal variables in complex combinations affect attitudes and behavior.

An Interactional Model for Individual Adjustment Research

Figure 1 presents an interactional approach to research on individual adjustment to technological innovation with a comprehensive perspective. A central tenet of the field or organizational behavior is the notion that organizational context, work group attributes, job characteristics, and individual characteristics affect individual attitudes and behavior (Brouseau, 1983). In addition, researchers on information systems have called for models that examine individual, group, and organizational influences (Markus and Robey, 1988). This interactional model suggests that to represent individual adjustment we must turn out attention to the situational variables (organizational, work group, and job factors) and personal variables (individual characteristics) that affect individual attitudes and subsequent adjustment and also to a broader range of outcome variables.

Before turning to the components of the model, it should be noted that the empirical studies as a whole point to certain trends. First, the studies come from a wide variety of disciplines: industrial engineering, social psychology, human resource management, psychiatry, information systems management. Second, the studies represent many national origins, including the U.S., Great Britain, Scotland, Australia, Sweden, and Israel. Third, computerization is the focus of the bulk of the research, while other types of information-related innovations have received less attention. Fourth, most of the studies have conspicuously neglected work behavior as an outcome variable, focusing instead on affective states of individuals. By examining the work in each of the components of the model, we can identify gaps in our knowledge to be filled with future studies. The Appendix presents a summary of the major field studies on individual adjustment. This summary contains the situational and personal influences considered and the outcome variables addressed. The major criterion for inclusion in the review was that the study's focus be on individual-level adjustment outcomes (as opposed to more macro-level organizational outcomes).
Organizational context factors

A primary situational influence on individual adjustment consists of the organizational context in which an individual works. Amick and Ostberg (1987) note that while some studies have focused on organizational variables as important determinants of how technology is implemented, few studies have examined the role of organizational factors in determining individual attitudes and behavior. As shown in the Appendix, this literature review supports Amick and Ostberg's contention. Only a handful of studies that focus on individual adjustment to information-driven innovations have included organizational-level constructs.

Those organizational variables that have been included in empirical studies or proposed in conceptual/review papers are climate-related and structural. Climate-related factors that have been studied center around themes of supportiveness of climate (Majrchzak and Cotton, 1988; Nelson and White, 1988), management objectives (Buchanan and Bessant, 1985; Chao and Kozlowski, 1986), and planning adequacy (Ginzberg, 1981; Gutek and Bikson, 1985). The results of these studies suggest that a supportive climate and thorough planning facilitate individual adjustment and that managerial objectives may work to facilitate or to constrain individual productivity (Buchanan and Boddy, 1982; 1983). Several conceptual papers have proposed other factors
related to organizational climate as potential influences on innovation success, including organizational politics (Cheney, et al., 1986), institutional leadership (Van de Ven, 1986), trust and confidence in management (Kaye and Sutton, 1985), and a general organizational culture concept (Morieux and Sutherland, 1988).

These variables share two characteristics: (1) they are oriented toward the organization's climate and (2) their conceptualization is vague, thus making measurement difficult. To operationalize the climate factors, more specific variables must be proposed. The need for greater precision becomes particularly challenging to address when applied to the variable of organizational culture. The organizational change literature indicates that a culture that rewards innovative and creative behavior will encourage individual adjustment, while a culture emphasizing conformity may inhibit adjustment (Burke, 1982; Kanter, 1983). Entrepreneurial spirit, idea champions, and bootlegging are concepts widely espoused by the popular management literature. It has been suggested, however, that new technology is not only a product of culture but also that innovation brings with it new artifacts of culture such as hardware, software, workstations, and communications facilities (Morieux and Sullivan, 1988). Perhaps an examination of the replacement of existing cultural artifacts with those artifacts associated with new technology is a starting point from which deeper levels of understanding about levels of culture can be derived (Schein, 1985).

Structural factors have also been included in empirical studies. Many of these factors fit a theme of organizational control. Irving, et al. (1986) found that employees working under a computerized monitoring system reported perceptions of greater organizational control than employees who did not work with such a system. In contrast, Agervold (1987) found no differences in perceived managerial control between VDT users and non-users. A study by Fleisher and Morell (1985) is illustrative of the complexity of the control issue. Their finding was that some organizational units perceived more centralized control following office automation, while other units perceived decentralization of control.

There are other structural factors that have been proposed in the conceptual literature as essential to successful innovation. Two commonly suggested factors are flexibility (Blackler and Brown, 1986; Tushman and Nadler, 1986) and environmental scanning capability (Aaker and Mascarenhas, 1984; Delbecq and Mills, 1985). Other factors related to structure and thought to contribute to individual adjustment include reward systems (Kaye and Sutton, 1985) and number of hierarchical levels in the structure (Amick and Ostberg, 1987).

The climate and structural factors that have been incorporated in empirical studies are perceptual in nature; that is, researchers have measured individuals' perceptions of these organizational context factors. The interactional approach proposes that both the subjective meaning of the situation and the objective situation should be measured. Organizational theory proposes that the major contextual factors are size, technology, environment, goals, structure, and strategy (Daft, 1989; Galbraith, 1977). While structure and goals (i.e., management objectives) have been included in previous studies, the other contextual factors have received comparatively less attention. Future research should address these variables in an objective fashion and examine their impact on individual adjustment. For example, the implementation process in a large, bureaucratic organization in an uncertain environment may provide a much different experience for individuals than a similar transition in a small, entrepreneurial firm in a stable environment.

