6. The Use of the Computer In the Practice of Industrial/ Organizational Psychology

Lyle F. Schoenfeldt  
*Texas A&M University*

Jorge L. Mendoza  
*Texas A&M University*

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The rapid proliferation of computer technology, in the form of mainframe computers, networks of interconnected machines, and stand-alone personal computers, is having a profound effect on many areas of life. As a result of the spread of computer equipment to offices, homes, and educational institutions, the variety of software applications has grown at an unprecedented rate. With this as background, it should be no surprise that computers have assumed an increasing role in professional practice, including applications in providing services in the area of industrial and organizational psychology.

Industrial-organizational psychologists function in a variety of settings, but primarily provide human resource management expertise to organizations. As such, typical industrial-organizational psychologists are either employed by larger organizations or provide services to smaller organizations as consultants. The organizations in which industrial-organizational psychologists work have long had computer capability; in fact most such organizations are of sufficient size to be among those at the cutting edge of this new technology.

In addition, many of the activities undertaken by industrial-organizational psychologists lend themselves to possible computerization. Included among the major services are the selection of employees, placement of employees on jobs within the organization, training of employees, the design and management of performance evaluation systems, the development of systems to manage career progression, and planning of organizational interventions. Most of these areas involve dealing with large groups or manipulation of substantial data bases in ways that lend themselves to computer application.

Thus it is somewhat surprising that despite the availability of computer resources, industrial-organizational psychologists have been slow to develop inno-
vative applications of this new technology. Computers have played a role in the practice of industrial-organizational psychology, but most often as a means of using sophisticated statistical procedures rather than as an adjunct to practice (Denton, 1987). For example, the *Handbook of Industrial and Organizational Psychology* (Dunnette, 1976), one of the most respected compendiums of information on industrial-organizational psychology, mentions computers only in conjunction with computer-assisted instruction, an application that has been in place for more than two decades. The more recent compilation on *Human Performance and Productivity* (Alluissi & Fleishman, 1982; Dunnette & Fleishman, 1982; Howell & Fleishman, 1982) also failed to address the topic of computer applications, except for computer-assisted instruction. The popular texts in the areas of industrial-organizational psychology, personnel selection, and human resource management also uniformly sidestep the topic of applications of computers to human resource management. One exception is the Schuler text (1987), *Personnel and Human Resource Management*, which touches on topics of computer applications in compensation, job analysis, performance appraisal, recruitment, selection, training, and related areas.

The purpose of the present review is to examine some of the computer applications for the practice of industrial-organizational psychology. Areas covered will be those that are the traditional service provider activities of industrial-organizational psychologists, and include human resource planning, job analysis, selection, placement, performance evaluation, training, career progression, and organizational facilitation. As will be seen, in most of these areas of practice, progress has been slow, but the prospects for the future are bright. Innovative computer applications are possible, and progress is being made in adapting the new technology to the delivery of industrial-organizational psychological services.

**HUMAN RESOURCE PLANNING**

For small organizations with limited human resource needs, the planning process is not an important concern. For large organizations the planning process is essential to meet the personnel needs that result when complex and multiple demands are pitted against the changing forces of a dynamic environment. The planning process consists of developing and implementing programs to ensure that the right numbers and types of individuals are available at the right time and place to fulfill organizational needs. Organizations depend on "what if" scenarios that look at future needs in the context of demographics, economic projections, anticipated technological changes, eligibility standards (i.e., current and future selection standards), recruitment success, and retention goals. In addition, more sophisticated techniques factor into the planning process job preferences.
among current and future employees, values toward work, and values toward geographical mobility (Dyer, 1982).

It should be no surprise that recruitment-planning models have been developed to take into consideration the many factors involved in developing human resource forecasts. As with several other human resource applications, the military, as one of the largest and most complex organizations, has led the way in developing and using models to forecast future needs. Traditionally, such analyses have been either on the basis of econometric or demographic analyses. However, more recent approaches have brought divergent methodological techniques together to allow more unified forecasts of needs and supply.

In 1987, Borack outlined a model to incorporate what he termed the three distinct approaches to investigating supply issues, demographic analysis, attitudes toward military service, and economic models. One innovation of the Borack model was the inclusion of interest and intention, as well as the usual aptitude and physical variables that tend to determine qualification, as a barometer of the size of the available supply of individuals. By following a panel of respondents over time, Borack found it possible to measure the relative intent to enlist as a function of demographic and geographical factors.

