Low-Tech Solutions for Ergonomic Issues of High-Tech Workers

Term Paper

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The purpose of this paper is to detail some appropriate individual coping mechanisms for information systems technology workers in a modern environment. Recent studies indicate even moderate changes in the ways workers manage their posture and motions in seated office environments can significantly improve productivity and subjectively reduce the incidence and severity of work-related pain[i].

The following operating definitions apply for this paper: an appropriate individual coping mechanism is a physical process which a person may apply to reduce health risk; information systems technology workers are an equivalence class[ii] of office workers which includes software analysts, programmers, and testers; and a modern environment is defined as modular furniture as provided at Science Applications International Corporation, CSX Technology, Information and Display Systems, PGA TOUR Technology, and Blue Cross Blue Shield of Florida[iii]. "Corporate" examples will be drawn from the author's experience in these environments without direct attribution to any one company. This paper assumes practical generalizability of these definitions in both research and application, but concentrates on workers over 40 years of age.

Information systems technology workers, hereinafter referred to as 'techies,' typically work in climate-controlled office spaces with adequate lighting and subdued sound, performing tasks requiring little physical exertion and which provide opportunities to set their own work/break periods (except when cloistered in meetings). Even the more robust techie challenges (e.g. palmtop programming huddled next to a survey laser in a sleet storm and hiking hundreds of mountainous meters beyond the limits of a 4x4 to reach remote automated test platforms) pale when compared to routinely dangerous occupations (e.g. commercial fishing). Techies have one of the safest of occupations. Yet the very nature of the techie work carries its own health risks, listed by the UCSD ergonomics site[iv] as including: "awkward postures; repetitive and prolonged activities; forceful exertions; static exertions; contact stress; lighting; temperature; and physical or emotional stress."[v] Lighting and temperature are generally common to all cubes in the prairie dog farm[vi] and thus not appropriate for individual coping. Repetitive stress (cumulative trauma) was already covered by the text[vii], class discussions, and mid-term. Dynamic exertions and extremely awkward postures are (by this author's observation) highly exceptional among techies in the modern environment, so this paper will focus on static exertions, contact stress, and emotional stress.

Static exertions ("ordinary postures") occur whenever a particular posture is maintained semi-rigidly. The two most common static exertions this author observed among techies were head position and arm position (especially for the dominant hand). These static exertions are the direct results of the principal human-computer interfaces in the most common operating systems (graphic or text visual display monitor and keyboard/mouse) and match those discovered in controlled studies.[viii]

Although even young techies were seen rubbing the back of their necks at the end of an extended programming session, static exertion of neck muscles to maintain a particular posture of the head is particularly acute among older techies who wear multi-focal eyeglasses. This acuteness derives from the restricted focal area of such augmented vision[ix]. This area can be expanded, providing opportunity for more natural

repositioning in response to neck strain from static exertion, through the use of progressive lenses designed for greater field-of-view. This is significant because presbyoptic conditions show higher incidence in aging workers. "Doctor Dave" Fawthrop provides numerous other commonsense suggestions, like using larger display monitors[x].

Advancing age also tends to reduce the viability of 'Type II' muscles cells and therefore static exertion poses a greater risk to older techies,[xi] who experience static exertions of the arm, wrist, or hand. To reduce static exertions, the arm/hand activities should be varied, the interface equipment placed in a natural position of near-rest for the wrists, and breaks taken.[xii]

Corporate responses in the aforementioned companies to static exertion were, in the main, unintentional. Environments included phones which rang unpredictably and were ordinarily expected to be answered immediately. Phone were seldom positioned near mice and keyboards, and were generally expected to be answered pen-in-hand for note-taking. While speakerphone usage went up as cost came down, most cube-dwelling techies frowned on using speakers when only one person was conversing from the cube (for multiple and apparent reasons). Headphones also came into play, but not widespread use. The practical effect was for ordinary telephone calls to provide frequent and significant changes in techie posture, particularly of the neck and head. Meetings were normally attended in person, and the conference table and (generally mal-adjusted) conference room chairs provided distinctly different working postures. A recent tendency in some groups toward 'stand-up' meetings was even more beneficial, albeit of shorter duration. One management decision which runs counter to accommodation is the establishment of an enterprise-wide standard resolution (horizontal by vertical pixels) for computer displays. While most companies can reasonably establish a minimum resolution (in concert with a minimum physical screen size), the decision to set every monitor at the same resolution (e.g. 1024x768) is neither necessary nor appropriate for all workers, and may exacerbate risks of eye strain and static exertion.

