

*Badly designed jobs are actually the cause of far more performance problems than managers realize. The authors present a way of analyzing job designs to make sure they encourage the outcomes managers want.*

# *Job Design: Approaches, Outcomes, and Trade-offs*

Michael A. Campion  
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*A*lthough the nearly catastrophic Three Mile Island incident was attributed to human error, it's clear that the poor design of the control room operator's job was the primary cause of the disaster. Operators had to monitor hundreds of poorly designed displays, controls, alarms, and lights. Because controls and related gauges were physically separated, operators could not respond quickly and accurately to danger signals. Emergency procedures were inadequately designed. In brief, the information and control systems for which the operators were responsible created overwhelming mental demands that quickly overloaded their capabilities. The operator's job was actually (though inadvertently) de-

signed to be error-prone—that is, designed for disaster.

The initial conclusion, however, was that human beings were entirely at fault. People have a natural tendency to conclude that the design of a job is a "given" dictated by the technology, and that poor performance on the job *must* be the fault of the worker.

In a recent study of job design in the wood-products industry, we found two examples that illustrate this point. Although our analysis of the jobs quickly pointed to design problems, in each case the supervisor accepted the job as given and blamed the incumbent for poor performance.

1. *A dryer-feeder job in a plywood plant.* In this job, the incumbent had to align strips of wood just before they entered a dryer on a moving belt so that maximum drying coverage would be achieved. Because dryer coverage was not up to standard, the su-

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pervisor concluded that the incumbent was lazy and negligent and considered filing a written reprimand. However, we found the job to be poorly designed from a biological perspective. The incumbent had to operate a foot pedal while standing and thus spent all day with most of her body weight on one foot. She also had to bend over frequently and extend her arms to adjust the strips of wood, which resulted in biomechanical stresses on the arms, legs, and back. Everyone hated the job, and it was almost impossible to staff. Despite that, the incumbent was blamed.

2. *A puller job in a sawmill.* In this job, the incumbents pulled 2-by-4s from a moving belt and placed them in racks. When production was low, employees were characterized as apathetic, lazy, and lacking a work ethic. However, the job itself was totally unattractive from a motivational viewpoint: It provided hardly any feedback and no variety, and it involved no significant skill. The task seemed unimportant and monotonous—a boring, thankless, dull job.

We, as managers, tend to blame the worker rather than the job despite the many

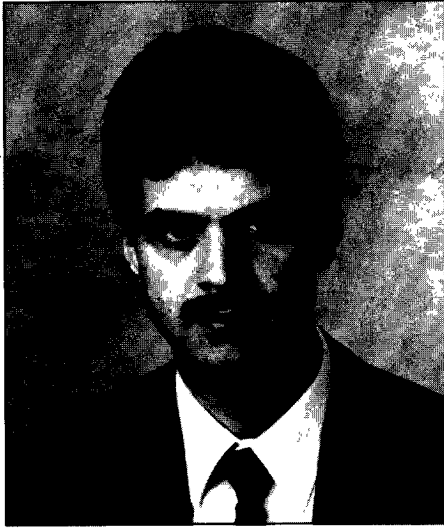
attempts to point out that job design may be the problem. Early in this century, Frederick Taylor and Frank Gilbreth developed a concept called “scientific management” that stressed specialization of duties, time and motion study, and work simplification. This approach to job design permitted employers to staff jobs with almost anyone and still hold down training costs. However, many viewed scientific management as dehumanizing because it assumed that workers were lazy and dull and that tight controls and manipulation were required.

Eventually theorists such as R. N. Ford, Frederick Herzberg, Arthur Turner, and Richard Hackman stressed the desirability of enlarging and/or enriching the job to enhance its motivational potential. They viewed the worker as creative, self-motivated, and responsive to a stimulating environment.

More recently, specialists have been pointing to the need to minimize the physical costs and biological risks of work, and they have emphasized occupational safety and health. A related school of thought is concerned with cognitive and perceptual-motor abilities. It suggests that a human being can

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absorb only so much information in a given time span and that a job design must recognize that limit. The jobs of the Three Mile Island operator and an air traffic controller are good illustrations of positions that must be designed with careful attention to the limitations of human perceptual capacities.

