ERGONOMICS AND PRODUCTIVITY: A STUDY OF
AN OFFICE EMPLOYEE'S RELATIONSHIP WITH
HIS OR HER PHYSICAL SURROUNDINGS

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INTRODUCTION

Since the beginning of its existence, the human race has worked to increase the comfort of its members. In the beginning these efforts may have consisted merely of turning the rock upon which one was sitting to the most comfortable position. Primitive ways of life resulted in the most primitive means to comfort; the caveman had nothing but a few animal skins with which to work. Gradually, with the coming of civilization, man developed the means to reduce hardship to the body. Along came new and improved fabrics, furniture, and buildings specifically designed to increase the comfort of their users. For the first time people could direct their attention away from their bodies and towards their tasks. As a result, people were able to get more accomplished with less physical hardship, and a trend was started that would continue even through today. The modern world has many innovations designed to help improve the productivity of the working force; ergonomics is only one of these many concepts.

According to Richard Koffler, "ergonomics is the art and science of reducing both physical and psychological problems that might arise from the interaction of people, equipment, and the environment." For many hundreds of years people have been forced to adapt to their surroundings. To do so meant survival; failure meant death. With today's modern conveniences, however, more managers and office designers are turning their attention away
from what the employees can do for the office and towards what the office can do for the employee. "The focus of ergonomics is on the design of products and environments that adapt to the user rather than vice versa." The more the work environment fits the worker, the more at ease they will feel. Productivity generally increases as satisfaction rises.

"The more satisfied (employees) are with their job . . . , the better their performance." Employees cannot work properly if their muscles ache from sitting too long in uncomfortable chairs or if their eyes burn from an improper lighting system. Ergonomics seeks to remove the causes of these discomforts and to ultimately improve worker productivity by allowing workers to concentrate on their tasks and not on the physical impediments of their jobs. Efficiency should increase and with it the satisfaction of everyone involved.

Dr. Jan Baumgartner reports that "environmental control and ergonomics equals economic success." If employees feel comfortable with their working environment, they will generally work more efficiently. Costs due to errors will decrease and productivity levels will generally rise, thus improving the cost effectiveness of operations. "Ergonomics does not actually improve productivity, but instead removes impediments to performance and thereby yields significant returns on investments." People are the best investments an organization has. Shouldn't they receive the best possible treatment? An ergonomically sound office design can make this possible.

The following report presents a discussion on some of the various elements an office manager can classify as ergonomic factors. When considering the office as a sum of its various parts, each aspect may seem relatively small and unimportant. Each, however, can have a significant effect on employees and their productivity, and, therefore, deserves consideration when designing an office to fit the needs of office employees.
STRUCTURE
STRUCTURE

"The office should be a space where architecture, furniture, fabric, color, and a little fantasy combine to create an attractive, comfortable, and functional environment." The office starts as a room or a cluster of rooms. From that point, the manager and designer must design an appropriate structure that will enhance the efficiency and productivity of the employees. The layout of an office, "the physical arrangement of furniture and walls within a work space," must not only follow an arrangement that accommodates furniture and equipment, but people as well. Furniture firms and design firms have developed hundreds of ways in which the interior of an office can be defined. Tastes have recently changed with the development of some very innovative concepts.

Styles

**Bull Pen.** For many years the office received very little attention. The office in many plants often consisted of a small room or group of rooms located in a back corner somewhere. These first offices often had no formal arrangement. No true "method to the madness." Later, as the number of workers in the office increased, design became more formalized and managers started preparing formal layout plans with which to arrange their work spaces. One of the most well-known of these plans became known as the bull pen seating plan. This plan, used extensively during the post World War II years, simply arranged the employees' desks in a "pooled office seating" order (See Figure 1). Allowing for little imagination and virtually no personality, the bull pen arrangement did enable supervisors to watch over employees with ease as well as keep the office arranged in an orderly fashion. The bull pen style, however,
led to many problems, some of which greatly hindered employees while they tried to work.

The bull pen method may have worked well for supervisors, but it proved very unsettling to many employees. Because desks were all located in one large room with no barriers between them, many employees found it very difficult to concentrate on their tasks. The lack of visual and acoustical privacy simply caused too many distractions to work effectively. Many employees felt alienated by the situation; gone was their sense of individualism and personal orientation. Employees, whether or not they consciously realized it, simply could not function as effectively as their capabilities permitted. Modernization has made some changes in office structure, however, and great inroads have been made in enhancing employee productivity.

Open Plan Office. One of the newest and most widely accepted innovations in office design is called the open plan office. This plan basically calls for the division of the work space into individual workstations by the use of panels and partitions. Since its introduction in the late 1960's, this concept in office structure has virtually taken the professional market by storm. Employees like it because it gives them a degree of privacy and allows them an area they can really identify with. Supervisors also like it because complaints are decreased and employee productivity is increased. The popularity of the open plan office has increased rapidly as managers see how it helps to increase employee productivity.

