ERGONOMICS-THE MIRACLE DRUG FOR TERMINAL ILLNESS AT MIT?

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A degree from the Massachusetts Institute of Technology is a coveted ticket to opportunities the world over. But what if the experience of computing on campus is enough to physically disable "the best and the brightest?"

THE DRAMA

Welcome to an MIT computer facility, a conglomeration of workstations known affectionately to students as a cluster. All are encouraged to settle in and make use of the special course software and mail applications, but be advised to enter at your own risk. The cluster, which provides a social atmosphere as well as an academic setting, seems innocuous enough, but there are insidious forces working to seduce the more-than-casual user. The rows of standard tables and chairs cannot comfortably accommodate a user for long stretches of time, but the volume of schoolwork and the computer culture inosculate to turn minutes into hours. Students remain rooted in place, unaware that their immobile stances and rapid keystrokes are causing bodily harm. Consider the following:

Our heroine sits before her terminal for ten hour stretches. Deep into her programming, she is unaware of the passage of time. She shuns the vapid externalities of life that impinge upon the world of cyberspace. Instead, cognition is transferred from brain to computer, her fingers on the keyboard acting as frantic intermediaries. She feels the fatigue, the stiffness in her neck and back, but she counts on having the weekend to rest before grappling with the rest of her assignments on Monday. The work comes to a close late at night, and with a congratulatory hug from her roommate, she traipses off to a cottage on the beach. That night she feels the same tingling and pain in her hands that she has been experiencing all week. Typing commences again on Monday morning, but by the evening she is having shooting pains in her forearms. A trip to the MIT Medical Department does not immediately pinpoint the problem, and the pain does not go away. Weeks later, she finds herself swallowing anti-inflammatory drugs in the morning and icing her wrists at night. She wears wrist braces on both hands and can no longer type. The doctor cannot confirm whether the condition will be chronic, leaving our heroine to rethink her plans for a career in computer science where she may be required to spend inordinate amounts of time at a keyboard. She also ponders legal action against the Institute for not taking measures to protect its students from computer-related injuries that are becoming more and more widespread on campus.

The above story is fictional, but while it is over dramatized, it is by no means implausible. It is illustrative of only a single hazard of extensive computer use, but one can acquire a veritable portfolio of ails. The MIT cluster administrators are aware of the hazards of computer-related injuries, and they must take steps to educate the student body and ensure that the clusters are safe places in which to work.

THE DANGERS

The exigent concerns fall into the following four categories: repetitive strain injuries (RSIs), problems with vision, stress, and harm from video display terminal (VDT) emissions. Of the four, VDT emissions have received the most press coverage; however the alleged dangers tied to low-frequency radiation given off by VDTs-ranging from cancer to an increased chance of miscarriages in pregnant women-remain unsubstantiated. A study comparing the miscarriage rates for female telephone operators exposed to VDTs twenty five hours a week or less and those exposed for more than that amount of time showed no significant differences between the two groups. "The overall miscarriage rates were 14.8 percent for the VDT-exposed pregnancies and 15.9 percent for those not exposed...Both figures (fall) within published estimates that somewhere between eleven percent and twenty

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percent of all pregnancies end in miscarriages..."1 Still, there are those who preach caution when using VDTs, citing reports that electrostatic fields from the monitors "bombard the computer user with ions that attract dust particles which can lead to eye and skin irritation."2 While the suspicions remain unproved, the level of public fear keeps the debate over VDT risks disproportionately rabid.

REPETITIVE STRAIN INJURIES

Conversely, RSIs are well-documented dangers that are well understood, though sometimes difficult to diagnose. In 1990 the Massachusetts Department of Industrial Accidents printed a fact sheet describing RSIs.

"RSIs are a category of injuries involving damage to muscles, tendons and nerves caused by overuse or misuse. Any combination of the following factors can lead to the overuse of some part of your body

-Repetitive tasks Small, rapid movements or tasks that are repeated over and over -Awkward or fixed postures Working in an awkward position or holding the same position for a long time -Forceful movements Using force or moving heavy loads to complete the tasks -Insufficient recovery time No time to rest during the above activities

Unlike strains and sprains, which usually result from a single incident(called acute trauma), RSIs develop slowly over time."3

Carpal tunnel syndrome (CTS), tenosynovitis, ganglionic cysts, and tendonitis are only some of the many disabling injuries that people develop from prolonged work at a terminal. CTS is perhaps the most debilitating.