Which job design approach is best? Advocates of each school point only to the strengths or advantages of their method. Can a job that has been designed from a motivational perspective have characteristics that make it bad from another standpoint? And if a job is designed well from one perspective,

does that mean it cannot be designed well from another? What are the costs and benefits of the various approaches? Job enrichment may be the current "in" approach, but what are the costs of this approach? Are the other approaches really so bad?

We tried to answer these questions through a study that attempts to assemble all the available approaches to job design and then determine which approaches produce which job outcomes.

#### THE STUDY

We conducted an exhaustive search of the literature and extracted specific "rules" on how to design jobs. We found rules for everything: equipment, facilities, and environments, as well as job content and methods. These rules were then analyzed and sorted into distinct groups based on their underlying theoretical orientation. Four job-design approaches resulted; these approaches then formed the basis for a job analysis questionnaire.

Using that questionnaire, we analyzed more than 120 jobs. We also collected information on a broad spectrum of job outcomes including job satisfaction, absenteeism, training time, staffing difficulty, physical effort required, injury rates, error rates, job stress, and mental demands.

The technical details of this study are presented in the February 1985 issue of *Journal of Applied Psychology*. We found that there are four different approaches to job design and that each approach is actually geared toward a different set of outcomes. Each approach has its own costs and benefits and no single approach is best; trade-offs will be required in most practical situations.

### Exhibit 1

#### THE MECHANISTIC JOB-DESIGN APPROACH

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1. *Job specialization*: Is the job highly specialized in terms of purpose and/or activity?
  2. *Specialization of tools and procedures*: Are the tools, procedures, materials, etc. used on this job highly specialized in terms of purpose?
  3. *Task simplification*: Are the tasks simple and uncomplicated?
  4. *Single activities*: Does the job require the incumbent to do only one task at a time? Does it *not* require the incumbent to do multiple activities at one time or in very close succession?
  5. *Job simplification*: Does the job require relatively little skill and training time?
  6. *Repetition*: Does the job require performing the same activity or activities repeatedly?
  7. *Spare time*: Is there very little spare time between activities on this job?
  8. *Automation*: Are many of the activities of this job automated or assisted by automation?
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What follows is a description of the content and theoretical orientation of each approach and the associated positive and negative outcomes of that approach. So that readers may analyze jobs in their organizations, we have presented sets of questions to determine how well jobs match each of the different approaches. Answers to these questions will suggest what costs and benefits can be expected from jobs as they are currently designed, as well as how jobs may be redesigned.

#### FOUR APPROACHES TO JOB DESIGN

##### *Mechanistic Job-Design Approach*

This approach stems from the scientific-management school of thought, time and motion study, and work simplification and specialization. Its primary scientific basis is classic industrial engineering. (The term *classic* is used because many contemporary writers include a variety of job design ap-

proaches under the label of industrial engineering.)

Exhibit 1 presents the questions one might ask to determine whether a job fits the mechanistic approach. Jobs high in mechanistic features can be staffed by almost anyone, and training time is typically very short. Because mental demands are minimal, stress and overload are unlikely. Errors are less common because mistakes are less likely to occur.

The disadvantages of the mechanistic approach include less satisfied, less motivated employees and higher absenteeism. Sometimes mechanistic work can lead to health complaints and injuries caused by the physical wear and the carelessness that can result from highly repetitive and machine-paced work.

Most low-level factory jobs are designed from a mechanistic perspective. Assembly-line jobs epitomize this approach because they are analyzed and carefully constructed to maximize productivity and efficiency.