Another way in which psychological variables can figure into the planning process are through determination of factors that influence staying versus leaving. Recent studies (Clay-Mendez, 1985; Hosek, Fernandez, & Grissmer, 1985) have looked at plans to enter the service, or to remain, as a function of demographic factors and economic considerations. As might be expected, predictions of continuation were heavily influenced by the other opportunities available, and the attractiveness of these alternatives. At the same time, both researchers found that predictions based on single trends or overly simple models did not measure up as a result of failure to take into consideration the interactions between psychological and economic factors.

The planning process is an important one, not only for the military, but also for other large organizations. It is critical to look at the change trajectory within the organization, including such factors as growth areas, skills, and talents that will be needed, as well as factors that will lead to attrition. Set against such internal projections are external considerations, including among others, demographic estimates, competitive factors, and attitudinal considerations of potential recruits. It is then possible to use computer models, as suggested by Borack (1987), to project supply as a dynamic interplay of many factors and forces rather than a specific result of a discrete survey or analysis.

The unique contribution of the industrial-organizational psychologist is in the measurement and incorporation of attitudinal and value trends in human resource projections. The computer plays an integral role in the process in modeling the human resource environment at future times (Dyer, 1982). These models include the many measurements involved and use sophisticated regression, time
series, stochastic, and Markov chain procedures to project labor force characteristics.

### JOB ANALYSIS

Job analysis is the process for obtaining information about a particular job. Researchers throughout the years have utilized a variety of procedures to collect data from jobs, methods which were recently reviewed by Feild and Gatewood (1987). Besides using the computer for the data analysis part of the job analysis, a number of investigators have used the computer to assist in the job analysis.

Christal (1974) at the Air Force Human Resources Laboratory has developed a series of programs (Comprehensive Occupational Data Analysis Programs) to evaluate task inventories. This system contains more than 40 programs performing a variety of features. One program generates job descriptions which include the average percentage of incumbents in each group performing a task, and the average amount of time spent on the task. A second program identifies and describes jobs within an occupational area. Another classifies jobs by their similarities on the percentage of time spent per task. According to Fleishman and Quaintance (1984), the occupational data supplied by these programs are useful in classification and training.

McCormick and his associates have also done extensive work on developing methods of job analysis (McCormick, 1979). The primary products of these efforts have been the Position Analysis Questionnaire (PAQ) and the Professional and Managerial Position Questionnaire (PMPQ). Both of these questionnaires utilize the computer to score and generate the work dimensions that characterize the job.

Recently, Coover (1986) discussed how artificial intelligence (AI) can be used to generate task statements for a job. Computer software could be developed to interact with job incumbents to generate task statements describing the job. Another procedure that can be adapted to generate task statements for a job analysis is that of Computerized Adaptive Testing (CAT). The CAT procedure tailors the test to the applicant’s ability, resulting in a shorter test with higher validity and reliability. The same principles could be applied to job analysis questionnaires, presenting only those tasks that are relevant for the job. The process could be similar to the decision tree procedure utilized by Mallamad, Levine, and Fleishman (1980) in estimating ability requirements for a job task. The procedure requires that the observer make a number of binary decisions about a task statement, resulting in assessing the presence or absence of an ability. (Software for the Mallamad, et al., procedure is being written for the Apple II computer.) The decision tree, of course, would have to be reversed to flow from an ability to tasks.

Fine’s (1977) functional job analysis scales could also be used to implement a
computer-based tailored job analysis. Fine claims that what workers do, they do in relation to people, things, and data. Each category is subdivided into smaller subcategories ranging from simple to complex. For example, in relation to people, the following are nine functions in ascending order of complexity: (a) taking instructions, helping, (b) serving, (c) speaking-signaling, (d) persuading, (e) diverting, (f) supervising, (g) instructing, (h) negotiating, and (i) mentoring. Since the worker functions are hierarchical and ordinal, it would be possible to utilize them in the construction of some sort of computerized adaptive job analysis. A number of other classificatory systems could also be used.

In summary, through the Comprehensive Occupational Data Analysis Programs and the PAQ, the computer has proved a valuable adjunct to job analysis. Further advances are possible through use of computerized adaptive testing in job analysis.

**SELECTION**

Computers can be used to improve personnel selection in a number of ways. The objective in personnel selection is to determine whether applicants meet the qualifications for a specific job, and then to select those applicants who are most qualified for the job. The computer can assist in testing the qualifications of applicants though adaptive testing or other computer-based cognitive or personality procedures discussed in other chapters of this volume. In addition, a more recent development has been that of computer-aided interviewing.

Rodgers (1987) discusses the role of the interview in selection, and the advantages of a computer-based approach. Research has shown that the best interviews, in terms of both reliability and validity, are structured or patterned. The advantage of using a computer to undertake an interview is in the standardization achieved and the ability to strip out those aspects of the interview that tend to reduce validity, such as overweighting of first impressions or applicant style.

