ERGONOMICS AND THE SEDENTARIAN

INTRODUCTION

The objective of this paper is to explore the ergonomic impact of the environment and mental stimuli on the sedentary worker. Based on Bureau of Labor Standards statistics, jobs that are less active, such as those of secretaries, various professional managers, and accountants are expected to show an increase from a low of 3.0 % to a high of over 40% by the year 2012. It appears fairly certain that the trend toward sedentary-type jobs is rising.

Repetitive strain injuries (RSIs) – which are sometimes included in the category of Upper Limb Disorders (ULDs) since RSI does not cover all "upper limb" disorders - are the nation's most common and costly occupational health problem, affecting hundreds of thousands of American workers, and costing more than $20 billion a year in worker's compensation. In 1992, there were 281,800 reports of repetitive task injuries, more than double that reported just 4 years earlier. Of 32,838 musculoskeletal disorders (MSDs) reported in 2001 in Texas, 3,146 were due to back pain, carpel tunnel syndrome, tendonitis, or tenosynovitis. Of the 522,528 persons reporting MSDs that year, 212,959, or 40.8%, came from the more sedentary managerial and professional, technical, sales, administrative, and service positions than from more active labor, "blue collar" positions.

With the advent of the computer and a multitude of "labor-saving" machines for both the office and the factory (such as the personal desk computer), jobs that were typically manually intensive have been quickly regenerated into less manual labor intensive ones, and the operator who was previously threatened by physical exertion, injury and exhaustion is now even more threatened by physiological illnesses caused by inactivity. Carpal tunnel syndrome, first described 125 years ago, has become a very common affliction for typists, data entry clerks, and persons whose work entails a lot of hand and wrist movement. It is the most reported medical problem, and now afflicts over 8-million Americans.

Another very common ailment, lower back pain, is common amongst those who tend to sit or stand the majority of the time, and infrequently have to walk or do anything that requires full body physical movement. One article on back pain estimates that 4.9 million working days (full-day equivalent) were lost in 2003/04 through MSDs chiefly affecting just the back.

Lower back pain is also probably the most mysterious of ailments for either the sedentary or the active worker, because of its invisibility as to detection and quite often, inability to determine the cause of. Modern back specialists admit that as much as 80% of the lower back pain complaints have no clear and distinctive physiological cause. In contrast, there are also many people who have readily discernible herniated or bulging disks that

appear in their x-rays or MRIs, and yet are pain-free. All of this lends credence to the prediction that 90% of all people are going to have a disabling episode at some point in their lives. It is known that jobs that typically require prolonged standing or sitting, are high risk with respect to lower back pain, as is sitting upright or forward, and not changing position.

Vision ailments, migraine headaches, stress, and depression, concerns that were typically attributed to the workaholic, are now common in the workplace setting across the country and across the laboring workforce. And the threat is not only to the professional workforce. With the tremendous increase in use of computers by schools, it has become apparent through research that children as well are at particular risk of developing MSDs, particularly carpal tunnel syndrome, because their muscles and bones are still developing. Computers and most of the accompanying equipment and furniture are not usually designed for children's smaller bodies. Thus, a child working at a computer could very likely be exposed to an increased threat of MSD injury just through the computer's use.

The problems facing the sedentarian, or Homo sedens, as one might call him, are obviously not new to the world, but they are much more pronounced and plentiful as a result of the multitudinous changes that have resulted in less active workers. This increase has led to a proportional increase in the number of ergonomic studies relative to such work, as well as in the number of safeguards that can and must be taken in order to best ensure the worker's well being. In this paper, I intend to examine the maladies that are fairly common to the sedentary worker, along with preventive efforts and precautions that should be taken in an effort to avoid them.

PHYSICAL MALADIES

Musculoskeletal disorders (MSDs), or injuries that affect the musculoskeletal system, abound with the sedentarian. Tendinitis, tenosynovitus, epicondylitis, carpal tunnel syndrome, bursitis, deQuervain's disease, ganglion cyst, and thoracic outlet syndrome are a few of those with specific names, but in addition, there are numerous lesser-defined sprains, strains, tears, or even just pain. With rapidly changing jobs and the equipment used for them, some of the afflictions are actually starting to be named after them. "Blackberry thumb," the newest painful disorder of the computer age, afflicts users of – naturally – the Blackberry, and other such hand-held devices designed for thumb tapping. Experienced Blackberry users tend to scroll through e-mail messages at high speed using their thumbs in an awkward motion, and several experts quoted recently in an Associated Press article on the condition claim that the thumb is not sufficiently dextrous for such "rigorous" work, thereby resulting in pain when the thumb is used for such movement. The preventive measures for the Blackberry thumb ailment is, essentially, don't do that. The experts recommend sending shorter e-mails, using an external keyboard attached to the unit, or substituting a pencil eraser tip or other thumb substitute.