Essentially, the largest difference between the open plan and the bull pen concerns enclosure. Enclosure is "the barriers, walls, file cabinets, etc. that physically separate one employee from the next." Most bull pen situations provide very little, if any at all. Open systems, on the other hand usually allow for some degree of enclosure by using partitions in such a way that em-
employees are designated individual working areas. Figure 2 presents an excellent example of an open office. While employees still work in one room or in groups of rooms, each can be assured that one of the little nooks in his or her personal territory. In this place they can work free from distractions, at least to a point. This environment is much more conducive to higher productivity and if designed using the proper elements, could prove very advantageous to everyone in the workplace.

Figure 1.
Open office.

Source: Administrative Office Management
by Eleanor Hollis Ladasco and Robert R. Mitchell
The open plan system provides the much needed flexibility in the modern office. Rather than constructed with solid walls, open plan systems usually use movable elements such as cabinets and partitions. Also, managers like the tax benefits experienced as a result of the rapid depreciation of partitions and lighting. Greater energy efficiency can often be accomplished, including improved lighting efficiency. The open office units often supply their own lighting, decreasing the use of unnecessary general lighting. These advantages can be realized if the open plan is constructed properly.

**Construction**

The interior space must be flexible to accommodate the expansion and shrinkage of various departments within the company. The employee, on the other hand, must be able to respond to these changes without losing his personal identity or reducing his productivity.

With today's rapidly changing technology, office managers are finding that they must constantly reorganize their office structures in order to keep pace with changing technological needs. This means that instead of constantly demolishing and building walls, a very expensive and time-consuming process, managers must use other means to separate workers. Sometimes file cabinets can be used. In this way, a double purpose is served in that the person is provided with privacy while the files he or she is working with are located close at hand. File cabinets, too, require a minimum amount of effort in relocating them. Even plants have received attention as dividers. These accented plants are "especially grown to live in low-light building interiors." They provide a human dimension to an environment often overflowing with electronic equipment. Plants and cabinets work well in the open office. Another very workable solution is the concept of movable partitions.
Movable partitions come in a variety of shapes and sizes and can often be mixed/matched to suit a variety of needs. Many organizations have found them to be very adaptable to the many demands of an automated environment. Usually easily assembled and disassembled, these panels can be rearranged with a minimum of effort and cost since they require no building or demolition. Simply snap and unsnap to build the new arrangement. Often these panels are made available as complete units. Vendors can then supply additional partitions when needed. These unit assemblies, with their reversible storage units and removable tackboards, offer unique opportunities for shared equipment, shared storage and work surfaces. A manager has the capability of designing a complete workstation in nearly any arrangement desired using any or all of the features offered by vendors. Movable wall partitions serve well as temporary walls. They can also be used for a number of different purposes.

Depending on the particular materials used in construction, wall panels can provide a certain degree of sound absorption. Tibbet, Incorporated, for example, specializes in the design of office dividers that provide the greatest amount of sound control. An office constructed using their panels can provide enough acoustical control that people will be able to function in an environment almost virtually free of disturbing noises. A personal experience demonstrated the effectiveness of this innovation. On a recent visit to the Merchandise Mart in Chicago, I had the opportunity to visit the Tibbet showroom. As I stepped from the carpeted and metallically furnished hallway into the display, I observed a very noticeable difference in the acoustical level between rooms. The hallway held a bit of an echo and caused voices to ring somewhat as the sound bounced off the hard, non-absorbing surfaces. The display, however, held no such characteristics, and, if anything, I almost felt I had to
shout to be heard in an empty room! Office panels, if constructed properly can provide very good noise control in addition to several other things.

Many vendors offer panels with a variety of features. Steelcase offers dividers that accept power in "from floor or ceiling." The buyer (user) has the option of designating wiring for different types of automation and even has the capacity to provide task lighting over the personal workstation. A variety of work surfaces (counters and shelves) can often be attached. GP Furniture Systems offers "hang-on components such as acoustibands, chalkboards, and wardrobe units (that) add to the overall efficiency of open plans." If managers can design a solid structure, they will be able to outfit their workstations with virtually everything needed. The same is true for variations of the open plan.

Variations

Many corporations want to make the workplace as conducive to efficiency as possible, but do not want to turn their space into a completely open system. From this notion came the modified open office. This plan presents a combination of open and private space. Usually the top executives are provided with private offices as a symbol of their status. The remaining employees then work in an open environment, using any of the various open office plans. Many buildings are constructed in such a way to allow for this type of structure. Other times the partitions can be added to accommodate various levels of privacy. The more enclosure, the more status. The modified office plan, while not perfect, can help solve some of the problems seen in a purely open plan office.