Computer-aided interviewing uses a computer to present a structured interview directly to an applicant without the presence of an interviewer. The interview typically probes the applicant's background, experience, education, skills, knowledge, and work attitudes as these topics relate to the specific position or positions involved. Branching to follow-up questions allows specific areas to be pursued during the interview, much as would be done with the presence of an interviewer. The results are scored and followed with a more traditional interview to answer applicant questions, clarify responses, and obtain further information. According to Rodgers (1987), computer-aided interviewing has been validated in a variety of settings.

Selection can be enhanced in an organization with the implementation of an integrated personnel data system (PDS), also termed a human resource information system (HRIS). A personnel data system can be designed to store test scores,
attendance records, performance appraisal information, job analysis data, assessment center evaluations and promotion records. A number of corporations have such, or similar, systems. In fact, such information systems have represented the single most dramatic application of the computer to human resources and, in turn, industrial and organizational psychology (DeSanctis, 1986; Harris, 1986; Hyde & Shafritz, 1977; Murdick & Schuster, 1983; Schuster, 1985; Walker, 1981).

The popularity of the human resource or personnel data system is related to the pivotal nature of the information captured and the opportunity to interconnect the data from several domains in working toward problem solutions in all areas of concern to the industrial-organizational psychologist. Beyond the utility of the information in addressing issues that comprise the separate areas of industrial-organization services is the possibility of creating enhanced human resource programs using data previously unavailable.

For selection, the HRIS can be utilized to identify candidates within the organization who have the appropriate background and qualifications for a job vacancy. (The system can also be used to design training courses for the candidates.) A decision can then be made whether to recruit within the organization or from outside of it. A PDS can also be designed to have a bidirectional flow of information between performance appraisals and job analysis data (Harvey, 1986). As changes are made in the performance evaluations to incorporate new job dimensions, the information is incorporated into the job analysis data, thus keeping track of job changes and eliminating the need for large, periodic job analysis (Johnson, Moorhead, & Griffin, 1983).

Organizations with HRIS can upgrade their selection weights periodically at little expense. As performance data become available for each employee, the computer can be set to upgrade the selection weights automatically. The computer can also be utilized to implement complicated selection models which balance recruiting cost against misclassification cost. Once the statistical relationship among selection cost, training cost, external labor market and the probabilities of success and failure are established, a computerized selection model can be used to evaluate the cost of alternative selection strategies.

The federal government is responsible for a number of selection programs. For instance, the Navy has developed the Cost of Attaining Personnel Requirement (CAPER) model (Sands, 1973). The CAPER model contains 20 equations, which are simultaneously solved by the computer to determine an optimal selection strategy for minimizing the estimated cost of selecting, recruiting, inducting, and training personnel. The program estimates the actual and the potential cost of selection. Actual cost consists of expenses incurred in obtaining the personnel; potential cost includes the cost of making erroneous decisions. The computer is also used by employment agencies to identify applicant-employer matches. Applicant data are stored in the computer along with employers' requirements. A computer search is made to print a list of possible successful
matches. Some matching programs give a relative ranking of potential candidate—employer pairs.

In summary, it is hard to look at computer applications to selection as a stand-alone component of the human resource management process. Computers can administer and score both tests and interviews. At the same time, the real advances are through the use of the computer to connect selection to other human resource and strategical concerns.

PLACEMENT

Successful performance is a function of selecting the right employees and maximizing the utilization of those hired through effective placement. In its simplest form, a position exists within an organization and applicants are screened until a suitable candidate is found. In other words, the job requirements guide a specific selection effort for the position. Placement is not an issue in this case.

A more general view of the placement function would consist of the following sequence: (a) the assessment of individual characteristics, (b) the identification of the psychological requirements of jobs, and (c) the matching of those constituting the labor supply with available opportunities. This approach would be the procedure of choice by the military, for example, where there is a steady flow of recruits that need to be placed in assignments or jobs. Selection is accomplished by "hiring" all those in the range of acceptability with subsequent emphasis on placement as being the function that is one of the critical linchpins to a successful organization.

Some private-sector organizations might find placement to be more important than selection. This would be true in organizations with a large number of lines of progression in a bounded geographical area. For example, an auto manufacturer may have several distinct operations in and around Detroit with a central screening and placement function. Each line would have an entry position, and the challenge would be placing qualified applicants in the progression that represented the best utilization of their talents.