The nuclear power plant operator's job, on the other hand, would get a very low

Exhibit 2

THE MOTIVATIONAL JOB-DESIGN APPROACH

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1. *Autonomy*: Does the job allow freedom, independence, or discretion in work scheduling, sequence, methods, procedures, quality control, or other decisions?
  2. *Intrinsic job feedback*: Do the work activities themselves provide direct, clear information about the effectiveness (in terms of quality and quantity) of job performance?
  3. *Extrinsic job feedback*: Do other people in the organization (such as managers and coworkers) provide information about the effectiveness (in terms of quality and quantity) of job performance?
  4. *Social interaction*: Does the job provide for positive social interaction (such as teamwork or coworker assistance)?
  5. *Task/goal clarity*: Are the job duties, requirements, and goals clear and specific?
  6. *Task variety*: Does the job have a variety of duties, tasks, and activities?
  7. *Task identity*: Does the job require completion of a whole and identifiable piece of work? Does it give the incumbent a chance to do an entire piece of work from beginning to end?
  8. *Ability/skill-level requirements*: Does the job require a high level of knowledge, skills, and abilities?
  9. *Ability/skill variety*: Does the job require a variety of types of knowledge, skills, and abilities?
  10. *Task significance*: Is the job significant and important compared with other jobs in the organization?
  11. *Growth/learning*: Does the job allow opportunities for learning and growth in competence and proficiency?
  12. *Promotion*: Are there opportunities for advancement to higher-level jobs?
  13. *Achievement*: Does the job provide for feelings of achievement and task accomplishment?
  14. *Participation*: Does the job allow participation in work-related decision making?
  15. *Communication*: Does the job provide access to relevant communication channels and information flows?
  16. *Pay adequacy*: Is the pay for this job adequate compared with the job requirements and pay for similar jobs?
  17. *Recognition*: Does the job provide acknowledgment and recognition from others?
  18. *Job security*: Do incumbents on this job have a high degree of job security?
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score on the mechanistic questionnaire because of the complex nature of many of the tasks involved and the corresponding training requirements. In fact, simplified procedures for nuclear power plant operators have been established as a result of the Three Mile Island incident.

Many jobs would get a low score on the mechanistic approach questions simply because of their inefficient nature. Such jobs include many sales and negotiating positions, which have a less than optimal probability of success, and jobs that are needed only in

emergency situations (such as the job of a fire fighter). Many office jobs are also poorly designed from a mechanistic point of view. However, the concepts of specialization and simplification of tasks and skill requirements have been applied to some office jobs to reduce staffing difficulties and training requirements.

*Motivational Job-Design Approach*

This approach stems from the work on job enrichment and enlargement and from the



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major theories of work motivation and organizational behavior. Its basis is organizational psychology.

Exhibit 2 shows the content of this approach. In addition to taking into account those characteristics that make jobs meaningful from a task-oriented perspective (such as variety, feedback, and achievement), this is the only approach that takes into account the social or people-interaction aspects of job design (including participation, communication, and recognition). Positive responses to

the questions in Exhibit 2 are associated with jobs that have more satisfied, more motivated, and more involved employees. Absenteeism tends to be lower and job performance higher among employees whose jobs can be characterized as high in motivational job-design approach. The converse is true for jobs that are low on this approach.

On the negative side, jobs that match the motivational approach tend to have longer training times and are more difficult to staff because of their greater mental demands. Furthermore, given the more stimulating nature of highly motivational jobs, the employees are more prone to suffer stress and mental overload, and errors are more likely to occur.

Many executive, managerial, and professional jobs would score well from a motivational point of view. They are satisfying, rewarding, and highly motivating. Many craft and technical jobs would also score well because of their highly skilled nature. On the down side, all of these jobs require extensive training and experience, and major errors are a regular possibility.

Jobs low in the motivational elements tend to be those same jobs that received high scores on the mechanistic approach: low-level factory jobs, laborer jobs, and other unskilled jobs. They are not particularly satisfying or motivating; however, their training times are very short, and they can be staffed easily.

From a practical perspective, managers can enhance the meaningfulness of many office, factory, and service-oriented jobs by applying motivational principles. The positive benefits may include higher satisfaction and improved performance. But there are limits: The jobs may become much more expensive to staff, or the incumbents may pay an undue price in job stress or demand higher wages for more mentally demanding work.