Unfortunately, the majority of MSD injuries are diagnosed after the fact, when symptoms of the injury make themselves known. Once the symptoms appear, it is typically too late

to avoid treatment of one kind or another. In the worst cases, unlimited medical treatment becomes necessary. Carpal tunnel syndrome, for instance, is a chronic condition in which nerve compression in the wrist leads to abnormal sensations, pain, or loss of function in parts of the hand, and is generally diagnosed with one or more of the following experiences:

- A painful or tingling feeling in one or both hands
- A feeling that the fingers are swollen
- A feeling of "uselessness" in the hand or that the hand is "asleep"
- Inability to make a fist
- Frequently dropping things
- Decreased ability to perform everyday tasks, like telephoning, cooking, grooming, etc.,
- A decreased power in the wrist
- A possible inability to discern hot from cold by touching
- Pain with wrist or finger movement.

Many sufferers have reported that the first symptoms appeared in the evenings, probably because many people sleep in a flexed position. In some cases, the pain became extraordinary enough to awaken them. Piece workers, whose pay is determined on the amount of their output, tend to be very susceptible to CTS.

Then again, just sitting can be dangerous to one's health. The old school of thought generally prescribed a 90-degree bent knee position when sitting, but the spinal discs experience more pressure in the sitting position than in the standing, therefore, it is better practice to sit with the hip joints somewhat straightened, with the legs moved frequently, and not kept in the 90-degree position. Additionally, one's chair ought to be low enough for the feet to rest on the floor, even when the legs are extended. From a personal point of view, I find sitting with my legs bent at a less than 90-degree position to be very comfortable, but only for short periods of time. If I find myself restricted from stretching my legs out in front of me periodically, it results in swollen ankles and aching leg muscles.

EXHAUSTION WITHOUT EXERTION

As paradoxical as it sounds, much of the exhaustion suffered by the less active workforce stems from their inactivity. Fibromylagia and chronic stress disorder (CSD) are both illnesses that are characterized by physical exhaustion, lack of energy or motivation to do work, feeling extremely tired or sleepy, and heightened anxiety. Again, based on figures taken from the U.S. Dept. of Labor Bureau of Labor Statistics, these are also illnesses more common to the worker in the office than those in the factory or service industries, where the work entails more movement and physical exertion.

Boredom with one's work can even result in a feeling of exhaustion. Boredom is the worker's emotional response to repetitive, monotonous tasks, and often results in ineffectiveness due to - and aggravated by - a feeling of tiredness or fatigue. This is an obvious example of what is referred to as "mental fatigue." Where physical fatigue is

defined as the disinclination to continue a task due to physical factors, the term mental fatigue is used by some psychologists to describe a condition where there is a disinclination to continue a task due to psychological factors.

STRESS

Evidence shows stress is related to physical illness, and there are various psychological approaches toward determining if stress exists, and if so, how much. The Social Readjustment Rating Questionnaire (Holmes and Rahe), the Life Event Scale (Tennant and Andrews), and the Recent Life Events Interview (Paykel) can all help to quantify and identify stress and ought to be used in all industries. The most horrible aspect of stress is its invisibility to others. Thus, investigative techniques ought to be used to uncover its presence, and prevent its degenerating into a debilitating condition.

Stress has become the buzz word of late, primarily because it is suffered by just about every person on the planet, whether they are working at sedentary jobs or not. But there are some non-personalized mental affectations that can infect the sedentary worker. There are good, or positive stresses and negative dis-stresses, both of which have an observable effect on the worker. Positive stresses tend to motivate, and prompt work output improvement, whereas dis-stresses do the opposite, often resulting in reduced motivation, apathy, ineffectiveness, anxiety, and even physical illness.

The biggest threat to the sedentary worker could very well be himself. Anxiety, a dis-stress that results from the challenges confronting the individual, has been shown to have a direct affect on health. It can compromise the body's immune system, speed the development of cancer, increase one's vulnerability to viral infections, accelerate the onset of Type I diabetes and the course of Type II diabetes, and ulcerate the gastrointestinal tract. Even the brain can be physically affected by stress-caused damage to the hippocampus, and thus, have a diminishing affect on one's memory.