Problems

While the open plan office does provide some degree of privacy, some employees complain that they still lack visual and acoustical privacy. They can
still hear noise and, in some cases, can still see movement and this is
even enough to distract them from their work. Some employees feel a loss of
status, especially if they are taken out of a private office and "put out
with the gang." Finally, managers sometimes resist the use of partitions due
to high installation costs. Costs may be high upon initial installation, but
if properly maintained, they should pay for themselves through increased pro-
ductivity within a relatively short time.

Conclusion

Managers can do much to design an office structure that will enhance the
productivity of their employees. The office may start out as a bare building
with a few rooms. With a few innovations and some creative designing, these
rooms can be transformed into a very effective workplace. The office should
be efficient and cost effective; this does not mean that it cannot have an
attractive and comfortable appearance that gives employees some much-needed
privacy.
LIGHTING
LIGHTING

"The relationship between lighting levels and productivity has been studied by a number of people indicating a significant loss of productivity with reduced light levels or poor quality lighting in general." Many companies do not seriously consider the effect lighting can have on employees and recklessly install the first system that comes along, whether suitable or not. Lighting, however, is actually one of the most critical factors in the office environment, and "since office work is primarily visual, an effective office lighting system should support human vision in every possible way." The installation of a company's lighting system is one of the most important factors of the office environment; managers should have at least a basic idea of what lighting means to the workplace.

Quantity

Employees need enough light to work by, and managers must take care to design lighting systems that neither under- or overcompensate these needs. The quantity of light, "the distance from the light source to the work object, and the strength of the light source," can be controlled in a variety of ways. Occasionally, wall panels and furniture can be organized in such a way that will enable people to shield themselves from the brightest sources while maintaining an adequate to work by. Sometimes an office can be designed using fixtures which can provide some type of filtering effect. Westinghouse Furniture Systems, for example, constructs High Intensity Discharge (HID) fixtures, panels that are either panel mounted or free-standing. These versatile panels are "a powerful ambient (surrounding) light source, replacing task (direct) lights in open areas," and help control the light that will reflect either directly or
indirectly onto the work surface. The most popular way of controlling light, however, is at its source. Many managers feel that by solving a problem where it starts will decrease problems in other areas.

Different types of lighting systems emit different quantities of light. Basically, six different types of lighting are available for office use: incandescent, fluorescent, mercury vapor, metal halide, high-pressure sodium, and low-pressure sodium. Managers need to evaluate the difficulty of the tasks and how the tasks receive light in order to determine how much light they need and what type of source they should use. Currently, "flourescent lighting constitutes about 70 percent of all lighting in the United States." This type of lighting acts as a very effective lighting source in many working situations because it provides light in adequate quantities to large open areas, especially in places where ceiling height measures between 7.5 feet and 10.0 feet. With the exception of metal halide lamps, any of these methods of lighting should provide satisfactory illumination over large areas. For smaller personal workspaces a new concept has recently received a great deal of attention.

Task/ambient lighting has become a very popular concept in properly illuminating the personal workspace. Task/ambient lighting "directs light to the task, and not into the user's eyes. At the same time, task/ambient lighting provides enough ambient light to illuminate the surrounding area." In other words, task/ambient lighting generally allows for a high amount of light over the surface where a person is actually working, but keeps the surrounding area lit at a lower level to provide a workable contrast. Many companies will structure such a lighting system in a way that allows the company to control the surrounding light through timers and computerized systems. Occasionally ambient lighting can be coordinated with daylight hours, enabling the company to decrease its electricity usage and make use of natural light from outdoors. The individual,
too, can control the lighting over his or her own personal workspace, turning it off and on as needed as well as adjusting lighting levels. Task/ambient lighting works well for both the individual and the company. Each gets the necessary lighting, and costs are kept to a minimum since large quantities of light are directed only to very small areas as compared to the entire workplace. One must be careful, however, to not overdo this type of lighting.

Task/ambient lighting can work well for a company, but managers must take care not to overdo task lighting while underdoing ambient lighting. Headaches and eyestrain could easily result from moving frequently from one type to another. The human eye is constantly adjusting itself to cope with changing lighting levels, and major adjustments made on a frequent basis will eventually strain it, causing impaired vision among other physical ailments. Generally, moderate levels for both task and ambient lighting should provide light satisfactory to work by while reducing the risks provided by poor lighting. However, no quantity of lighting will suffice if the quality is poor.