To suggest that the existing technology of an organization affects innovation is to suggest the obvious; however, existing technology is often attended to in a "lip-service" fashion in both case histories and field studies. The individual's experience with previous technology becomes particularly salient when the innovation under consideration is computer-related. Individuals who have worked with a computer possess more positive attitudes toward computer-related innovations (Millman and Hartwick, 1987; Nelson and White, 1988; 1989). The recognition of existing technology in the organization goes beyond the mere technical aspects of performing a task; rather, if one views technology as a pattern of social relationships as suggested by Blackler and Brown (1986) and Kling (1982), the importance and complexity of this variable increase immeasurably.

In summary, both climate-related and structure-related variables have been identified as impor-
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tant to implementation success. It is suggested here that additional organizational context variables be treated as situational influences upon the attitudes and behaviors of individuals experiencing technological transitions. In addition, both the psychological meaning of the organizational context and the objective context should be examined. Within the organization, there are also work group factors that are situational influences in the adjustment process.

Work group factors

Perhaps the most neglected influence on individual adjustment to new technology is that of the work group. Alterations in work groups may begin even before the organization implements the innovation (Billings, et al., 1977). The Appendix shows that among the major pieces of empirical research reviewed, only a few specifically examined work group attributes. Gutek, et al. (1984) focused on offices (a group of four or more people occupying at least two hierarchy levels and united by a common task, process, or goal) as groups in their study of computer-based information technology. Their finding was that workers believed their individual efforts had less effect on the organization than the efforts of their office; consequently, Gutek, et al., argue that productivity efforts aimed at the group level may produce greater benefit than those aimed at the individual worker.

Kraut, et al. (1989) found that service representatives' satisfaction with the work group declined one month following the transition to the automated record system. Interviews indicated that this resulted from the changes in social interaction that accompanied new physical arrangements and restricted physical movement in the job. Satisfaction with the work group increased three months after the system's introduction, indicating that the work group had adapted to the new arrangements. Zuboff (1982) also examined alterations in communication patterns within work groups. In her study of computer-mediated work, it was found that within-group interactions were diminished because work was no longer collective or synchronous.

Nelson and White (1989) examined the relationship between individual attitudes toward change, attitudes toward working with a computer, and group characteristics in their study of library automation. Their finding was that in the initiation stage when the automation transition was pending, group openness and high group morale were positively related to attitudes toward change, while group goal clarity and cohesion were positively related to attitudes toward working with computers. Group pressure was negatively related to both attitudinal variables.

The literature on group behavior suggests that there are several work group variables that may affect individual adjustment to technological change. Work groups place strong conformity pressures on members. The norms and values of highly cohesive work groups tend to be strongly ingrained and less adaptive; therefore, members of cohesive groups may perceive any change as threatening to the group (Janis, 1982). Group-level problems such as inertia, conformity pressures, and incompatible preferences are challenges for managers in organizations facing technological change (Van de Ven, 1986). Even if individual group members' attitudes toward the innovation are favorable, fears of losing the group's identity may override the individual attitudes (Shaw, 1981). Individuals may be assigned to different work groups or to multiple project-oriented work groups following technological innovation.

The focus of power and politics is particularly salient for studying the influence of work groups on individual adjustment (Ginzberg, 1980; Keen, 1981). Groups that hold expert power due to their technical expertise may fear loss of this power when technology becomes available to other groups. Group boundaries are often reinforced by technical expertise and the in-group language that is not shared by outsiders. The threat of loss of this special status may affect individual attitudes toward innovation.

Group characteristics may, however, facilitate individual adjustment to innovation. In a study of innovative vs. non-innovative work groups, it was determined that certain factors encouraged innovative behavior. The innovation-enhancing characteristics identified were active collaboration within the group, an absence of reliance on others outside the group, and supervisors who were less creative but more critical in terms of evaluation of innovative ideas (Farris, 1981). Work groups may thus encourage or undermine adjustment on the part of the individual.

Group factors comprise an important situational influence on individual attitudes toward innova-
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Individual adjustment does not occur in isolation; rather, it is a process that is full of social cues, and undoubtedly many influences on behavior come from the individual's experience within the work group.

Job characteristics

The component of the interactional model that has received the lion's share of research attention is job characteristics. Many of the previous studies of individual adjustment to innovation have cast job characteristics as stressors and have investigated individual perceptions of these job content factors and their relationships to strain symptoms following the implementation of new technologies in organizations. When the job content factors are not cast as stressors, researchers have concerned themselves with the perceptions of these characteristics following innovation and their effects on satisfaction (c.f. Yaverbaum, 1988). A vast array of job characteristics have been investigated, including autonomy, control over work quality, work pace, responsibility for work outcomes, skill level, identity, significance, feedback, and social interaction level, among others. In reviewing these studies, confusion arises because it seems that for every study reporting that innovation depletes the job of its positive characteristics there is a corresponding study claiming that innovation results in positive effects by enriching job content (Millman and Hartwick, 1987).

Kling (1980), in his study of municipal employees, concluded that computer innovations "did not profoundly alter the character" of the employee's jobs (p. 76). In contrast, Kraut, et al. (1989) reported that "the changes associated with computerization were as large as any other natural source of variation that we could identify in this setting" (p. 236). Attewell and Rule (1984) review the research evidence to analyze the "deskilling controversy"; that is, while some studies have found deskilling of job content following innovation, other studies have reported upgrading. They argue that the deskilling thesis has been contradicted but note that methodological problems in previous studies make comparisons difficult.