Exhibit 3

THE BIOLOGICAL JOB-DESIGN APPROACH

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1. *Strength*: Does the job require fairly little muscular strength?
  2. *Lifting*: Does the job require fairly little lifting, and/or is the lifting of very light weights?
  3. *Endurance*: Does the job require fairly little muscular endurance?
  4. *Seating*: Are the seating arrangements on the job adequate (with ample opportunities to sit, comfortable chairs, good postural support, etc.)?
  5. *Size differences*: Does the workplace allow for all size differences between people in terms of clearance, reach, eye height, leg room, etc.?
  6. *Wrist movement*: Does the job allow the wrists to remain straight, without excessive movement?
  7. *Noise*: Is the workplace free from excessive noise?
  8. *Climate*: Is the climate at the workplace comfortable in terms of temperature and humidity, and is it free of excessive dust and fumes?
  9. *Work breaks*: Is there adequate time for work breaks given the demands of the job?
  10. *Shift work*: Does the job *not* require shift work or excessive overtime?
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*Biological Job-Design Approach*

This approach is derived from the sciences of biomechanics (the study of body movements), work physiology, occupational medicine, and anthropometry (the study of body measurements). It is often called ergonomics, and its main thrust is to minimize the physical costs and biological risks of work. The goal is to ensure that people's physical capabilities and limitations are not exceeded by the design of their jobs (a consideration that is frequently ignored).

Not surprisingly, jobs rating high on the biological approach (Exhibit 3) require less physical effort, result in less physical fatigue, create fewer health complaints, and cause fewer injuries than other jobs. They may even be associated with lower absenteeism and higher job satisfaction because they are less physically arduous than other jobs.

The biological approach might appear to have no drawbacks because the biological aspects of jobs are largely unrelated

to other aspects of job design. However, changes in equipment or job environments needed to implement these principles may be prohibitively expensive. In addition, it is possible to design a job with so few physical demands that the workers become drowsy or lethargic.

The biological approach has been extensively applied in the redesign of equipment used in physically demanding jobs so that women can better perform them. For example, ladders and other equipment have been changed for the telephone installer job, and handles on many assembly tools have been made smaller to better accommodate the female grasp.

These principles obviously apply to traditionally "heavy" industry jobs that involve difficult physical tasks and environmental stressors, such as jobs in the coal, steel, oil, forest, and construction industries. But some considerations are also important to many "lighter" jobs. For example, many light assembly positions require excessive

#### Exhibit 4

#### THE PERCEPTUAL/MOTOR JOB-DESIGN APPROACH

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1. *Lighting*: Is the lighting in the workplace adequate and free from glare?
  2. *Displays*: Are the displays, gauges, meters, and computerized equipment used on this job easy to read and understand?
  3. *Programs*: Are the programs in the computerized equipment for this job easy to learn and use?
  4. *Other equipment*: Is the other equipment (all types) used on this job easy to learn and use?
  5. *Printed job materials*: Are the printed materials used on this job easy to read and interpret?
  6. *Workplace layout*: Is the workplace laid out so that the employee can see and hear well enough to perform the job?
  7. *Information input requirements*: Is the amount of attention needed to perform this job fairly minimal?
  8. *Information output requirements*: Is the amount of information that the employee must output on this job, in terms of both action and communication, fairly minimal?
  9. *Information processing requirements*: Is the amount of information that must be processed, in terms of thinking and problem solving, fairly minimal?
  10. *Memory requirements*: Is the amount of information that must be remembered on this job fairly minimal?
  11. *Stress*: Is there relatively little stress on this job?
  12. *Boredom*: Are the chances of boredom on this job fairly small?
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wrist movements that can eventually lead to a chronic wrist condition. As another example, seating, anthropometry, and posture are important factors to consider in the design of an increasingly common office position, the video display terminal operator. In fact, the influence of proper seating design on long-term musculoskeletal health is an important concern for nearly all office jobs.

#### *Perceptual/Motor Job-Design Approach*

The main contributors of principles to this approach are the many human-factors engineering guidelines and the research on skills and how people mentally process information. Its basis, with its emphasis on perceptual and motor abilities, is experimental psychology.

In contrast to the biological ap-

proach, the perceptual/motor job-design approach ensures that people's mental capabilities and limitations are not exceeded. The two approaches are similar in that they both suggest that job-design principles can extend beyond the content of the job to the equipment and work environments involved.

The goal of designing jobs around people's perceptual/motor limitations (Exhibit 4) is to decrease the likelihood of errors and accidents. However, another result is to reduce the general mental demands of a job. Thus, like the mechanistic approach, the perceptual/motor approach decreases the chances of mental overload and stress, reduces training times, and improves utilization levels (i.e., percentages of workers who can perform the jobs with little or no training).