Quality

An office or personal workspace lighting system may be composed of certain elements that, while seemingly minor in themselves, can pose a problem to the individual. People need stimulation in their environments to help relieve boredom and monotony that occurs from time to time in their work. Variations in light patterns can provide one solution to this problem. For example, "... research indicates that 'sparkle' ... invigorates the mind, thereby encouraging conversation, productivity, and other positive traits." Bright, vivid colors also help to direct peoples' attention to the particular light concentration. Designers will often recommend that conference rooms and corridors be provided with this type of lighting. These areas usually are not
the locations where critical work is performed, but they do serve as places where people frequently interact and may need a "picker-upper." One must take care, on the other hand, not to clutter the workspace with lighting innovations.

While some variations in light patterns are good, designers must be careful not to overdo the effect they intend to create. Coordinating the lighting pattern with the design of the workspace is very important in that conflicting patterns may distract the worker. Although the employee is provided with too many stimuli and is provided with too many things on which to concentrate in addition to his or her work, with the typical employee, judging from personal experience and observation, the outside stimulation will win in the contest for workers' attention. One of these "attention getters" surprisingly is shadows, or actually a lack thereof. Shadows supply contrast to the work area and without them, the area can become literally boring. People need stimulation in their work areas and by varying the lighting patterns, can receive that boost that will help them better direct their attention to their work and keep it there. Lighting variations with color can often have the same effect.

Office managers and designers must coordinate the lighting structure in an office with the color scheme. "Most people generally prefer cool tints for high light levels and warm tints for lower levels." Imagine the blending effect a bright light would have in a room painted yellow! Better yet, imagine the improvement when the same room is painted blue. Lighting also has a tendency to affect color perception. Fluorescent lighting, for example, can cause various color shadings to appear quite differently than when in natural lighting. Different lighting sources have different effects and do not necessarily match other sources. As an employee moves about him or her building,
he or she may notice differing shadings in different areas. This aspect must be seriously taken into consideration as one is designing the office and its lighting system. A designer must know what colors appear well with what lighting and work for satisfaction in all aspects. These elements, when combined, can create major lighting problems for people if not handled properly.

Glare

Have you ever been driving on a bright, sunny day and been nearly blinded by the glare off the windshield? This effect, on a somewhat lesser scale, has appeared in many offices and has presented a major problem to employees. “Glare is defined as unwanted extremes in brightness.” Experts have even developed a measure called the Visual Comfort Probability rating in order to measure the glare in a particular office. The VCP rating measures the percent of the people seated in the worst location in a space who would not be bothered by glare. This rating depends on the room(s) configuration, surface reflectivity, and the space between fixtures. Obviously the lower the rating, the lower the glare and the better the visual environment in the office. Glare basically comes in two forms: direct and reflected. Neither is particularly desirable in high quantities.

When a person looks at unshielded or improperly shielded lighting equipment, he or she encounters direct glare. Looking at a lamp without a shade will provide an excellent example of glare, especially as the bulb strength increases in intensity. Reflected glare, on the other hand, usually results from shiny reflections caused by light literally bouncing off mirror-like surfaces. A variation of this situation, veiling reflections, occurs “when light bounces off the task or workstation into the viewer’s eyes, washing out contrast on the surface of the task.” This has been a very common problem with video display
terminals (VDTs), and lighting systems must be structured in such a way as
to prevent this from happening as much as possible.
Controlling the light source with reflectors, lenses or louvers will help
control direct glare. In this way, the light does not shine directly into
the employees' eyes, but still emanates plenty of light onto the worksurface.
Reflected glare, by placing the light source at an oblique angle to the task, can be
reduced to a satisfactory level. In other words, managers and designers
should try to avoid placing light sources at angles that will reflect light at
a perpendicular angle back into the employees' eyes. As you can see in Figure 3,
a slight modification in the modification in the angle that light is directed
upon the worksurface can provide the much needed improvement to the workers'
environment. Improved lighting is not a very difficult concept to grasp, and only
by understanding even a few of its basic ideas will managers be able to improve
the total environment of their offices and individual workstations.

Conclusion

A good lighting design is realized if all spaces are properly
composed in a clear hierarchy of importance and purpose; the
lighting provides spatial clarity; its mood is consistent with
each function and the space design; it provides for good po-
tential productivity; is readily maintainable, energy-effective
and is within budget allowance.

A basic understanding of the office's physical environment includes at least
a minimal grasp of it lighting and how it affects the workers and their well-
being. Employees must have proper lighting if they hope to serve as productively
as possible. Managers must research the specific lighting needs of their business
and then select the most suitable lighting system. Selecting one of the
inferior systems could prove disastrous and costly in the long run if it requires
replacing. Poor quality lighting has been shown to result in reduced productivity.

Why not get it right the first time and make everyone happy?
Figure 1. The offending zone. Light from this area creates glare on a specular surface lying flat on the desk.

However, oblique lighting reduces glare.

Source: Furniture Integrated Lighting
By James L. Suckolls
CARPETING

The origins of carpet weaving have been lost in antiquity. The first wool carpet may have been crudely hand woven in Nineveh or Babylon around 5,000 B.C. An Egyptian fresco, depicting workers at a loom, provides concrete evidence of skillful weaving as far back as 3,000 B.C. The most ancient records, including the Bible, mention the use of carpets.