It is often said – and has been supported both statistically and experimentally – that stress can lead to cardiovascular problems. A study conducted on 30 people who were subjected to a rigorous, anxiety-laden program while having the adenosine triphosphate (ATP) level in their blood streams monitored, showed that stress increased the level sharply, as well as their heart rates and blood pressure readings. ATP triggers changes in the blood vessels that can lead to heart attack or stroke. Combined with the heightened blood pressure and heart rate makes for a very serious physical threat.

WORKLOAD

The workload put upon any worker can be too easy, just right, or too difficult. Either of the extremes – too easy or too difficult – can cause the worker stress. Both sedentary as well as physically active workers, of course, can experience these stressful influences, but the "desk job" typically does not have the product, or tangible output that measures a production worker's success. Reports and communications witnessed by just a few

people – which is typical of the "desk job" – provide little justification to the majority for being kept busy. Thus, the person doing the job is often the object of the question, "just what does that person do?" This, in itself, is a seriously de-motivating and stress inducing situation to be in. Good communication between the manager and his subordinates can help to foster an environment in which everyone is aware and respectful of other's functions.

Any job is comprised of tasks of various types, each governed by schedule and conditions both mental and physical. The completion of the tasks results directly from the capability of the worker. It is one of the primary jobs of the manager to assign tasks that are neither an under- or overload to subordinates. Once this proper balance has been achieved, work performance and the worker's well-being is optimized.

A job that requires more than the employee can possibly do within the allotted time imparts stress upon the worker by making him feel abused, misdirected, and – without the necessary advisement and guidelines – incapable of performing to expectations. Add a hint of paranoia and he feels as though the job is being made "impossible" simply to devise a reason to fire him. It is hard to imagine a more upsetting – and stressful - mindset.

PSYCHOSOCIAL FACTORS

Psychosocial risk factors stem from the worker's psychological response to the work and the workplace. They are directly related to the working relationships that one has with peers, superiors and subordinates, the amount of work they are expected to do, the deadlines they are expected to meet, and whether or not they have true control over their own work. Some of the more common causal factors for psychosocial threat are:

- little control over one's work and work methods;
- inability to make full use of one's skills;
- no involvement in decisions affecting them;
- repetitive, monotonous tasks;
- being paced by a machine (i.e., monitoring a machine);
- extreme work demands;
- administrative systems that encourage working too quickly or without breaks;
- limited socialization opportunity;
- little reward for high levels of effort

When one or more of these elements are beyond the control of the person experiencing it, it is little wonder that stress often does result.

A job that is felt to be too simple to do, generally unfulfilling, and which does not typically fill the workday, can make the worker feel as though he or she isn't trusted to perform more complex tasks, or perhaps just not that valuable as an employee. In today's world

of constantly changing workforce and "job-hopping" often caused by company restructuring, such a job generally stands out to all of the employees, and is almost assuredly doomed. And that is exactly how the worker doing the job can feel.

Treating employees with trust, respect and generally making them feel a valuable contributor to the job, gives them the inspiration to work harder or, if necessary, the self-confidence to question perceived inequalities and similar unknowns. Psychosocial issues are best addressed with full consultation and involvement of the workforce. The psychosocial "environment" can be improved by:

- combining or otherwise revising tasks to eliminate monotonous jobs;
- ensuring that the workload is do-able, neither too much nor too little;
- ensuring that deadlines are reasonable and achievable;
- encouraging teamwork;
- ensuring good communication;
- monitoring productivity to ward against excessive overtime or exertion;
- eliminating, wherever possible, piece-rate, or "reward for quantity" pay systems;
- providing appropriate training.

ENVIRONMENTAL CONSIDERATIONS

Noise is defined as any unwanted, objectionable, or unacceptable sound. Noise can be very bothersome and certainly distracting in the workplace. A recent German study, conducted on 4,115 people that had experienced heart attacks between June, 1998 and March, 2001, showed that the risk of heart attack due to environmental noise was increased by 46% for men and 30% for women. I present these figures primarily to demonstrate that noise can actually have a disastrous physiological impact on a person, and ought to be given appropriate ergonomic consideration. Most office workers are not faced with exposure to excessive or overly loud noise, but machine operators, production supervisors and others who perform relatively sedentary jobs in a manufacturing environment are.