On the negative side, the perceptual/motor approach may lower satisfaction



and motivation because jobs can be less mentally stimulating.

The nuclear power plant operator's job, previously described, would get a low score on this job-design approach. The air traffic controller's job would also get a low score because of the amount of information the controller must attend to and remember and because of the stress of knowing the potentially devastating consequences of an error. Other jobs that would score low for the same reasons include most jobs that involve the operation of complex machinery, such as flying a jet aircraft or operating heavy construction vehicles. Other, less obvious jobs that can tax people's perceptual and motor capabilities include many product-inspection or equipment-monitoring positions. Not only must much information be taken in and processed in these jobs, but the vigilance requirements can also be mentally draining.

Jobs that would get a high score on

the perceptual/motor questionnaire are best described as not overly demanding in terms of concentration or attention. These jobs would include many administrative and clerical or service and custodial positions.

Some of the perceptual/motor elements, such as information processing and memory requirements, are relevant to nearly all jobs, both in the factory and in the office. No matter what the job, then, managers should always ask how much information employees must attend to, think about, remember, and communicate. They should also ask whether these requirements are within the capabilities of the least capable potential incumbent.

#### SOME PRACTICAL IMPLICATIONS

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ple checklist fashion to measure quickly the quality of a job's design in terms of the four approaches. The greater the number of affirmative responses to the questions for one of the approaches, the better that job is designed in terms of that approach and the more likely it is that the job will produce the outcomes that approach is intended to maximize.

For example, if you see that employees are not motivated, that job satisfaction is low, that absenteeism is high, or other similar symptoms, perhaps you should examine the motivational characteristics of the job's design. If you have difficulty staffing a job, if training times are high, if many errors are being committed, or if employees are stressed, consider the mechanistic or perceptual/motor aspects of the job. Likewise, if there is evidence of excessive physical toil and fatigue, look to the biological approach for potential solutions. The questions in Exhibits 1 through 4 will not only point out a problem, they will also lead to recommendations for improvement.

These job-design measures can actually be used in at least three different ways. First, they can be useful as a means of diagnosing organization problems. Only rarely is a job recognized as a potential problem source; as noted earlier, the most common explanation is that there is a "problem person." Along with other means of exploring the situation, the job-design questions can be used to determine if any significant problems exist with the job.

A second use of the job-design questions is in job-redesign projects. They can be used to identify jobs that need redesign, to indicate what redesign is needed, and to evaluate the jobs after they have been changed.

A third use is in developing new facilities or work organizations. The questions can be used as guidelines for providing job-

design recommendations during the design phase, as a checklist for evaluating equipment and job descriptions during the development phase, and as an evaluation instrument once the system is developed. The questions may have their greatest positive impact in the area of development, since they can lead to proper job design from the outset and help a manager avoid problems later.

Up to this point, we have not explicitly recognized the role of the incumbent in the job-design process. This is because most jobs exist before the employee arrives on the scene, and they will probably be filled by more than one person over the course of time. Initial job designs must be completed under the assumption that the job will be occupied by an average person. However, with time the incumbent can significantly influence the design of the job – by seeking out additional tasks, ignoring tasks, focusing on the interesting activities, changing the physical environment to reduce discomfort (through homemade padding or extra lighting, for example), or developing a job aid (such as a chart of commonly used numbers). The incumbent is actually an expert who can provide critical job-design information and recommendations. In fact, the incumbent is the primary source of information for the questions in Exhibits 1 through 4. We feel incumbents should be consulted much more often than they usually are.

#### A FEW CAVEATS

Job-design approaches have many similarities and differences, and no one approach can satisfy all criteria. Exhibit 5 summarizes the pros and cons of each approach. The perceptual/motor and mechanistic approaches tend to produce the same types of outcomes, both