Nine flexor tendons and the median nerve extend from the forearm into the hand through a passage made up of transverse carpal ligament and bone. Repetitive keystrokes cause the tendons to rub against the bone and ligament, resulting in irritation and eventually swelling. The ensuing compression of the median nerve results in CTS and is identifiable by numbness, tingling, pain, and sometimes weakness in the hands. When the keyboard is placed on a high desktop and the user's wrists are not held up, the situation becomes exacerbated. Genetic predisposition, in the form of lower levels of lubrication around the tendons, dictates that certain people will be more prone than others to develop this syndrome.

Tenosynovitis and ganglionic cysts are tendon sheath conditions. The synovial sheaths are lubricated tubes through which tendons in the hands, wrists, legs, elbows, and shoulders pass. Repetitive motion can cause inflammation of the sheaths, painfully restricting movement of the tendons. Sometimes the swelling causes fluid to form a bump, known as a ganglionic cyst, under the skin .

An RSI-afflicted person with pain in the neck, shoulder, upper or lower arm, wrist, or hand may not be able to type or perform the most routine daily activities. While this is devastating to the injured party, it may also affect the company they work for or the school they attend in terms of liability, compensation, and lost manpower.

In an effort to curb the increasing volume of injured people who can no longer be productive at their terminals, institutions are looking at ergonomically designed furniture that redefines the classic office. Beautiful oak desks retain their aura of power and prestige, but they are impractical for desktop terminals. The ergonomic workspace consists of a table top that raises, lowers, and pivots to conform more to the reach of the human body. The keyboard and the mouse are low so that the user 's arms remain parallel to the floor, and the monitor is straight ahead at eye level but at a safe distance from the user's face. The chair provides lumbar support and is adjustable to the myriad shapes of the human body, and there is a rocking foot rest to keep circulation flowing in the legs. Commercial vendors have seized upon the blossoming field of ergonomic design, but their solutions do not come cheaply. An educational discount for a single adjustable table was estimated at just over $1800 in 1993.

In some cases, the computer hardware itself is altered to fit more naturally with human posture. Radical new keyboard designs abound, ranging from split to hinged to one with only fourteen keys (it relies on chordal key depression similar to a Braille typewriter). Along with the change in keyboards, the new mice on the market are smaller and curved to fit easily into the palm of the hand.

While it is assumed that better hardware can help prevent RSIs, there is still no definitive study to prove which designs are the most suitable and effective. Choosing the right solution is a matter of taste if one can afford it.

Furniture and hardware solutions are costly, but they are not the only alternatives. Wrist-saver pads placed at the bottom of the keyboard are relatively inexpensive, but while they keep the user's hands from slouching to the desktop, they can exert pressure on the tendons on the underside of the wrists. The wrists need to be held up while typing, and wrist pads are only helpful if the typist keeps this in mind.

Individual users must pay close attention to their work habits and their posture. The best preventive method against RSIs is to sit in the proper position and take frequent breaks. Regular periods of respite allow the muscles time to recover from strenuous or repetitive activity, and they give the user an opportunity to engage in easy stretching exercises.

Gently massaging the wrist and forearm stimulates circulation and relaxes the muscles. Nodding the head relieves some strain on neck muscles and helps to relieve headaches and improve concentration. Stretching routines are simple and enjoyable, and they can help to prevent the onset of computer-related injury.

VISION

Though no studies have been able to link VDTs to permanent ocular damage, eyestrain, blurred vision, and irritation are common maladies of computer users. It is not the monitors in and of themselves that are the culprits but instead the way in which they are utilized. Once again, long hours without regular breaks are highlighted as damaging, but there are also problems with glare and improper lighting. Some users suffer from "color contingent after-effects after viewing monochrome monitors because of the constant stimulation by only one color."4 These images usually disappear after several hours, but they are avoidable.