To the extent the computer has been applied to the selection-placement problem of human resource management, the emphasis has been on the selection part of the equation. Schoenfeldt (1974) introduced an assessment-classification model aimed at joining selection and placement into a systems approach to matching people with employment opportunities. The assessment-classification model, included as Fig. 6.1, follows from other statistical approaches, (Campbell, Dunnette, Lawler, & Weick, 1970; Dunnette, 1963) and involves the assessment of individuals, measurement of jobs, and the prediction of job success.

The assessment of individuals or the inventory of the psychological capabilities the individual brings to the job market has two aspects. The first involves using standard predictors found to be valid for the jobs in question, the
individual differences variables of the Campbell et al. (1970) model. The second aspect involves implementation of the approach described by Owens (1968, 1971), suggesting the formation of subgroups with respect to the major dimensions of antecedent behavior and relating the subgroups to relevant criteria. This would involve administering a biographical questionnaire to assess the antecedent behaviors. Individuals would then be classified on the basis of their responses to the life history items to form subgroups homogeneous with respect to important dimensions of life behavior.

The job structure segment of the model would consist of an occupational taxonomy, forming job families on the basis of suitable descriptors. Thus, in the same way individuals are placed in subgroups homogeneous with respect to past behavior, jobs can be classified into families homogeneous with respect to task elements, worker elements, or required attributes. The assessment-classification model is then developed by the use of a maximization procedure, such as discriminant analysis or canonical correlation, to determine the probability of success and satisfaction in a particular job family given that the individual is a
member of a particular life history subgroup. The goal of the model is the prediction and understanding of person-job relationships.

Schoenfeldt (1974) examined the validity of the model with a large sample of students \(N = 1934\) working toward college degrees. Subgroups, formed on the basis of previous behavioral data collected during the freshman year, differed with respect to criterion (major, grade-point average, and so forth) measurements taken 4 years later. More important, the subgroups differed with respect to the curricular paths taken during college. The results indicated that it was possible to differentiate people in meaningful ways, to identify “job families,” and to match people with jobs.

Two industrial studies have been reported using the assessment-classification model. In the first, Morrison (1977) tested the model’s efficacy in making placement decisions in an industrial setting with hourly employees. Eight developmental-interest dimensions describing life choices, values, and interests of 438 blue-collar workers were formulated. Job analysis identified two clusters of positions that were homogeneous within, and differentiated between, each other on relevant job attributes. One cluster consisted of process operator positions and had 102 incumbents with more than 6 months’ service. The other cluster was composed of heavy equipment operator positions that had 148 incumbents. A discriminant function was calculated on a validation group of incumbents in an effort to develop a linear combination of the life history factors that maximally differentiated the two job families. Cross-validation demonstrated that three psychologically meaningful dimensions discriminated among the groups at both statistical and practical levels. The process operators were more likely to be raised in an urban environment, to have a more favorable self-image, and to prefer standardized work schedules.

The second study was by Brush and Owens (1979) and covered a total of 1,987 hourly employees of a major oil company. Each employee completed an extensive biographical inventory. Hierarchical clustering of the resulting biographical profiles produced 18 subgroups of employees, such that within any one subgroup, background experiences and interests were similar, and among subgroups, they were different. A similar methodology was applied to job analysis data in creating a structure of 19 job families for 939 office and clerical jobs. Significant relationships were found between biodata subgroups and criteria, such as sex, educational level, termination rate, job classification and, most important, performance rating.

The value of the assessment-classification model is in the potential to place applicants in jobs for which the probability of success and satisfaction is maximal. Other purely statistical approaches exist, but do not incorporate dimensions psychologists would suggest are important to the match of individuals to jobs.

In a more recent study, Granrose and Portwood (1987) looked at placement in the context of career management. Programs that attempt to match individual career plans with overall trends and needs within the organization are simply
matching individual characteristics, psychological requirements of jobs, and available opportunities on a continuous basis. The core of the Granrose and Portwood research was the development of a path-analytical model of organizational influences on individual career beliefs and attitudes. Their data suggested that the extent of perceived matching between individual and organizational career plans is related to individuals’ attitudes concerning their careers. To quote Granrose and Portwood:

[M]atches [between individual and organizational career plans] seem to have an influence on satisfaction and desires to leave or remain with an organization. . . [B]oth perceptions of organizational planning activity and the perceived availability of career information increase[d] participation in company-sponsored career assistance programs, and perceptions of organizational planning activity also increase[d] employees’ awareness of organizational plans for their careers. (1987, p. 714)

In these examples, placement and career management is the function of complex, computer-based models, either the assessment-classification model or a path-analytical model designed to predict the match between individual and organizational career alternatives. What has been at best ad hoc processes in most organizations, placement and career management, are greatly facilitated by the adaptation of computer models to the complexities of the task. The result is an orderly process that incorporates the important individual and organizational elements in maximizing overall utility and satisfaction.