*Exhibit 5*  
 SUMMARY OF OUTCOMES  
 FROM THE JOB-DESIGN APPROACHES

<i>Job-Design Approach</i>	<i>Positive Outcomes</i>	<i>Negative Outcomes</i>
Mechanistic	Decreased training time Higher utilization levels Lower likelihood of error Less chance of mental overload and stress	Lower job satisfaction Lower motivation Higher absenteeism
Motivational	Higher job satisfaction Higher motivation Greater job involvement Higher job performance Lower absenteeism	Increased training time Lower utilization levels Greater likelihood of error Greater chance of mental overload and stress
Biological	Less physical effort Less physical fatigue Fewer health complaints Fewer medical incidents Lower absenteeism Higher job satisfaction	Higher financial costs because of changes in equipment or job environment
Perceptual/motor	Lower likelihood of error Lower likelihood of accidents Less chance of mental overload and stress Lower training time Higher utilization levels	Lower job satisfaction Lower motivation

positive and negative. The biological approach is quite independent; it produces no outcomes in common with the others.

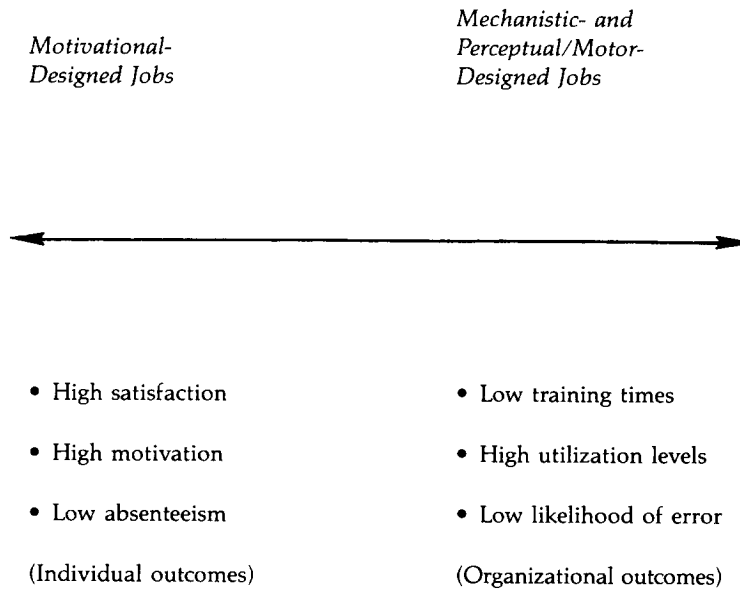
However, some distinct conflicts do exist. The motivational approach produces outcomes that are almost opposite to those produced by the mechanistic and perceptual/motor approaches. This opposition occurs because the mechanistic and perceptual/motor perspectives strive to design jobs that are simple, easy to learn, safe, and reliable, with minimal mental demands on workers. The

motivational approach encourages more complicated, challenging, and rewarding jobs. Furthermore, the motivational approach is the only perspective that encompasses the social aspects of job design.

Regardless of these conflicts, jobs can often be improved in one area and still maintain their high scores in other areas. Sometimes, however, trade-offs will be necessary. Fortunately, physical job demands, best understood in terms of the biological job-design approach, are independent of mental

*Exhibit 6*  
MENTAL-DEMANDS CONTINUUM

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job demands. Employers can reduce physical demands without sacrificing the mental quality of a job's design. The cost of equipment may, however, be a significant deterrent to implementation, and designing jobs with too little physical activity may also be unpleasant for the worker.

On the other hand, major trade-offs may be necessary in the mental demands of jobs. A mental-demands continuum, such as that depicted in Exhibit 6, illustrates the potential trade-offs. At one end of the continuum are jobs high in motivational features. They are mentally demanding and they attempt to maximize such individual outcomes as job satisfaction, motivation, and lower absenteeism.

At the other end are jobs designed in terms of mechanistic and perceptual/motor principles. They are less mentally demanding and attempt to maximize such organizational outcomes as higher utilization levels, lower training times, and lower likelihood of errors.

Most of the trade-offs in job design will involve this mental-demands dimension. Which trade-offs will be made depends on which types of outcomes a manager wants to maximize; the choice depends on one's values. Our research indicates that managers most often make compromises between an individual-outcomes orientation and an organization-outcomes orientation. (Some readers may have suspected this already.)

In other words, practitioners of the motivational approach are obviously concerned with organizational goals since they are interested in enhancing job performance, improving quality, and reducing costly absenteeism through job redesign. However, enhancing a job's motivational aspects may result in more errors, more stress, or more staffing difficulties. On the other hand, simplifying the job to enhance efficiency may make it less meaningful for the employees.