Reactance theory (Brehm, 1966) may form the basis for future studies addressing this controversy. The theory proposes that when individuals feel their freedom threatened, they resist. Research in organizational development programs has found that individuals resist change to the extent that it involves potential loss of status quo or loss of personal choice (Burke, 1982). Employees, therefore, who consider themselves to be the incumbents of jobs with enriched content prior to innovation may be those who are dissatisfied when innovation erodes these positive attributes. Those individuals who are in mundane, unskilled positions may have the most to gain from innovations that provide greater skill demands and variety. Thus, simply measuring perceived job content following technological change is not sufficient; what is needed is an examination of the way in which perceived job characteristics change over the three-stage process of initiation, implementation, and institutionalization.

Interactional psychology would suggest that investigations of individual adjustment to technological innovations should include job characteristics as potential influences on attitudes and behavior but should do so in a longitudinal, multiple measures design, with a thorough analysis of potential individual and organizational moderators included. In addition, objective job content along with perceived job characteristics should be studied. Majchrzak and Cotton (1988) found that changes in perceived job characteristics only weakly predicted worker adjustment, while observed job changes were a major predictor of worker adjustment to a computer-automated production system.

Individual characteristics

Interactional psychology contends that behavior is a function of the person and the environment (Schneider, 1983). Individuals vary in terms of cognitions, affect, motivation, and skill. The most widely addressed individual-level variable in previous studies of information-driven innovations is attitudes. Correlates of attitudes toward working with computers have been identified including the feeling/thinking cognitive style (Igbaria and Parasuraman, 1989), low computer anxiety (Gilroy and Desai, 1986), internal locus of control (Howard, 1986), use of computers on the job (Kerber, 1983; Nelson and White, 1989), and high job involvement and high organizational commitment (Rafaeli, 1986). In addition, women have been found to possess more positive attitudes toward computers than men (Rafaeli, 1986), and older workers have been found to possess less...
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favorable attitudes than younger workers (Zoltan and Chapanis, 1982).

In studies of attitudes, it has been suggested that the optimum way to relate attitudes to innovative behavior is to simultaneously evaluate attitudes toward change in general and attitudes toward a specific innovation (Ettlie and O'Keefe, 1982); yet most researchers have not adopted this strategy. Some progress is being made with scale development; Chao and Kozlowski (1987), for example, developed a scale to measure attitudes toward robotics. Another deficiency in the literature is that the link between attitudes toward information innovations and job behavior has not been empirically established. Perhaps most troublesome in this area is the finding that attempts to change attitudes toward computers through the application of training programs have been largely unsuccessful (Howard, 1986; Taylor, 1986).

Gender is an individual difference variable that has been widely examined in terms of its relationship to outcomes. Women have been found to report more negative health effects from VDT usage (Evans, 1987) and more negative effects on work group relationships. They also report that they work longer hours at the terminal with fewer breaks than do men (Kraut, et al., 1989) and are more optimistic about the benefits of computer technology than men (Gutek and Bikson, 1985). In contrast, a study of Danish workers found that men reported more mental stress from VDT work (Agervold, 1987).

Thus, several individual differences variables have been examined in the empirical literature, including age, education, sex, occupation, experience with computers, locus of control, and cognitive style. Most of the studies have correlated these individual characteristics with attitudes toward computers. Reviewing the evidence in the Appendix indicates that the individual difference variables examined do not completely capture the "person" influences suggested by interactional psychology. Other personality variables are potential influences on individual adjustment. Persons who possess high negative affectivity, for example, tend to accentuate the negative aspects of all situations; thus, we would expect a more difficult adjustment for these individuals (Brief, et al., 1988; Watson and Clark, 1984). Other cognitive influences should be examined, such as intellectual flexibility (Kohn and Schooner, 1978) and self-efficacy (Bandura, 1982).

To summarize, organizational context factors, work group factors, and job characteristics comprise the situational variables in the interactional framework, and, along with individual characteristics, are the major influences on individual adjustment to information-driven innovations. Terborg (1981) suggests that in using an interactional psychology approach, a dependent variable of interest must first be identified; then relevant person and situational factors should be proposed. It is evident that there are many personal and situational variables that await research attention in the area of individual adjustment.

Individual adjustment outcomes

A more comprehensive approach to the study of individual adjustment to technological innovation requires that a broader range of outcomes be investigated. Previous research has concentrated on the individual outcomes of general job satisfaction and self-reported distress symptoms. In the studies that have explored job satisfaction following technological innovations, the evidence is quite mixed, with some reports of increased satisfaction (Form and McMillen, 1983; Patrickson, 1986), some reports of decreased satisfaction (Kraut, et al., 1989; Turner, 1984), and still other reports of no change in job satisfaction (Argote, et al., 1983).

To fully explore the changing quality of work life following technological transitions, individual outcomes such as internal work motivation and job involvement should also be explored. The changing nature of the job and potential changes in the organization of work dictate that specific facets of satisfaction should be measured. Particularly important facets are satisfaction with the work itself, satisfaction with supervision, and satisfaction with interpersonal relationships at work.

There is a common assumption that the introduction of new technology in the workplace is stressful for individuals. Based on this assumption, it is to be expected that individuals undergoing transitions would report greater symptoms of distress, and some studies have found this to be true (Argote, et al., 1983; Johansson and Aronsson, 1984). Yet other studies have failed to find differences in strain between system users and
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non-users (Kling, 1978; Sauter, et al., 1983; Turner, 1980). The link between information-related innovations and distress is not straightforward. Musculoskeletal and visual complaints, which have been presumed to be associated with VDT usage, have not been supported by research that has attempted to demonstrate causal linkages (Czaja, et al., 1987; Dainoff, 1982). Agervold (1987), in his study of Danish office workers, found that where new technology had a negative effect on quality of life and personal influence, there were increased reports of psychosomatic complaints. Increased strain appears to result not from the introduction of technology itself but instead from the changes that occur in job characteristics and the psychological aspects of work.