Noise is psychological and subjective. One man's noise is another man's music, and the scientific application of using music to motivate, calm, or otherwise affect employee work pace or anxiety level remains undefined. Any sound, musical or otherwise, can be conceived by some as noise. Noise can:

- create negative emotions (anger, fear, anxiety)
- delay or disturb one's sleep
- override more pleasant sounds
- change body chemistry, both temporarily and permanently
- affect temporarily or permanently one's ability to hear
- interfere with some sensory and perceptual capabilities

Most factories battle excessively loud noise with sound-proofed enclosures and/or ear protection devices. The latter work well, of course, only if and when they are used, so rigid enforcement should be an integral part of their implementation.

Offensive odors can also be very distracting (if not physically endangering), and the air quality of the workplace should also be considered as a prime contributor to workplace comfort and safety. There are a number of effective and efficient air purifiers on the market, for both home and industry. Air conditioned areas are generally recycled filtered air, but there must always be the awareness – and lookout for – air polluters, such as chemical treatments, plating or soldering processes and the like. These will undoubtedly require specific exhaust applications. The primary pollutants to air quality are carbon monoxide, sulfur dioxide and nitrogen dioxide, and particulates, all of which can be satisfactorily eliminated with the proper filtration equipment.

Temperature, humidity and air movement all go hand in hand. As with practically any sensory characteristic, there is no one, universally acceptable or pleasing combination, but generally a temperature setting in the 70's, along with a relative humidity averaging at about 50% is considered "comfortable" for most work environments. Some jobs are very difficult to control as far as temperature and humidity are concerned – a welder, for instance – so arrangements for regular relief from the extreme conditions ought to be made a part of the job. As a heart patient, I can say from experience that when the thermometer goes into the 80's or 90's, my productivity begins to rapidly diminish.

Excessively dim or bright lighting and/or glare can inhibit productivity and cause headaches. Such conditions can very easily turn a well-balanced job into one that is stressful. The principal factors affecting one's ability to see things clearly are:

- glare
- the luminance (brightness) difference between what is being looked at and its environment
- the amount of light (illumination)
- the viewing distance
- the clarity (readability) of the object being viewed
- the employee's visual acuity

Glare, luminance and illumination are all easily controllable through the appropriate selection of light sources and their positioning. Contrast – the most overlooked cause of eyestrain - can generally be controlled through adjustment of the viewing screen and/or the use of viewing filters. Viewing distance, of course, is a manual adjustment, and as stated previously, strains the eyes more at closer distances than it does at further distances. Clarity is governed by the focus of the viewing screen as well as the last item – visual acuity of the employee. The last item, because of its being more under the employee's influence than that of management, becomes the one of greatest concern.

The use of corrective lenses, prescriptive or not, can ameliorate a clarity problem, but obviously, they should be utilized only with the approval of the wearer, and if applicable,

proper medical prescription and advisory. Provision of improper eyeglasses, or allowing a person to continually work without the necessary eye corrective lenses, can only do more harm than good.

PREVENTION - SUMMARY

As with most injuries, prevention is the best course of action, and there are several ergonomic efforts that can be taken to avoid them. At the onset, every ergonomic program ought to consist of four components: workplace analysis, hazard prevention and control, medical management, and training and education.

WORKPLACE ANALYSIS

One of the best preventatives for the office environment is a survey of the workplace as to ergonomic characteristics. This will, enable early detection of ergonomic problems and allow for early implementation of corrections for the same. There are a number of checklists available to the HFE practitioner that can be used to evaluate – and remedy, as necessary – the workplace before any physical maladies actually occur. Cornell University, for instance, makes available on its web page both a seating evaluation questionnaire and an ergonomic keyboard and mouse system evaluation checklist, as designed by Prof. Alan Hedge. Be warned that checklists, when used improperly however, can actually put blinders on the auditor, and steer him to the obvious rather than to the less apparent but just as important issues. In using any checklist, it is important to remember that the intent is to design for comfort of the user, and not to any pre-determined, magical all-inclusive dimensions of body or machine. Using the five W's – who, what, where, why, and when – in addition to how as questions for every checklist item will help to audit "outside the box" and hopefully, uncover all concerns.

Accordingly, audit not just the equipment, working distances and the furniture, but the employee from a physical standpoint as well. Look for unnatural work positions in the shoulders, arms, elbows or back, excessive head or neck movements, or evidence of working in the same position for extended periods of time. Naturally, look out for repetitive motions and poor posture.

Whenever you feel it is necessary, question "conventional wisdom" as to ergonomic design considerations. For instance, in the recent past, the rule for placement of the monitor was 18-24" away from the user. Today, it is preferred to position the screen 25" or more away from the user. It has been shown that close viewing causes more eye strain than does viewing from a distance.