Many eye problems can be eliminated with good work habits, such as resting periodically and refocusing the eyes on objects at different distances. Other discomforts can be removed with diffused overhead lighting and appropriate placement of the monitor. Screen glare, reflections of light off the monitor glass, should be reduced as much as possible by placing the computer at a right angle from brightly lit windows. When buying a new monitor, one should examine those with flatter screens and tilt-swivel stands. Although there are quite a few anti-glare screens which can be attached to the front of a monitor, they can "reduce image sharpness, and that in itself can be a source of (eye) fatigue...A better-quality monitor may be better for (the computer user)."5

Additionally, there are exercises to keep the eyes hearty and happy. Changing the focus of the eyes relaxes the ciliary muscles that control the lens. Blinking rapidly moistens the eyes and stimulates tearing to remove pollutants.

STRESS

While stress has been given a large amount of attention in the past, the particular tension surrounding computer use is not usually highlighted. Students at MIT have many resources available to edify them in the use of computers and course-related software, and the communal nature of clusters allows beneficial interaction between the naive user and the more sophisticated one. However, the heavy demands thrust upon pupils creates a level of stress that makes injury more likely. When a user feels anxiety, the muscles automatically tighten up. So, while stress carries its own host of ailments, it also contributes to the likelihood of getting a computer-related injury.

The manifold perils cited above need to be addressed in a committed manner. Is it the sole responsibility of the users and private companies or a matter of public safety for big government?

COMPUTER SAFETY LAWS

In December of 1990 San Francisco adopted a law affecting companies with fifteen or more employees that "requires the use of adjustable chairs and tables, lighting, angle-adjustable screen and keyboards, work time at tasks away from the computer, training of workers and supervisors, and the use of printers covers to reduce office noise."6 Critics of this law point to the fact that the value of ergonomically-designed furniture is still not calculated, while the costs to the companies are unreasonably high. Considering the growing concern over computer-related injuries, it would not be surprising if other cities passed similar ordinances. Will these laws affect educational institutions such as MIT where computer use is almost taken for granted?

ERGONOMICS AT MIT

The plenitude of wrist braces on campus is only the most overt display of the prominence of computer-related injury issues. While the MIT Benefits Office, Safety Office, and others are becoming well-aware of the implications of these injuries on the workforce and the time and monetary costs, the liability of the university where students is concerned is still unresolved. There have been efforts to improve the clusters from an ergonomic standpoint which stem as much from concerns for students as a sense of

urgency regarding litigation. However, while computer injury is a pressing consideration, the costs of outfitting the four hundred odd workstations in the nineteen clusters on campus with all of the ergonomic accouterments is prohibitive.

The current state of the clusters is not unsalvageable. Private clusters, such as those of the language lab and the network development group, have replaced their old furniture with ergonomic tables and chairs. Many office desks are equipped with adjustable keyboard trays and footrests. As these furnishings become the norm around campus, they are more likely to be deemed necessary for the student clusters, and the budget may be stretched to accommodate the change. Additionally, standardization of ergonomically designed equipment in the workplace could push the costs of producing down, making a well-designed space affordable and accessible.

In an experiment last year, MIT supplied wrist pads to each workstation in one cluster. An accompanying campaign to educate the students was initiated, including posters describing the possible benefits of the wrist pads and explanations of carpal tunnel syndrome. Since the parameters of the experiment were vague and the notions of data-collection ignored, the impact of the wrist pads was never determined. Ironically, it became clear that the students valued the wrist pads for their own personal use, since all but one were stolen by the year's end.

Presently, the clusters at MIT are equipped with good lighting and adjustable chairs, but there are many other options under consideration. Whether the next step is to replace tables, install keyboard trays, or simply supply every workstation with a wrist pad, the physical conditions in the clusters will not be enough to deter computer-related injury. A campaign to educate students to sit properly and rest often is the most effective and affordable course of action.

A HAPPY ENDING?

As a leader in the race for innovation, MIT must not lose the imperative for finding compatibility between technology and the human body. Buying the finest computers for the clusters should be accompanied with good facilities in which to use them. Computer education should involve learning how to take care of one's health. In the final tally, the student is the most valuable asset of the university, and they deserve to survive their college careers injury-free.

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