The organization itself may undergo alterations in structure and climate in the wake of innovation. Individual attitudes toward the organization should be studied, including organizational commitment and intention to remain with the organization.

The most overlooked individual-level outcome of technological innovation is performance/productivity. Those studies that have included productivity measures have reported positive evidence regarding the link between computer use and individual productivity (Buchanan and Boddy, 1983; Gutek, et al., 1984; Kraut, et al., 1989; Lefebvre and Lefebvre, 1988; Turner and Karasek, 1984). Attewell and Rule (1984) reviewed the empirical studies and concluded that many reports of increased productivity attributed to technological innovation are self-reports and best-guess estimates.

In addition to the empirical studies, there is a host of prescriptive writings that posit ways to improve productivity, including aligning the technological innovation with organizational culture and structure (c.f. Morieux and Sutherland, 1988; Ogilvie, et al., 1988). It is suggested here that objective productivity measures should be included in future studies, along with self-reported mastery over various aspects of the job.

It is assumed that organizations undertake technological innovation in the pursuit of higher productivity, cost reduction, or more effective responses to environmental instability (Attewell and Rule, 1984). Other reasons for technological change might be to increase efficiency, gain and sustain competitive advantage, or mere organizational survival. Whatever the organizational rationale for innovation, our understanding of individual adjustment can be enhanced by broadening the range of outcomes examined at the individual level and relating these outcomes to the outcomes sought by the organization. The dependence of organizational productivity on individual performance requires that organizations facilitate individual adjustment to technological innovation.

The Process of Studying Individual Adjustment to Technology

The ways in which individuals adjust to the introduction of new technology in the workplace is an issue of paramount importance given the rapid advent of technological innovation in our society. The reliance of past research on the narrow themes of stress and attitudes has resulted in a fragmentary treatment of this topic. The more comprehensive, interactional framework presented here is meant to serve as a unifying mechanism that will reconcile research directions with the practical problems experienced by managers as they attempt to instill new information-driven technologies in their organizations.

The purpose of this framework is to identify organizational context factors, work group attributes, job characteristics, and individual characteristics that facilitate or discourage individual adjustment. An examination of the Appendix shows that none of the empirical studies has effectively integrated individual and situational variables in its design. Previous literature has demonstrated that attempts to change individual attitudes through training programs are futile; therefore, it becomes important to identify elements of the work context that are associated with individual attitudes and behavior. In other words, creating and maintaining a work environment that encourages innovative attitudes and behavior may be more worthy of managerial efforts than designing and applying training to change these attitudes.

The interactional model developed here represents a process in which the model must be applied three times: in the initiation stage of innovation, in which individuals are readied for change; in the implementation stage, at which
point the technological innovation is introduced into the workplace; and in the institutionalization stage, when the innovation becomes status quo. The variables in the model are continuous throughout the process of innovation. Longitudinal designs with multiple measurement points are necessary in order to determine how individual attitudes and perceptions of the job, work group, and organization change during the transition process. Simply measuring perceived job content during implementation, for example, reveals very little about individual adjustment. We must know the prior state of affairs (i.e., perceived job content prior to the innovation) to fully understand the process of innovation and its effects on the individual's total psychological work experience. The interactional approach further dictates that the objective work environment must be included in studies on individual adjustment.

Methodological issues

There are other methodological issues that arise from the adoption of the interactional psychology model. Most of the studies reviewed here are cross-sectional or case studies employing self-report measures, although there are laudable exceptions. Lagged time series designs were used by Counte, et al. (1984) and Kraut, et al. (1989). Johansson and Aronsson (1984) utilized physiological measures of strain, and Sauter, et al. (1983) used objective physical workstation measures. Brass (1985) included both employees' and supervisors' ratings of performance and other outcome variables. Roskies, et al. (1988) used both self-reports and observer ratings of threatened job status to classify their "winners" and "losers" in innovation. Several researchers combined questionnaire and interview data, including Form and McMillen (1983), Gutek, et al. (1984), and Patrickson (1986). Control group designs are seldom in evidence, with the notable exception of Irving, et al. (1986), who used a control group of similar jobs in different organizations to examine the effects of computerized monitoring on individual adjustment. The prescriptive and conceptual literatures often contribute to methodological problems by proposing the inclusion of variables that are difficult to operationalize.

The point to be made regarding methodology is that the interaction perspective requires more rigorous methods than we have seen in previous studies. What is needed are studies that are field-oriented, longitudinal, multi-situational, and that include data on both individual and situational characteristics (Schneider, 1983). Because persons, situations and adjustment outcomes are reciprocally interdependent, data must be collected that permit the study of multidirectional change among all three categories of variables (Terborg, 1981). An examination of the studies reviewed in the Appendix reveals that none of the studies meets these methodological goals.

Issues for future research

When individual adjustment is focused in this interactional manner several potentially interesting content issues emerge. In summary, it is suggested that future studies address a broader range of technologies, specific features of technologies, alterations in information flows and use, the changing nature of managerial work, reinvention, and the complex issue of control.

Broader Range of Technologies

One suggestion is that a broader range of technologies be examined. The vast majority of the studies reviewed here involved computing technology. More research is needed on computer-aided design, computer-aided manufacturing, robotics, and other information-driven complex technologies.

Specific Features of Technologies

Many studies treat technologies in an undifferentiated fashion and do not consider the effects on individual workers of specific features of the technologies (Mankin, et al., 1984). For example, a computer itself may not be a source of stress; rather, delayed response times may be stressful to the worker. Therefore, it is important that future studies focus on specific features of information technologies in order to understand how individuals adjust.