Seek input from the employees themselves as to their comfort in performing their jobs. Speak directly with them, or if that is impossible, conduct surveys or distribute questionnaires – and require their completion and return. And do not "settle" for a one-time snapshot of the situation. Routinely elicit input and repeat the surveys and questionnaires to avoid problems creeping into place.

Do some benchmarking for problems and not just best practices. See what similar industries have experienced with ergonomic problems and what precautionary measures they have employed as well as preventive accommodations they have made.

HAZARD PREVENTION AND CONTROL

Just as a diet and exercise regimen can fight the war against obesity, preventive measures that can be taken to avoid or appreciably decrease the risk of MSDs include seating adjustments and alignments, and in general, improvement of the working posture.

Workplace furniture and equipment ought to be designed for adjustment. The entire workplace environment should be designed to accommodate the employee who has to work in it every day. The HFE designer should abandon the myths of a "universal" working posture good for everyone, as well as that of there being a single set of anthropometric data that fits everyone. Flexibility via adjustment is what should enable customization for various users who come in differing shapes and sizes.

Organization of the workplace ought to be done with conscious attention paid to both posture when sitting and standing, and when working at every location within the workplace. In general, attempt to:

- keep the keyboard and monitor in a straight line to prevent twisting of the neck and arms;
- keep things that are frequently used – such as the mouse – close to avoid excessive stretching or reaching;
- avoid cradling the telephone between ear and shoulder (use an earphone or headset);
- align the keyboard such that it is easily and clearly viewed without bending the neck;
- use the adjustments your office chair offers, and fit it to you for comfort;
- cater to your vision and avoid eye strain. Wear glasses (if necessary) that are comfortable to use, and do not necessitate head and neck contortions or squinting to see clearly;
- move periodically throughout the work day. Do not remain in a stationary position for extended period. Get up, walk around, stretch;
- in typing or keyboarding, keep your wrists straight. Get a keyboard that "fits" your style best – straight, ergonomic.

The Computer

The computer is so prevalent in today's society, that it deserves special mention. If one works at a computer all day, then seating and workplace arrangement become of utmost importance in the avoidance of MSD injury. Even choosing a computer mouse that is easy to handle, in proper alignment with the keyboard, and not uncomfortable for the wrist and hand, can make a huge difference. Although wrist supports have become

increasingly popular, one must be careful that the chosen support does not actually exert pressure on the carpal tunnel area, and thereby aggravate the situation. The keyboard has undergone – and continues to undergo – substantial improvement from an ergonomic viewpoint. In September of this year, Microsoft released the "Microsoft Natural Ergonomic Keyboard 4000," which is just one of their line of such equipment, including the Comfort Curve Keyboard 2000, and the Comfort Optical Mouse 3000. The principal designer of the Keyboard 4000, Dan Odell, PhD, explains the difference to be incorporation of the best ergonomic advances developed over the past 10 years. Two unnamed independent research projects have found that the new keyboard (1) is associate with a reduction in computer-related pain; and (2) is associated with reduction in carpal tunnel syndrome. The office chair should be height adjustable to "fit" different users with different foot-to-knee anthropological measures. Research has shown that the seat itself ought to be slightly tilted forward, thus causing the pelvis to rotate, and thereby complementing the natural hip angle, and providing a natural convex curve to the spine.

An excellent reference on computer workstation ergonomic concerns and preventive techniques for computer-related repetitive strain injuries (RSIs) can be found at http://eeshop.unl.edu/rsi.html. Written by Paul Marxhausen, of the University of Nebraska-Lincoln, it explains what RSI is,its symptoms, and means of preventing it.

MEDICAL MANAGEMENT

Several instances where job comfort and safety depend upon characteristics or habits of the employee have been discussed. Because they are potential causal factors to ergonomic problems, employers have no choice but to attempt to take them into consideration. However, because they are not as obvious to detection as the physical and environmental job characteristics, they merit special considerations, such as medical examinations and provision of special, "customized" equipment, such as eye and ear protection, and even possibly monitored work schedules.

Because many MSDs, RMIs and ULDs "sneak up" on the sufferer and become most disabling after the damage has been done, it is advisable that every employer make available on site, or at least require of all employees, routinely scheduled physical examinations for such. In Mexican manufacturing plants, having a doctor and nurse on staff is a union requirement. Maybe the United States can learn something from that.