People have used carpeting in their homes for thousands of years. Sometimes they weaved it merely for decoration; a tapestry to hang on the wall. Most people, however, weave or buy carpet for a more practical purpose: to cover the floor and keep their feet warm. This has proven especially true for people in furnishing their homes, but many offices have discovered the advantages of carpeting their floors. Carpeting an office is not much different than carpeting a home and may prove very beneficial in improving the working conditions and in increasing worker productivity in the long run.

Profile

Throughout history carpets have been constructed in a variety of ways for a variety of purposes. By the time they made their grand entrance into the workplace, however, "much machinery and skillful labor (had) found its way to our shores, and the roots of many of today's major carpet manufacturing firms were firmly established." Most employees appreciate the comfort and warmth they get when stepping off a bare floor onto one that is carpeted. Carpeting helps to absorb the impact placed on the feet while walking and generally increases walking comfort. In addition to absorbing impact, carpeting helps to absorb sound. No longer do employees have to be disturbed by a person's footsteps everywhere he or she crosses the room. Automated equipment also, especially if placed directly on the carpeted surface, have much of their sound absorbed. Employees can then concentrate more on their tasks without distracting
clattering and humming noises. Wool carpeting suits these purposes nicely and has become a great favorite with designers as well as office managers.

While synthetics have succeeded in many different products, they have not received nearly as much positive recognition as wool. Wool has achieved a much higher acceptance rate simply because "synthetic rugs and carpets cannot compare to the exquisite beauty and luxury of wool—even when new."34 Wool can fulfill virtually all demands and look good too! Many office managers like wool carpeting for its durability. "Laboratory tests and actual wear tests . . . have shown that wool looks better, lasts longer and retains a position of superiority among fibers that cannot be duplicated in a test tube."31 In this sense, managers need not worry about frequent repair and replacement costs. Also, "wool fiber has a natural crimp, like a small spring. It can stretch up to 30 percent of its length and still return to its original form."32 Wool is very capable of withstanding the large amount of traffic that constantly flows through the office. Managers want carpeting that will wear well and be cost-effective; employees want something attractive and comfortable underfoot.

The tactile reaction to wool is a very positive one. It's soft. It's smooth. It feels like nothing else feels. You can run your hand over it, walk across it on your bare feet, sit on it, and the good, quality feeling of wool is there.

Wool can help increase the warmth in a room by increasing the amount of insulation that the room contains. In the same fashion, "wool's lift and air pockets also help to keep out surrounding heat."35 This helps keep down heating and air conditioning costs as well as keeps the office's atmospheric conditions at a comfortable level. Wool is manufactured using fibers of a natural quality.33 With today's present attitudes towards getting back to nature, this helps put a positive aspect on the working environment in addition to helping relieve some of the stark sterility often found at the workplace.
Finally, wool carpeting contains a unique ability to absorb moisture and vapor. This reduces static electricity, which, as seen with other types of flooring materials, can severely inhibit the operation of automatic equipment and cause annoyances to affected employees. Wool carpeting offers many advantages to its benefactors. Alone it works well; however, when carpeting, wool or other, is used with some form of padding underneath, the benefits multiply.

**Cushioning**

"Carpet with separate cushion can mask surface irregularities found on most concrete floors and eliminate the need for costly sub floors." Managers have found that by using a separate carpet cushion or pad, they can cover up floor irregularities by increasing or decreasing pad thickness where needed. This will obviously save the expense and inconveniences caused by construction. Some companies have attempted to use direct-applied carpeting that sticks to the surface that it is placed on. If these carpets need maintenance, however, they must be picked up and scraped to remove any residue from the adhesive backing. This can result in a very costly operation especially if the floor itself requires cleaning and repair as a result of the carpeting. Separate carpet cushioning eliminates this problem as well as provides a number of additional advantages.

Separate carpet cushions help to increase the sense of luxury employees feel when treading on a carpeted surface. Instead of one layer, employees have two into which to sink their feet. In addition to creating a more honey feeling in the office, carpet padding helps decrease the amount of jarring that walking causes for the body. People feel more comfortable on their feet (providing they wear appropriate shoes) and will not be discouraged from spending time doing tasks that require time walking or standing. Carpet
cushioning also increases "the sound-absorption property" of carpeting. Adhesive-backed carpeting reduces the noise level in an office to some extent. However, separate padding provides that extra layer of sound-absorbing material. Without this feature, the office could have problems with echoes, especially if it has a low ceiling. Employees will find their concentration constantly broken, and they will not be able to function as well as desired. As insignificant as it may appear, carpeting and its padding are a very important element in the office environment.