Alterations in Information Flows and Use

Information is the key issue in examining adjustment, yet few studies have focused on the changing nature of information uses and flows within the organization undergoing technological transformation. Future research must incorporate issues of information separately from the enabling technology. Information is often redistributed.
following innovation, and its link with status and power issues has profound effects upon relationships within the organization (Keen, 1981). Further, the dimensionality and value of information may be altered by innovation and may result in substantial changes in the decision-making process.

Changing Nature of Managerial Work
The changing nature of managerial work is another issue for researchers to address. Managers whose previous duty was to coax workers back to their desks from breaks may find, following innovation, that their new role is to encourage rest periods for those employees who become ego-involved with the new technology. Computerized monitoring holds not only the promise of rich information but also the danger of misuse as a policing system to tightly control employees. It has been suggested that the job of first-line supervisors is significantly altered when computer-integrated manufacturing systems are introduced into the workplace, with the need for more participative styles, enhanced communication skills, and more technical expertise upon the part of the supervisor (Hill and Kerr, 1984).

Reinvention
The term "individual adjustment" to innovation may be a misnomer, as it may appear that the burden of adjustment is placed on the employee. This should not be the case. The interactional framework proposes that the influences of individuals and technologies be mutual and reciprocal and that the individual be an intentional, active agent in the interaction (Terborg, 1981). Another avenue for future research would be to study those individuals who "go above and beyond" in innovation; that is, those individuals who creatively apply the technology in inventive ways. "Reinvention" is the term used in the information systems literature to describe the individual's influence upon the new technology (Mankin, et al., 1988). Kraut, et al. (1989), in their study of service representatives, found that two reinventions emerged: one that involved the use of dual screens to switch back and forth between billing accounts (officially sanctioned) and another that formed a personal note-passing network (not officially sanctioned). The individuals who explore the boundaries of the new technology and adapt it to their personal and job needs may become experts within the work group to whom others turn for assistance.

The work group may be the proper setting to focus on in this regard. What makes an individual an innovator or a product champion? How does peer interaction serve to stimulate innovative behavior? Undoubtedly there are many unanswered questions concerning the work group's influences on individual adjustment. The application of social support concepts in encouraging individual adjustment may provide further insight. The sources of support and type of support provided may be important catalysts for individual adaptation.

Control
The issue of control is a complicated one and requires further study. While some studies have found that individual control over work decreased following technological innovation, others have found that managerial control increased after such a transition (c.f. Gardner, et al., 1988). Interventions that maintain or increase the user's perception of control over work are associated with increased satisfaction (Baronas and Louis, 1988). The ability to manage an innovation so that it results in perceptions of increased control for both parties is a key concern that relates to the aforementioned issue of creating an environment that fosters individual adjustment.

Conclusion
The proposed framework and methodological suggestions hold much promise for MIS practitioners. To design and manage information technology innovations that enhance human capabilities, MIS practitioners must cope with the social and political issues as well as the technical issues that surface during transitions. The interactional framework allows managers to approach job design and quality of work life issues that heretofore were often neglected. When researchers use this framework, the results of their studies will provide practitioners with information to identify favorable workplace conditions prior to implementation and will also allow them to assess potential problem areas before their appearance. Users of new technology need to know what to expect in the transition process, and the comprehensive approach advocated here can provide rich detail in this regard. In short, the framework can provide practitioners a means for understanding the complexities of the dynamic implementation process.
These suggestions represent only a few of many that emerge when we recast individual adjustment to technological innovation into a more integrated perspective. The task of increasing productivity for the organization and sustaining high quality work life for the individual will require joint efforts between managers and researchers. They should study not only those technological innovations that have succeeded but also those that have failed. Adopting an interactional psychology framework for studying individual adjustment further allows researchers to realign their research efforts with the practical problems experienced by managers when they install new information-driven technologies.

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### Table 1A. Summary of Studies Reviewed

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<thead>
<tr>
<th>Reference</th>
<th>Sample</th>
<th>Organizational Context Variables</th>
<th>Work Group Variables</th>
<th>Job Characteristics</th>
<th>Individual Characteristics</th>
<th>Outcomes</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Kraut, Dumais &amp; Koch (1989)</td>
<td>485 customer service representatives in a large public utility</td>
<td></td>
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<td>Satisfaction with group</td>
<td>Variety, autonomy, challenge, impact, pressure</td>
<td>Attitudes toward computers, competence with computers</td>
<td>Productivity, pressure, job satisfaction, mental health</td>
</tr>
<tr>
<td>Nelson &amp; White (1989)</td>
<td>87 employees of a large university library</td>
<td>Homogeneity, goal clarity, morale, openness, pressure</td>
<td></td>
<td></td>
<td></td>
<td>Physiological and psychological distress symptoms</td>
<td>Experience with automated office equipment</td>
</tr>
<tr>
<td>Dolan &amp; Tziner (1988)</td>
<td>191 secretaries in a Canadian university</td>
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<tr>
<td>Majchrzak &amp; Cotton (1988)</td>
<td>31 unskilled workers at midwest Western Electric facility</td>
<td>Organizational climate, social support</td>
<td>Automation level, unpredictability, control, workflow integration, coordination, informal communication, variety, autonomy, identity, significance, feedback</td>
<td></td>
<td>Age, job tenure, type A personality, automation attitudes</td>
<td>Psychological stress problems, quality of life, job satisfaction, organizational commitment</td>
<td>Actual (observed) changes in jobs were best predictors of adjustment.</td>
</tr>
<tr>
<td>Gardner, Ruth &amp; Render (1988)</td>
<td>140 clerical &amp; administrative workers in U.S. Navy</td>
<td>VDT use, management, control, ambiguity, workload, physical comfort, variance, autonomy, peer cohesion</td>
<td></td>
<td></td>
<td></td>
<td>Job involvement, workload dissatisfaction, boredom, health complaints</td>
<td>VDT users reported more boredom, job pressure, management control, and health complaints (depression, eye irritation, difficulty sleeping, anxiety, cramps in hands, ringing in ears, neck and chest pain) than non-users. Correlates of attitudes toward working with a computer were motivational conditions, impact, pace control, skill (all +), and task completion, role conflict, responsibility for people, and group pressure (all -). Correlates of both attitudes were freedom and participative decision-making practices (both +).</td>
</tr>
<tr>
<td>Nelson &amp; White (1988)</td>
<td>87 employees of a large university library</td>
<td>Decision-making practices, human resource primacy, communications flow, motivational conditions</td>
<td></td>
<td></td>
<td>Attitudes toward change, attitudes toward working with a computer, age, experience with computers, sex, tenure</td>
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</tbody>
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Table 1A. (continued)