It makes obvious sense that in order to counter the negative effects of inactivity, one should exercise. Even with an ergonomically correct workstation, merely holding one's position for extended periods of time cuts off or slows down circulation in some areas and causes blood to pool in other areas. Tense (contracted) muscles cause blood to be squeezed out of the tissue, resulting in oxygen and nutrient deprivation. Muscle stretching relaxes tension and increases the flow of oxygen and nutrients into the area. Physical activity and muscle stretching and strengthening release mental and emotional, as well as physical tension." The sedentary worker should devise an exercise regimen while both in and out of the workplace.

There are many good books written on at-the-desk exercises, such as Wellness 9 to 5 – Managing Stress at Work, by Valerie O'Hara, and others that provide the reader with simple to perform exercises in the comfort of his or her office, without undue interruption of the work day. Exercise, of course, supports the "activity theory," that claims the more active a person is, the more satisfied with life he is.

Over the past several decades, there have been monumental improvements in the white-collar professional's work techniques, as well as with the equipment needed to perform the work. The increase in inactivity, along with that of less-than-optimal eating habits, have made the US the fattest of all countries. Dr. James Levine, an obesity researcher at the Mayo Clinic, has described what very well may become the "Office of the Future," consisting of an open plan space with standing computer desks, complete with variable-speed treadmills. Employees are intended to work while walking. Cell phones worn on their belts replace the usually desk phones. Meetings are actually track meetings – held while walking a two-lane circular track bordered with magnetic white boards for scribbling and posting notes during the moving meetings. Even moving from meeting to workplace is covered with plastic carpet skates to enable sliding instead of simple walking. It makes one wonder if the health risk implications of implementing such a plan (i.e., consider those for whom excessive walking might be injurious) would offset the benefits, but I cannot see it being more difficult than trying to maintain an ergonomically healthy environment for every employee within an organization today.

TRAINING AND EDUCATION

There is a host of information available on the internet regarding preventive measures that can be taken to avoid MSDs as well as psychosocial stress factors, discussed earlier. Ergonomics.com, is a web site devoted to the exchange of information between the fields of ergonomics and the Alexander Technique, developed in the early 20th century, before ergonomics even became a recognized science. The technique essentially educates people as to ways in which they are misusing their bodies, and how everyday work habits may be harming them. It is sort of the Scientology of Ergonomics, but nonetheless, has its followers.

In addition to utilizing adequate ergonomic considerations in workplace design, employers should also conduct postural training, so as to ensure that the employee is well aware of the importance of his or her being comfortable while performing their duties. Every employee, whether obviously susceptible or not, should be made aware of the symptoms of musculoskeletal disorders, and of the necessity of reporting such, should they arise. Years ago it was common practice in some high school driver education classes to show the students shocking and gruesome movies taken at accident sites. It may not be too bad of an idea to do something similar for MSDs, such as the viewing of surgeries that can become necessary when proper attention is not given to the problems.

Training is one door to effective communication, and effective communication is one of the most important steps toward improving the psychosocial climate.

I have worked in a variety of industries for the past 30-plus years. My years as an industrial engineer made me very much aware of the working environment on the factory floor, and my years as a manager did the same for the office area. I have witnessed what happens when ergonomic warnings are not heeded, or precautions not taken, and I am fully aware of the necessity of practicing human factors engineering.

There have been many great improvements in working equipment, furniture, methodology and psychosocial efforts to reduce or eliminate the chance of musculoskeletal disorders, repetitive motion injury, and the multitude of afflictions brought on by stress, both physical and mental. Research is forever ongoing, and advancements are always being made. Sedentary jobs are on the rise – some predict that the US industries will ultimately evolve into primarily services – and the jobs are becoming much more stressful from a psychological viewpoint than from a physical one. Of the two, physical dangers are easier to prevent than are emotional or mental ones, and I seriously think that psychiatric considerations as to workplace comfort and security need to take a front seat in the ergonomic practices of the future.

Yet there remains a hole in the system with the involvement of human factor analyses, period. This class is an integral, required component of a master's degree curriculum, but in my college courses for industrial engineering and management, I was never before required to study or at least comprehensively understand ergonomics for what it really is. Going into this class I remembered workplace layouts that I had done in my previous jobs, and thought myself to be pretty complete in my analyses. I was wrong, and yet I was right. For what I knew at the time regarding ergonomics, I was right, and I had applied all of the principles that I was aware of. Judging from what I've learned in this course, I was wrong, and my projects very likely sub-optimal. I now believe that ergonomics should be a required course in every single major where the student is going to be ultimately working anywhere, doing anything whatsoever … in short, every single major that I can think of.

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