**PERFORMANCE EVALUATION**

The process of appraising employee performance, along with the feedback of results, is typically thought of as a singular evaluation process whereby a supervisor considers information collected over a period of time with respect to subordinate performance, and makes judgments. As such, it is not seen as a process amenable to computer technology. However, the computer can be used in two important ways.

First, performance evaluation inevitably involves subjective judgments, even when objective information is available. Employee characteristics, such as initiative, dependability, relationships with coworkers, and so forth, are incorporated into evaluations. The problem in depending on such judgments is that of bias, either intentional or inadvertent. Intentional bias is very difficult, if not impossible, to detect, especially if undertaken selectively. However, the general feeling among industrial-organizational psychologists is that it is not a widespread problem (Gatewood & Feild, 1987). However, the frequent sources of inadvertent bias, halo (rating the subordinate equally on different performance scales because
of a general impression), leniency or severity (disproportionately high or low ratings), and central tendency (large number of subordinates receive ratings in the middle of the scale) can be detected by comparing the separate ratings of a superior and by comparing the ratings of one supervisor with those of other supervisors. The computer can be valuable in facilitating the process of error detection, and thus is important as a quality control mechanism in performance evaluation.

A second role of the computer is as an important link between the results of the performance evaluation process and other aspects of human resource management activities (Verdin, 1987). For example, performance evaluation results are indicative of training needed, of further challenge the individual is capable of undertaking (i.e., career progression), and of salary progression. Computer technology can facilitate the link between performance appraisal and other human resource management functions.

Brush and Schoenfeldt (1982) outlined computer-based performance appraisal applications that facilitate the achievement of wider personnel and human resource goals of the organization. The system they described was developed by a major energy corporation for appraisal of all salaried personnel. In addition to providing performance feedback to employees, the system was used for enhancing human resource procedures throughout the organization. The system included the following core performance dimensions: (1) Past accomplishments, (2) Administration, (3) Job knowledge, (4) Forecasting and planning, (5) Innovation, (6) Communication, (7) Initiative and responsibility, (8) Work relationships, (9) Salesmanship, (10) Decision making, (11) Leadership, (12) Selection and development (of subordinates).

In one application, organizational strengths and weaknesses were determined by comparing job families constructed on the basis of job analysis data collected to establish the core dimensions. The major groups were comprised of corporate officers, manufacturing managers, distribution managers, and sales staff. Each functional group was further stratified into four organizational levels. This characterization was done on the basis of the number of job evaluation points (based on the Hay system of evaluating salaried positions) assigned to the job. The result was a functional area by organizational-level matrix where performance factors could be studied free from the potentially confounding influences of function and/or level.

Average performance ratings within each of the functional areas were obtained. The question became one of factors which are ranked consistently low or consistently high, regardless of organizational level, within a functional group. The results for the four groups are illustrated in Fig. 6.2. For example, at least three of four levels of corporate officers ranked communication skills and work relationships in the bottom quartile of performance ratings. Decision making and responsibility, on the other hand, consistently ranked high as performance factors. Thus, within each group, performance deficiencies that were consistent
throughout a functional group could be identified. In addition, deficiencies across groups could also be identified. For example, three of the four groups consistently rated forecasting and planning as a low factor, suggesting this to be a problem throughout the organization.

The result is an illustration of a computer-based system for transforming the separate performance evaluations of hundreds of salaried employees into information of strategical value to the organization. It should be pointed out that a first step after entering the performance ratings into the computer would be to check for the common errors mentioned previously. This would be done by comparing the several ratings from each manager and by contrasting the average ratings submitted by each manager to comparable managers from the same unit or from similar units. Problems detected should be reviewed with the appropriate managers, and needed corrections incorporated into the data set. The data set can then be used to diagnose and solve organizational issues.

### COMPUTER-BASED TRAINING

According to Kearsley (1983) the main advantage of computer-based training (CBT) is its interactive nature, which transforms passive learning into active learning. Other advantages are increased control over the material that is being taught (increasing standardization), and individualization of training which allows the student to learn at his or her own pace. Also, CBT increases the availability of training by making the training virtually always accessible to the students. Orlansky and String (1979) claimed that CBT saves 30% of the time required for training while increasing learning and satisfaction. An important

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#### FIG. 6.2 Performance factors rated consistently high or low by area.