<table>
<thead>
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<tbody>
<tr>
<td>Rockies, Liker, &amp; Roitman</td>
<td>56 employees of a manufacturing plant in northwest U.S.</td>
<td></td>
<td></td>
<td>Use of machines, disruption experienced</td>
<td>Age, computer training, work experience, education, tenure, job level, orientation to change, perceptions of job fate</td>
<td>Identification with company, satisfaction with company, job satisfaction</td>
<td>Based on proportion of personal gains to personal losses, employees were classified (by self and researcher) as winners (n = 21), losers (n = 17), or sideliners (n = 18). Losers and winners were similar in orientation to change, identification with company, and disruption experienced. Losers feared for their job security and future job prospects, and this was corroborated by a correlation between loser status and threatened/diminished job status as rated by external observers.</td>
</tr>
<tr>
<td>Agervold</td>
<td>907 Danish white-collar workers</td>
<td>Managerial control</td>
<td></td>
<td>Personal influence, isolation, pressure, mental workload</td>
<td>Attitudes toward technology</td>
<td>Mental fatigue, stress reactions, psychosomatic reactions</td>
<td>Where new technology had a negative influence on job characteristics, greater stress-related outcomes were reported.</td>
</tr>
<tr>
<td>Evans</td>
<td>2,175 VDT users</td>
<td>General office conditions</td>
<td></td>
<td>Sex</td>
<td>Eye problems, musculoskeletal problems</td>
<td>Women reported more repetitive work, longer hours, fewer breaks, and more health effects. Ergonomically designed equipment had no effect on symptom reporting.</td>
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</tr>
<tr>
<td>Millman &amp; Hartwick</td>
<td>75 middle managers in various Canadian industries</td>
<td></td>
<td></td>
<td>Previous experience with automation systems</td>
<td>Personal, departmental, and organizational effectiveness</td>
<td>Middle managers reported job enrichment following office automation. First-hand experience with systems increased positive perception.</td>
<td></td>
</tr>
<tr>
<td>Chao &amp; Kozlowski</td>
<td>461 non-exempt employees in U.S. manufacturing plant</td>
<td>Management concern</td>
<td></td>
<td>Job class, expected job changes</td>
<td>General robotics orientation</td>
<td>Job security Low-skill workers reacted most negatively toward robots, perceiving them as threats to job security. High-skill workers perceived robots as opportunities to advance their skills.</td>
<td></td>
</tr>
<tr>
<td>Howard</td>
<td>111 managers enrolled as MBA students</td>
<td></td>
<td></td>
<td>Math anxiety, locus of control, cognitive style, trait anxiety, computer knowledge, computer experience, age, sex, work experience</td>
<td>Computer anxiety, attitude toward microcomputers</td>
<td>Significant correlates of microcomputer attitudes were computer anxiety (inverse), locus of control (intimate more favorable), trait anxiety (inverse). Significant correlates of computer anxiety were math anxiety (direct), computer knowledge (inverse), and age (direct).</td>
<td></td>
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<tr>
<td>Irving, Higgins, &amp; Sat métier (1986)</td>
<td>50 clerical employees in insurance companies with computerized monitoring; 94 clerical workers without computerized monitoring from another insurance company, financial institution, and government agency</td>
<td>Organizational control</td>
<td></td>
<td>Emphasis on performance measures, feedback, importance of evaluation for rewards, closeness of supervision, participation in evaluation process</td>
<td>Satisfaction, facets of satisfaction, performance</td>
<td>Computerized monitoring was associated with perceived increases in office productivity, more accurate and complete performance evaluation, and greater organizational control. Workers perceived increased stress, lower satisfaction, and lower quality relationships with managers and peers as consequences of computerized monitoring.</td>
<td></td>
</tr>
<tr>
<td>Patrickson (1986)</td>
<td>67 Australian newspaper compositors</td>
<td></td>
<td></td>
<td>Skill level, influence</td>
<td>Job satisfaction, career opportunities</td>
<td>Electronic production process innovation was associated with deskilling, reduced influence, reduced future opportunities. Employees who used computers on the job were highly involved in job, more committed to organization, reported more favorable attitudes toward working with computers.</td>
<td></td>
</tr>
<tr>
<td>Rafaelli (1986)</td>
<td>284 non-managerial white collar employees from 3 California manufacturers</td>
<td></td>
<td></td>
<td>Usage of computers, attitudes toward working with computers</td>
<td>Job involvement, organizational commitment</td>
<td>Ease of use, screen quality, and dependability were related to system satisfaction. Use of word processing was associated with perceptions of increased control over work. Employees who experienced low job characteristics and high uncertainty were rated lowest on performance. Job characteristics and technology dimensions were positively related to influence. Job characteristics related positively to satisfaction, while input and conversion uncertainty related negatively to satisfaction.</td>