Conclusion

While the uses and types of carpeting have been varied for thousands of years, the office has managed to adapt it to become a very workable element in the office environment. Carpets have proven that they can serve very practical purposes and still remain attractive to the eye. An office manager need not be an expert in the area of carpeting in order to select the best carpeting for his or her facilities. All he or she needs is a little common sense mixed with a touch of good taste.
COLORING

Over 60 percent of an interior's acceptability will be based on the color in which it is presented. Color . . . can mean the difference between an optimally successful, memorable interior environment, and one which is not.

Many people are often surprised to find out the effect color can have in an office environment. Obviously, a pretty color will be much more appealing to employees than an ugly one. Yet, very few realize some of the subtle differences that can be wrought simply by slightly altering a particular shade of a particular color. Some colors produce stimulating moods; others help to calm and relax employees. Managers can do much to help and hinder the moods of their subordinates merely by decorating their offices in certain color classifications.

Moods

Studies have shown that colors placed within certain classifications have varying effects on the moods and attitudes of employees. The basic classes of colors usually reflect the temperatures that each color associates with. In the same fashion, these "temperature colors" usually place the associated feeling in the minds of the employees. Light, cool colors, such as blue, lavender, and light green, usually suggest moods of repose and freshness. Picture the scenery of a meadow with long, soft grass and a clear blue sky. These scenes generally present us with relaxed feelings, feelings of a calm and peaceful nature. Imagine the results of these colors were used in the decorating scheme of an office or even the personal work space. Managers, of course, do not want to lull their employees into a state of lethargy, but by giving their employees an atmosphere to relax somewhat by, they will succeed in keeping tempers down.
And generally helping to relieve some of the tensions felt in the rapidly-paced business community. Some colors, however, have just the opposite effect.

Bright, warm colors such as orange and scarlet, have a very invigorating effect on employees. Rather than calming people down as do cool colors, warm colors tend to bring a sense of excitement and exhilaration to the office environment. "Good set by color can affect health (in that color) affect(s) pulse and respiration rates, blood pressure, brain activity, and biotymews." 32 Red, yellows, and oranges tend to wake the soul, to bring people out of dull, sleepy states. Why do you suppose emergency vehicles and traffic control devices are painted with those colors? Many businesses, also, will use warm colors when daily operations require a high stimulus for action. Schools, for example, have recently been experimenting with warm color combinations in attempts to stimulate students more with their studies. In the office, however, warm colors usually do not generate a high level of success, and managers tend to stay away from them. Experts have generally found that "quiet and pastel colors are desired most" 33 often by employees for a variety of reasons.

Some warm colors, such as some shades of yellow, have proven successful in the office environment. However, many people report that bright, warm colors increase tension and decrease comfort. They can never relax for long periods of time when constantly surrounded by invigorating colors. Some stimulus may be good, but enough is enough! Cool colors, on the other hand, have proven to be very successful in the office environment. Employees generally feel more at ease and can generally concentrate more on the tasks at hand because it is the strongest stimulus at the moment. Managers have greatly preferred using cool colors such as blue for many years in designing their office coloring schemes. Office coloring schemes often follow many of the same trends that dictate the colors people use for their own personal use.
Trends

According to Patricia Stevens of Black Tie Designs, "commercial office colors tend to follow clothing fads by about three years, but in more muted tones." Recent clothing styles have emphasized brown and beiges in their fabrics. Likewise, office designers have witnessed a significant increase in tans and beiges as part of the coloring schemes for major companies. "Fawns and greys, also, are seeing an increased amount of usage. "Fawn makes people feel less threatened while grey signals a noninvolvement feeling." Both of these colors have seen increased usage by clothing designers as well. "Grey, (also), allows a businessman to alter his tones while always incorporating the neutral grey scheme." Ever notice how grey is fast becoming the most popular color to wear in a job interview? The same is true when decorating an office; a manager wants to remain fairly neutral in his or her coloring scheme while still allowing for the personal touch.

Violet, due to popularity by young girls, is becoming popular in offices where women will soon become half of the workers. Women have long favored this color and as they increase in numbers within the work force, more companies are creating color schemes which will give them the greatest amount of satisfaction while they work. However, according to Cynthia E. Ostrander of Tibbet, Incorporated, peach appears to be taking the lead in the demand for color schematics. This is not particularly surprising if one reflects for a moment on the clothing trends of the past few years. Pink will probably never reach the office, but peach, in subdued shades has already achieved a moderate level of success. Color schemes are very important in designing an office; most color is permanent until the next major overhaul. Managers can find ways to alter color in their work places without major redecoration.
Artwork

Artwork, while usually one of the most minor touches in a decorating scheme, often becomes the focal point of a room, especially when a person first enters. "The dominant color and 'movement' within a painting or graphic can prove to be the most important aspect of the room setting. Artwork combined with the general coloring plan of an office can often provide just the right amount of stimulus to keep employees from sagging, yet not enough to keep their blood pressure constantly high. Managers should attempt to choose conservative paintings if they wish to liven up their walls. Trendy or faddish artwork is often objectionable to conservative people and usually fades in its appeal within a short amount of time even to the people who like it. Actually, managers may find that they can provide some stimulus simply by rotating their artwork from time to time. Different designs on the same background (wall or panel) can often wake up a bored mind if even just a small amount. In any case, managers can find that using a positive coloring scheme in their office could have many positive effects on the employees.