<table>
<thead>
<tr>
<th>Performance Factor</th>
<th>Functional group</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Corporation officers</td>
</tr>
<tr>
<td>Forecasting &amp; planning</td>
<td>L</td>
</tr>
<tr>
<td>Communication skills</td>
<td>L</td>
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<tr>
<td>Selection &amp; development</td>
<td>L</td>
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<tr>
<td>Work relationships</td>
<td>L</td>
</tr>
<tr>
<td>Salesmanship</td>
<td>H</td>
</tr>
<tr>
<td>Decision-making</td>
<td>H</td>
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<tr>
<td>Job knowledge</td>
<td>H</td>
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<tr>
<td>Initiative &amp; responsibility</td>
<td>H</td>
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</tbody>
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Note: L = Factor ranked in the lowest quartile in at least 3 or 4 organizational levels. H = Factor ranked in the highest quartile in at least 3 of 4 organizational levels. All other factors received mixed or moderate rankings.
feature of CBT is that it can be used in conjunction with a video disk for instantaneous access to a multimedia database (e.g., photos, audio, scenarios).

As the microcomputer becomes more technologically advanced with multi-user capacity, hard-disk-on-board, faster chips, and more memory, interactive video disk becomes a reality for training. The key hardware component in realizing interactive video is the newly developed optical disk. Similar in nature to the popular compact disk, the optical video disk can store large amounts of information. (You can store an entire encyclopedia on one side of a 5½-inch optical disk.) Optical storage provides users instant access to large data bases by storing blocks of text or visual images in frames. The laser-read system can access each frame quickly and precisely. With appropriate software and hardware, the laser system can be coupled with a microcomputer for interactive video.

Currently most interactive video is found in the corporate training centers and in the military. McDonnell Douglas uses interactive video for training and production. For example, in a training system developed for the F–15 fighter plane, pilots can experience simulations of engine failure utilizing a video disk. Maintenance personnel, on the other hand, can learn to repair the plane with the system evaluating the results of their work. The company claims that interactive video disk training is safer and less expensive than field training. McDonnell Douglas is also experimenting with interactive video for visual storage of technical drawing and reference materials for on-board-display (“Computer-Based Training,” 1987) to assist pilots and technical personnel in flight. Another company that utilized video disk for training is the Wilson Learning Corporation. This group is using the video disk to teach strategies, concepts, and management principles. As the software becomes more flexible and the hardware becomes less expensive, we should experience an increase in video disk use for training.

Computer-based training can take many forms. One popular form of CBT is that of Computer-managed Instruction (CMI). In CMI the computer is used to manage the instructional resources (media, simulators, classrooms) and the student’s progress. The CMI system coordinates all teaching and testing activities while keeping track of student records. The system monitors the student’s progress to make adjustments, identifying students who may be in danger of failing and, similarly, those who are likely to succeed.

A number of industries presently make use of CBT to train their employees. American Airlines uses a CBT to train its flight crews. American Airlines claims to have reduced training time by 50% with savings of approximately $30 million per year in fuel costs (Kearsley, 1983). Other airlines also utilize CBT to train crews. The IBM corporation uses CBT to train field engineering staff (Branscomb, 1983). Banks and insurance companies also use CBT. Aetna Life and Casualty uses CBT to train personnel in mathematics (Lowe, 1979). The largest users of CBT, however, are the armed services. The Navy, for example, uses CBT to manage the daily instruction of thousands of students, in a number of courses, at nine schools (Davis, 1978).
Computer simulations can play an important role in training and selection. The computer can be used to simulate a particular piece of equipment or situation. A simulator is such a device. Generally computer-controlled, the simulator is used to train employees to operate a particular piece of equipment (e.g., an airplane, radar scope, or letter sorter). The computer simulates the critical aspects of equipment operation responding to the student’s commands or instructions. It also records the student’s action for assessment and training purposes. Simulators range from those which are very expensive, flight simulators, to those which are not, such as “Resusci-Annie” used to teach cardiopulmonary resuscitation (Kearsley, 1984). Simulators are generally less expensive than the actual equipment and in some cases much safer.

Simulators are used by a variety of organizations to train and assess personnel. The Navy and Air Force use simulators to train flight crews and maintenance personnel. Farrow (1982) reports 10 different types of simulators in military air training. NASA also uses simulators for training. Shelly and Groom (1970) describe one of the simulators used to train Apollo II personnel. Another organization which utilizes the simulator is the Postal Service. The Postal Service has developed a simulator to train employees on mail sorter machines (Kearsley, 1984). The simulator is similar in size to the sorter machine, but it does not use real mail. Instead, letters are simulated by the computer, at the terminal display. The rate which these electronic letters are generated can be varied. Thus, new employees can be trained at lower speeds.