<td></td>
</tr>
<tr>
<td>Rafaelli &amp; Sutton (1986)</td>
<td>109 clerical employees at a large Michigan university</td>
<td></td>
<td></td>
<td>Workload control, general control, Word processor use</td>
<td>Satisfaction with career opportunities</td>
<td>Operators reported less mobility, more isolation. Management expected system to reduce need for human intervention; the computerized system was found to require more human intervention.</td>
<td></td>
</tr>
<tr>
<td>Brass (1985)</td>
<td>140 employees in a large newspaper publishing company and their supervisors</td>
<td></td>
<td></td>
<td>Autonomy, variety, identity, feedback, significance, technological uncertainty, interdependence</td>
<td>Satisfaction, influence, performance</td>
<td></td>
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</tr>
<tr>
<td>Buchanan &amp; Beasant (1986)</td>
<td>9 managers and 12 operators in a computerized pigment-processing plant in Scotland</td>
<td>Management objectives</td>
<td></td>
<td>Skill level, mobility, social contact, job challenge, autonomy</td>
<td>Experience, training</td>
<td></td>
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<tr>
<td>Fleischer &amp; Morell</td>
<td>22 managers from 8 U.S. organizations who used office automation</td>
<td>Locus of decision-making authority</td>
<td></td>
<td>Managerial job characteristics</td>
<td>Beliefs about problems automation can solve</td>
<td>Both centralization and decentralization were reported in different parts of organizations. Managerial tasks changed in various ways through automation; more routine tasks were delegated. Beliefs about the amount of data required to make decisions were altered such that, in most cases, more data was preferred.</td>
</tr>
<tr>
<td>Gutek &amp; Bikson</td>
<td>55 U.S. managers and 232 office workers</td>
<td>Management objectives, planning adequacy</td>
<td></td>
<td>Access to system, use of system in decision making</td>
<td>Sex, education, occupation, experience with computers, computer attitudes, training, computer use</td>
<td>Men possessed more computer-related skills, held more influential positions, made more computer-related decisions. Women reported greater satisfaction with training received, fewer problems with access to hardware, software and human support and were more positive about the benefits of computer technology for white-collar work.</td>
</tr>
<tr>
<td>Counte, Kjøruff, Saylor &amp; Campbell</td>
<td>45 clerical employees in a U.S. hospital</td>
<td>Work role activities, role conflict, role ambiguity</td>
<td></td>
<td>Attitude toward new MIS</td>
<td>Job satisfaction</td>
<td>Attitudes toward new MIS system increased over time, while job satisfaction decreased. Workers spent more time processing data and less time helping colleagues.</td>
</tr>
<tr>
<td>Gutek, Bikson &amp; Marklin</td>
<td>55 U.S. managers and 232 office workers</td>
<td>Management, objectives, planning adequacy</td>
<td></td>
<td>Predictions about effects of computer technology</td>
<td>Office productivity, individual productivity, stress, satisfaction</td>
<td>Advanced technology contributed to perceptions of higher individual and office productivity. Management objectives rather than technology itself determined effects of change.</td>
</tr>
<tr>
<td>Johansson &amp; Aronsson</td>
<td>55 white-collar Swedish insurance workers</td>
<td>Routine work, autonomy, variety, need for concentration, responsibility, computer breakdowns, response time</td>
<td></td>
<td>Attitudes toward computerization</td>
<td>Mental strain, physical symptoms, catecholamine excretion, blood pressure, heart rate, mood, perceived stress</td>
<td>Computerization was associated with increased demands for concentration, routine work, mental strain, stomach complaints. Stress and strain reports were associated with delayed response times and interruptions. Data entry operators reported greater stress and strain.</td>
</tr>
<tr>
<td>Turner</td>
<td>620 claims representatives in Social Security Administration</td>
<td>Job discretion, workload, skill level</td>
<td></td>
<td></td>
<td>Mental strain, job satisfaction, absenteeism, performance</td>
<td>Characteristics of the computer system influenced perceived task environment such that online users reported greater task demands, mental strain, absenteeism, and performance; lower job satisfaction.</td>
</tr>
<tr>
<td>Argote, Goodman, &amp; Schlake</td>
<td>37 production workers and 30 managers in a U.S. metal alloy manufacturer</td>
<td>Work activities, interaction patterns</td>
<td></td>
<td></td>
<td>Stress, satisfaction</td>
<td>Beliefs about robots became more complex and pessimistic with time. Reported job stress increased with innovation. Satisfaction did not change. Interactions with co-workers declined.</td>
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</table>