Conclusion

Without consciously knowing it, people can be subtly manipulated through the use of a number of coloring schematics. Color can wake up or calm down simply by the stimulation or lack of stimulation that the color provides. A color that is unattractive will likely create a bad mood and attitude, and managers should try to stay away from odd and unappealing coloring schemes. Not everyone likes the same things. However, managers by using a well-coordinated coloring scheme can usually find a mix that will satisfy a majority of employees while still enhancing the working environment.
SEATING

Once the physical aspects of the office have been adjusted (walls, floor, etc.), the manager must be sure to complete the job. Selecting the proper furniture for the office can prove to be a very vital component to the employees; they are in almost constant contact with it during the entire workday. Furniture, "those objects in the environment, functional or not, that are movable," affects practically every part of the human body in one way or another. Probably the single most important piece of furniture in the office is the chair. According to Dr. Perry Haney, a chiropractic physician, "sitting is just as perilous to the back as lifting. There is just as much back pain in sedentary workers as equipment operators." The muscles may be strained in different ways, but the pain is the same. Office managers must take great care in choosing the right kind of seating for their employees.

Importance

"The spine is the pillar of our body." It is also one of the most important things to properly care for. Most office tasks are done in a sitting position, and people usually can shift their positions periodically to relieve some of the pressure placed on the various parts of their backs. A person can only curtail around so much, however, especially when their chair is designed in such a way that restricts movement.

All of us are more productive when we are comfortable. It is equally obvious that human beings come in a multitude of different sizes, shapes and sometimes limited physical capacities. There is no average size person, only average statistics. Your chair will affect your comfort more than any other single factor as it is your most used and personal item. If a chair is to support so many variables in a comfortable way, then it must have adjustments that can be set in an infinite variety of fixed positions (static-posture) or move with you as you move (dynamic-motion). You should not have to adjust to the chair, the chair should adjust to you."
Managers can do all they want to build an office that will be conducive to high productivity rates, and success may be obtained to some degree. However, anyone who has ever attempted to function for any length of time in an uncomfortable chair will understand how difficult it can be to fully concentrate on his or her tasks. If the feet do not touch the floor properly, circulation can be affected, and the feet can literally "be put to sleep" and the leg muscles strained uncomfortably. Improper back support may cause the back to ache and may force the worker into an incorrect posture. These are only some of the short-term effects caused by poor office seating. Permanent damage could result if managers do not take measures to provide adequate seating for their employees.

Construction

The number of variables that must be considered when selecting the seating for office employees is almost seemingly endless. Many people tend to take for granted the many elements involved in the construction of the chairs they sit in. No one chair will likely be perfect in all factors, but each is a vital part of the chair and must be considered in its design and selection.

Height. The "appropriate seat height reduces substantially the stress placed on legs, arms, and lower back."63 The chair must be set at an appropriate seat height as compared to the actual work surface; "as a rule, this should be 10 to 12 inches."64 See Figure 4 for specific height measurements. The seat should be high enough to allow the wrists and arms to rest and move comfortably on the work surface and yet be low enough to allow the feet to rest completely flat on the floor with a minimum of pressure to the bottom of the thighs.65 Obviously, different sized people will require different chair heights. "A simple means of determining appropriate seat height is to stand..."
Figure 4. The ratio for the distance between seat height and working surface.

Source: Ergonomics and the Science of Successful Seating, 1981,
by CF Business Equipment
facing the chair. The front edge should be even with a point one to two inches below the knees."66 Employees should be able to find a chair height that will be suitable to each individual body structure.

**Back Height.** Where possible, a backrest that reaches right up to the shoulders should give full support and effectively relieve the back muscles of strain."67 People must take into consideration the way body weight is distributed while in a seated position. The way the spine curves has a great effect on this. "Proper lumbar (lower back) support is provided by backrest curvature in the lumbar area in combination with the saddle effect of the seat."68 Specific pressure points on the back can make all the difference in a comfortable backrest. If it is too low a person may feel themselves forced to work in a stooped position with a majority of their weight placed on the pelvis and lower part of the body. Effective support should be obtained by positioning the lower edge of the back (of the chair) at the back of the lumbar curve."69 In this way the employee should be able to obtain the back support needed to avoid unnecessary discomfort.