The future for CBT appears bright as more companies move to automate their training programs. In a recent special issue of Training (“Computer-Based Training,” 1987), a number of experts concurred on the growth of CBT, but cautioned that this growth will be moderate, since good CBT development is still very expensive. This high cost is countered, however, by pressures within many organizations for accountability in their training programs. This has created an environment that favors CBT. Additionally, as the cost of hardware and software decreases and jobs become more knowledge-intensive in the workplace, conventional forms of training will be less adequate, increasing the need for good CBT.

**CAREER PROGRESSION**

Hall and Goodale distinguish between career planning, an individual-level approach, and career management, an organizationally focused process.

Career planning is a deliberate process of becoming aware of self, opportunities, constraints, choices, and consequences, identifying career-related goals, and programming work, education, and related developmental experiences to provide the direction, timing, and sequence of steps to attain a specific career goal. Career management is an ongoing process of preparing, implementing, and monitoring
career plans undertaken by the individual alone or in concert with the organization’s career systems. (1986, pp. 391–392)

Yet another perspective was that articulated by Glinow, Driver, Brousseau, and Prince (1983) in their design of a “career-sensitive” human resource system. Their concern was the propensity to view career management as a separate, add-on, component in the overall utilization of human resources. Career information is available on a continuous basis from multiple sources. Viewed in this manner, the problem is one of having the data in usable form at points when career decisions need to be considered and implemented.

The computer can play a valuable role in bringing together the information needed into an integrated framework. The application of the computer in this way was undertaken by Brush and Schoenfeldt (1982) in the research described previously. Analyses were performed to examine factors differentiating effective from ineffective managers by level within each functional group. For example, Fig. 6.3 illustrates five performance factors that are important for top corporate officers in this particular corporation. They were found to be important for two

![Performance factors differentiating management effectiveness.](image-url)
reasons. First, they are factors for which were found statistically significant differences between effective and less effective managers. Secondly, they were rated by the managers themselves as being either extremely important to their job or performed frequently, or both. It would appear that in considering career management positions, particular attention should be paid to these critical factors which may mean the difference between success or failure.

An incident at the time of this study illustrates the point well. The situation involved a top-ranking manufacturing manager who was under consideration for a position within the corporate group. Fig. 6.4 illustrates his performance profile compared with that of the average profiles of the effective corporate officer. Several points are of interest. First, the manufacturing manager appears to be a higher performer in both communication skills and work relationships than the corporate group. This is particularly noteworthy, since corporate officers at all levels were consistently ranked low in these areas. On the other hand, the candidate is ranked lower in decision making and selection and development. This is equally important because these two factors represent two of the four factors significantly differentiating effective from less effective managers within this group (Fig. 6.3). Perhaps these data raise more questions than they answer. However, it does give management a way of pinpointing and evaluating strengths and weaknesses relative to a particular target group. In this case, a decision had to be made whether to train in those weak areas, provide more developmental

![FIG. 6.4 Comparison of a manufacturing manager with the corporation officer performance profile.](image-url)
experiences or pass over for promotion. An evaluation of the company’s training and development resources and an understanding of those areas which the company felt it could effectively develop led management to the decision that this manager was most suited to his or her current position.

It should be noted that this is not a static system. Although performance profiles of effective managers are useful in establishing a framework from which to evaluate future candidates, management is not necessarily wedded to a design that continues to manage careers on the basis of what has been effective in the past. Indeed, the whole notion of management is likely to change dramatically over the next several decades. New attributes and skills anticipated as important for the future can be built into models with which to compare, select, or suggest training and development for future employees.

Software, along the lines of that shown in Fig. 6.5, was developed to manage the career progression process. Using the system, individual performance appraisal data, along with individual career plans generated in conjunction with the performance evaluation and feedback process, are compared with average values for salaried employees in different functional areas and at different organizational levels. Areas found to be needing improvement can be linked with training alternatives. Promotional opportunities can be evaluated in relation to strengths and weaknesses as well as individual career plans. All other things being equal, the goal would be job changes which capitalize on some individual strengths while developing some of the areas that need improvement.

The result is a system that allows the identification of organization-wide strengths and weaknesses. It also has been shown that a meaningful structure involving both functional area and organizational level can be used to determine performance factors that are important in differentiating effective from less effective managers and to allow managers to evaluate alternative career possibilities.
ORGANIZATIONAL ISSUES

The computer has created organizational issues and, in turn, is involved in addressing organizational problems. The former has been addressed by Fleischer and Morell (1985) in an examination of the organizational consequences of computer technology. Specifically, Fleischer and Morell surveyed managers with respect to the impact of computers on their ability to obtain, analyze, and transmit information. They found important changes occurred in three areas: (1) information used for decision making; (2) beliefs concerning what kinds of problems can be solved; and (3) locus of decision-making authority and managerial job characteristics. In other words, in the sample they surveyed, the ready availability of information through personal computers and computer networks changed the organizations and the nature of the managerial role within those organizations.