Both centralization and decentralization were reported in different parts of organizations. Managerial tasks changed in various ways through automation; more routine tasks were delegated. Beliefs about the amount of data required to make decisions were altered such that, in most cases, more data was preferred. Men possessed more computer-related skills, held more influential positions, made more computer-related decisions. Women reported greater satisfaction with training received, fewer problems with access to hardware, software and human support and were more positive about the benefits of computer technology for white-collar work. Attitudes toward new MIS system increased over time, while job satisfaction decreased. Workers spent more time processing data and less time helping colleagues. Advanced technology contributed to perceptions of higher individual and office productivity. Management objectives rather than technology itself determined effects of change. Computerization was associated with increased demands for concentration, routine work, mental strain, stomach complaints. Stress and strain reports were associated with delayed response times and interruptions. Data entry operators reported greater stress and strain. Characteristics of the computer system influenced perceived task environment such that online users reported greater task demands, mental strain, absenteeism, and performance; lower job satisfaction. Beliefs about robots became more complex and pessimistic with time. Reported job stress increased with innovation. Satisfaction did not change. Interactions with co-workers declined.
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<tr>
<td>Buchanan &amp; Boddy (1933)</td>
<td>13 managers and 7 operators in a computer-controlled biscuit-making factory in Scotland</td>
<td>Investment policy, management objectives</td>
<td>Skill level, discretion required, equipment used</td>
<td>Productivity</td>
<td>Computerized process replaced some skills and complemented others. Management's desire for control constrained productivity improvements.</td>
<td></td>
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</tr>
<tr>
<td>Form &amp; McMillen (1983)</td>
<td>1,800 men, 855 women</td>
<td>Machinery used, automation, speed of work, skill, need for planning, need for supervision</td>
<td>Sex, job level, work experience, education</td>
<td>Attitudes toward technology, job satisfaction</td>
<td>Women reported more negative effects (deterioration of job characteristics) from technological change. Change was associated with increased job satisfaction for both sexes.</td>
<td></td>
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</tr>
<tr>
<td>Kerber (1983)</td>
<td>203 undergraduate students from Eastern U.S. liberal arts college</td>
<td>Interpersonal trust, locus of control, experience, beliefs about computers</td>
<td>Attitudes toward using computers for quantitative, record-keeping, and decision-making applications</td>
<td>Job satisfaction, emotional reactions, visual musculoskeletal stress</td>
<td>Experience with computers and positive beliefs about computer were associated with attitudes toward specific applications. Locus of control and interpersonal trust were unrelated to attitudes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sauter, et al. (1983)</td>
<td>333 office workers in Wisconsin state agencies</td>
<td>Job control, social support, task demands, job/skill security, physical environment problems</td>
<td>Age, physical limitations, behavioral style</td>
<td>Job satisfaction, emotional reactions, visual musculoskeletal stress</td>
<td>VDT users expected less job control, supervisory support, and job autonomy, and greater external control and underratification of skills than did non-users. The two groups did not differ significantly on indices of stress and well-being.</td>
<td></td>
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</tr>
<tr>
<td>Buchanan &amp; Boddy (1982)</td>
<td>3 managers, 12 authors, and 11 videotypists in a Scotland engineering consultancy</td>
<td>Management objectives</td>
<td>Variety, meaning, control, feedback, skill, pay, promotion opportunities</td>
<td>Productivity</td>
<td>Word processing was associated with less variety, meaning, control over, scheduling, and feedback. Manager's desire for control limited typists' ability to exploit benefits of innovation.</td>
<td></td>
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</tr>
<tr>
<td>Zoltan &amp; Chapanis (1982)</td>
<td>521 U.S. lawyers, pharmacists, physicians, and accountants</td>
<td>Use of computers</td>
<td>Occupation, age, sex, computer training, computer experience, beliefs about computers</td>
<td>Productivity</td>
<td>Youth was associated with more computer training. Users of computers possessed more favorable attitudes. Significant differences in computer-related attitudes were found among the professionals.</td>
<td></td>
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</tr>
<tr>
<td>Zuboff (1982)</td>
<td>200 office workers performing computer-mediated work</td>
<td>Interaction patterns</td>
<td>Autonomy, skill level, communication flow, control</td>
<td>Productivity</td>
<td>Work was perceived as more abstract following computerization. Loss of control, skill, autonomy, and poor communication were major concerns.</td>
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<tr>
<td>Ginzberg</td>
<td>35 users of 27 information systems</td>
<td>Extent of project definition &amp;</td>
<td></td>
<td>User responsibility</td>
<td>Satisfaction with</td>
<td>Findings</td>
<td>Extent of project planning and definition; organizational commitment to project and to change were key issues differentiating system successes (satisfaction of users) from failures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>planning, org. commitment to</td>
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<td>for system, user</td>
<td>system</td>
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<td></td>
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<td>project, breadth of analysis, org.</td>
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<td>ownership of system</td>
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<td></td>
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<td>commitment to change</td>
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<tr>
<td>Covert &amp;</td>
<td>68 under-graduates at a large U.S. university</td>
<td>Locus of control</td>
<td></td>
<td></td>
<td>Attitudes toward</td>
<td>Findings</td>
<td>Internal scorers possessed more positive attitudes toward computers than externals.</td>
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<tr>
<td>Goldstein</td>
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<td>computers</td>
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<tr>
<td>Turner</td>
<td>1,001 mortgage loan service workers</td>
<td>Size, system complexity</td>
<td></td>
<td></td>
<td>Strain, job satisfaction</td>
<td>Findings</td>
<td>Workload increased with computer use. A positive association was found between interdependence and perceived workload. No direct association was found between computer use and psychological strain or job satisfaction. Online system use was associated with increased productivity, as was high use of computer system. Task characteristics intervened between system design factors and worker outcomes.</td>
</tr>
<tr>
<td>Kling</td>
<td>1,200 office workers in 42 U.S. municipal jobs</td>
<td>Skill level, pressure, autonomy,</td>
<td></td>
<td></td>
<td>Job pressure, satisfaction,</td>
<td>Findings</td>
<td>No differences in autonomy or strain were found. A modest upgrading of skill and job satisfaction was found, and this increased as employees' jobs climbed the hierarchy.</td>
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<tr>
<td></td>
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<td>task significance</td>
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<td>strain</td>
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