Since job redesign may have unintended consequences, all job-design approaches must be considered. Knowing all the approaches and their outcomes may help employers make more intelligent job-design decisions.

#### A FINAL WORD

Too often, jobs are developed haphazardly; they become arbitrary groupings of activities that our machines cannot do. Little consideration is given to the mental and physical capabilities, limitations, and needs of the workers who must perform them.

If any consideration is given, it is likely to be from a partisan perspective. Because of the academic discipline bases of the various job-design approaches, each approach tends to be owned by a different staff specialty or profession within an organization. Industrial engineers are typically located in manufacturing departments, ergonomists in industrial hygiene or safety departments, human-factors engineers in research and development labs, and organizational psychologists in personnel or human resources departments.

Universities have more cross-fertilization, but they do not have complete integration. Industrial engineers will usually learn the mechanistic approach and perhaps be exposed to the biological. Ergonomics and human-factors engineering are frequently combined in the same program, and students will study both the biological and perceptual/motor approaches, but the program will be primarily aligned with either the industrial engineering or the psychology department. Thus, students will get additional exposure to either the mechanistic or motivational approach, but probably not to both. Psycholo-

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gists usually receive training only in the motivational approach, with perhaps some exposure to the perceptual/motor.

This compartmentalization in both industry and academe tends to work against the interdisciplinary perspective we encourage. We hope that exposure to all approaches will bring about an awareness of people's multidimensional needs. Through the use of tools such as the questions in Exhibits 1 through 4, we can ensure that all critical considerations are recognized in the design of jobs.



#### SELECTED BIBLIOGRAPHY

The technical details of this study are published in "Development and Field Evaluation of an Interdisciplinary Measure of Job Design" by Michael A. Campion and Paul W. Thayer (*Journal of Applied Psychology*, February 1985). Other published work on job design by the first author includes "Biomechanics and the Design of Industrial Jobs" by Michael A. Campion and Eileen J. Phelan (*Personnel Journal*, December 1981).

A great number of literature references were drawn upon in the design of this study, and they were taken from a variety of different academic disciplines. In fact, there are literally hundreds of written works on the broad topic of job design in each of the relevant disciplines. Therefore, we will provide only citations to the more contemporary writings and to books that summarize the literature. For the interested reader, the books listed will contain references to the classic works and to the research articles in each of the areas.

A good contemporary book on the mechanistic approach to job design is *Motion and Time Study: Design and Measurement of Work* by Ralph M. Barnes (John Wiley & Sons, 1980). Another good description of the mechanistic approach that also addresses the biological features of job design is *Work Design* by Stephan Konz (Grid, 1979).

The most widely recognized version of the motivational approach is found in *Work Redesign* by J. Richard Hackman and Greg R. Oldham (Addison-Wesley, 1980). An excellent document that addresses the motivational approach from a broader perspective is *Task Design: An Integrative Approach* by Ricky W. Griffin (Scott-Foresman, 1982).

A well-known book on the biological approach is *Fitting the Task to the Man: An Ergonomic Approach* by Etienne Grandjean (Taylor & Francis, 1980). Grandjean also treats the perceptual/motor approach to job design. Another good book on the biological approach that focuses mainly on the biomechanical aspects is *The Biomechanical Basis of Ergonomics: Anatomy Applied to the Design of Work Situations* by E. R. Tichauer (John Wiley & Sons, 1978).

An excellent reference source on the perceptual/motor approach, *Human Engineering Guide to Equipment Design*, was written by a variety of authors and edited by Harold P. Van Cott and Robert G. Kinkade (U.S. Government Printing Office, 1972). Another well-recognized book on the topic is *Human Factors in Engineering and Design* by Ernest J. McCormick (McGraw-Hill, 1972).

Finally, *Design of Jobs*, edited by Louis E. Davis and James C. Taylor (Goodyear, 1979), is a novel book that includes the unusual combination of articles on both the mechanistic and motivational approaches and that provides a historical perspective on job design.

If you wish to make photocopies or obtain reprints of this or other articles in ORGANIZATIONAL DYNAMICS, please refer to the special reprint service instructions on page 80.