**Back Inclination.**

Although the optimum seating profile is important, it cannot, by itself, prevent the anatomical problems of the sedentary lifestyle. An occasional change of posture is the workplace—for instance, from forward to back—is essential in keeping the intervertebral discs supplied with nutrients and therefore avoiding back problems. If the discs are subject to strain, an inside-to-outside diffusion "drop" develops and the tissue fluid in the discs is expelled. When the strain is relieved, the fluid flows back in, bringing new nutrient substances with it.

Given the importance of motion in sitting, it's obvious that the ideal working chair should provide the worker the opportunity to change from a forward position to a leaning-back position as he desires. Correct seating is dynamic seating.

Figure 1 diagrams the optimum inclination needed for proper seating.
Figure 9. Optimum Sitting Profile

Source: Ergonomics and the Science of Successful Seating...
by GF Business Equipment
People must be able to lean back and stretch periodically throughout the workday. They cannot do this properly if their chairs are not flexible enough to tilt backwards (or forwards for that matter). "The backrest tilt provides support to the upper back... As the center of gravity is shifted back, the amount of back muscle strain is relieved." Many furniture designers, including Steelcase, Fixtures Furniture, and Knoll, are designing chairs with flexible back supports. Fixtures Furniture, for example, can be set "from 15° behind vertical to 5° forward of vertical." The muscles need to be used every once in a while; people can try to stretch out, but without a well-designed backrest, they will find it difficult to really get comfortable.

Today's chairs are at last making that possible.

**Seat Inclination.** A good chair seat should tilt slightly backwards for a comfortable fit. This will help eliminate pressure at the back of the knees. It will also help keep the employee from sliding off the front of the chair. The seat must not tilt up too high, however. The back should still be able to rest comfortably on the floor, and the employee must never feel as if he or she is going to fall over backwards when sitting down. The exact amount of tilt will vary from person to person. People may be approximately the same height, but one person may have longer legs than another. Therefore, he or she may prefer a higher tilt than someone with shorter legs. Fixtures Furniture offers chairs that can vary in tilt from approximately 15° above horizontal to 5° below horizontal. People have the tilt features available; it is up to them to make their chairs as comfortable as possible.

**Adjustability.** The most important concept associated with today's chairs deals with their adjustability. Employers cannot possibly fit every individual chair to every individual employee, especially in a very large company. Likewise, employees often move from chair to chair throughout the workday, and they cannot spend time hauling personal chairs with them. Sometimes special leve-
can be attached in such a way that an employee can easily raise and lower various chair parts. Occasionally buttons can be pushed to change needed elements. In any case, adjustments must be easily made without causing inconvenience to employees. After all, if he or she feels that adjusting the chair is "too much of a hassle," he or she will probably not bother and will continue sitting in an uncomfortable chair. Managers may spend considerable time and money in getting comfortable seating for their employees. They must take care not to waste it by not allowing for some personal adjusting by the employees.

Style

Any furniture that is unattractive will automatically help to hinder productivity. Chairs must have an aesthetic appeal as well as a functional one. One must consider the fabric a chair is upholstered with, including the color. Some people prefer leather or vinyl chair coverings; often these fabrics designate status and prestige. These coverings are often rather cold to the touch, however, and many people prefer to choose a variety of fabrics that can be then woven in the desired colors. Chair color must obviously blend with the coloring scheme used for the overall office. Browns, tans, and greys appear to be popular colors for chairs. These colors usually provide a nice contrast with the general surroundings while not distracting employees from their work. Chairs can be designed in many ways that will help enhance employees' productivity. No chair is perfect, then again, neither is any worker.

Conclusion

Employees do more activities in a sitting position than in any other position. While everyone finds relief from getting off their feet occasionally, too much sitting can prove hazardous to the body. Proper chair design can help
alleviate many of the problems encountered during long periods of sitting. Increasing chair comfort should help increase productivity. Employers will not have reason to concentrate on their physical bodies and will be able to focus on their tasks. The office incorporates many different aspects in its physical design. Properly designed furniture helps complete the job in a manager's quest to improve worker productivity.


10. Ibid., p. 10.


15. Steelcase--Series 9000 Systems Furniture, p. 11.

16. Ibid., p. 12.


19. All-Steel--Performance Lighting.


27. Steele, Guide to Ambient/Task Lighting, December, 1979, p. 3.21.
23. Ibid., p. 3.4.
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29. Nuckolls, p. 10.
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33. Nuckolls, p. 8.
35. Nuckolls, p. 8.
41. The Wool Bureau, Inc., p. 3.
42. Vincent A. Murillo, "Life-Cycle Cost Analysis--Wool Carpets."
43. The Wool Bureau, Inc., p. 3.
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