In a related study, Gardner, Souza, Scabbia, and Breuer (1986) examined the impact of the microcomputer on the delivery of services in an nonprofit agency. The study was unique in that it involved the application of the computer in multiple aspects of organizational life over a 5-year period. The computer was used in direct care (production), research, and administration. Within the direct-care function there were multiple applications, including assessment, evaluation, intervention, quality assurance, and management information. The result was the finding that computers can be enormously beneficial in terms of productivity and quality of service delivery, but not without organizational cost. To quote the authors, “For every promise there are a dozen corresponding pitfalls, each one waiting to engulf individuals and systems and to create as many new problems as the innovations solve” (p. 155).

Organizational issues emerge as a result of the introduction of the computer into organizational activities. In addition, the computer can be applied to addressing organizational issues. To quote Heneman, Schwab, Fossum, and Dyer (1980),

Organizational development consists of processes and techniques designed to attain such goals as improved communications between groups, restructured authority relationships to base decision-making power more on expertise than hierarchical position, and organizational flexibility in the face of rapid environmental changes.

(p. 349)

A first step to any intervention is the diagnosis of the problem. A popular method is by way of an organizational survey. An organizational survey measures the quality of the organization’s internal environment in an effort to develop necessary changes. Also, it helps in evaluating the effectiveness of any interventions.

As indicated by Schuler (1987), an organizational survey might solicit
Employee perceptions of organizational characteristics, including the consequences of job performance, organizational policies, frequency of feedback, job design qualities, task interference characteristics, aspects of goal setting, role conflict and awareness, and supervisor behaviors. Equally necessary is gathering data on the employee’s reactions to the organizational conditions, the quality of work life, and reactions such as satisfaction and job involvement. (p. 674)

Many other aspects of work, perceptions of job activities, and reactions to policies can also be measured.

An example of a fairly sophisticated application of the computer to this type of organizational diagnosis is provided by M. A. Lewis (personal communication, February 1, 1988), and is based on efforts to develop a useful base of organizational information in a major corporation. More specifically, information is sought on such elements of organizational life as management practices, communication patterns, and possible areas of conflict. Traditionally this type of information has been gathered by interview and/or paper-pencil questionnaire. The development of questionnaires, the actual collection of information, analysis, and reporting of results were all extremely time consuming. In fact, the process is generally regarded as so cumbersome as to preclude anything but a long-range approach to addressing organizational issues.

In the case of the system developed by M. A. Lewis, the microcomputer replaces the questionnaire in the gathering, analysis, interpretation, and feedback of organizational information. Employees respond to questions about various organizational issues presented on the computer screen and can also enter comments. Results are organized in terms of each item, and also by area. Interpretation is by comparison of results with the team at previous times and to other units of the organization. In this way, group leaders can track management issues and communications within their groups over a period of time and compare their progress with that of other teams.

In the system reported by M. A. Lewis, as well as similar approaches, organizational information can be used to guide interventions. The questionnaire information, along with the rich data provided by comments, becomes a practical basis for improving both individual and organizational performance.

**SUMMARY**

Industrial-organizational psychologists have been slow to embrace the computer as a tool for the delivery of personnel and human resource services. Despite this, models and procedures exist for innovative computer applications to all major phases of industrial-organizational psychology.

An even more encouraging note has to do with the trend to use the computer to bridge areas of human resource and organizational behavior that have been tradi-
tionally considered as distinct entities. For example, in the present review, we observed instances where selection systems incorporated input from other segments of the organization. Job analysis information is combined with planning data as an indication of current job activities/requirements and future activities/skills that will be needed. Thus selection can be more dynamic, and individuals brought into the organization have the capabilities needed immediately and skills anticipated as valuable for future organizational changes.

Another example of potential integration would be the combining of selection and placement functions. Performance appraisal information can be used to refine both, that is to suggest adjustments needed in the identification of skills and knowledge required as a part of the selection-placement system. Performance appraisal issues might also suggest organizational and training issues needing attention, that is deficiencies in current performance that could be addressed on a programmatic basis. Finally, performance information can be extremely valuable in terms of career progression decisions of either an individual or organizational nature. In this way, performance appraisal becomes the quality control element of the entire personnel-human resource framework.

Computers have proved to be a valuable adjunct to the delivery of services in a variety of areas, and are now finding increasing use in the management of personnel and human resources. Look for large organizations and the military to lead the way with respect to innovative computer applications, and for research-oriented professionals to provide the necessary theory and models to facilitate this new direction. The trend will be one of increasing use of computers to bring together human resource and organizational issues into an integrated system.

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