One ineffective individual response to limb strain from static exertion is to rest the arm or wrist on a hard surface, such as a table or chair. To do so produces contact stress[xiii], particularly if the position results in a fulcrum effect, as might be found when the edge of a folding table is used to rest a forearm during mouse operation or when the elbows are rested against chair arms during typing. The concentration of force across a small area may causes crushing of tissues, interruption of blood flow, and nerve damage[xiv]. An effective countermeasure is to so arrange the working arms that they distribute their weight across a larger surface and to make that surface more pliant. Gel pads for wrists on mousepads are a poor solution, but cushioned desk surfaces long enough to support forearms, when properly arranged, can reduce contact stress.

More than one of the corporate environments provided contingency or continuous techie workstations which were arranged in the manner of what has been called a 1950s-era desk; specifically, there was a horizontal surface which extended left and right in front of the techie but not to either side and at well above lap height. This caused the techies to both lean forward and to lean upon the desktop, often pinching the mid-forearm against

the desktop when using a mouse, with arms canted at approximately 30 degrees of incline. The results experienced by this author and reported by co-workers under these conditions included sore and tingling forearms, wrists, elbows, and upper arms. Postures across a roomful of such workstations were significantly varied as some leaned left, others right, and some forward or backward in attempts to make the best of an uncomfortable arrangement. Contact stress was thus uniquely affecting different bodies and, if plotted anatomically, may not have exhibited a clear pattern within the group.

This author posits that most techies are more affected by stress involved in contact with other people than by contact stress with desks and chairs. This seems to be supported by rising claims for payment of counseling to relieve emotional stress among techies.[xv] IBM, in a recent survey[xvi], did not even list workplace ergonomics (or any of its particular elements) but determined that communicated social perception (i.e. “respect”) was the number one concern of techies. This was not news but consistent with the prior three years of survey data. In other words, allowing that personal values drive personal emotions, lack of respect or challenge to reputation is the greatest stressor for techies.

The social component of this fact raises a great challenge to determining individual coping mechanisms, but stress reduction, the principal means used for countering physical stresses listed above, is not the only or best response to emotional stress. Just as a muscle, stressed and strained within acceptable limits, grows stronger and less likely to tear, so emotional stress is amenable to management through physical exercise. This coping behaviour is directly related to the physical nature of emotional stress, notably so in persons of mature years.

One physical symptom of emotional stress which affects some senior techies with significant occupational effects is arthritic swelling. Exercise, even in moderate amounts and without medication, helps to relieve the pain and reduce swelling.[xvii] Part of this effect is from countering the effects of static exertion through dynamic exertion. Dr Sacks, in *Exercise for Stress Control*, went so far as to suggest “… that the stress-reducing effect of exercise-not just its cardiovascular benefits-may help improve physical health.” While there are many other ways of ‘managing’ emotional stress, physical activity seems most beneficial for the longest period.

Emotional stress was clearly encountered and countered in corporate environments, some more successfully than others. Supervisors and professional counselors were available during office hours for the time to make, repectively, an ‘open door policy’ office visit or a toll-free phone call. There was always direct instruction in team conflict communication skills and always some employment benefit related to personal fitness and exercise. One company offered free massage therapy on a periodic basis and others provided ‘stretch breaks’ in extended meetings (these tended also to help against static exertion in an auditorium posture). There were in addition subtler emotional stress countermeasures. “Up one, down two” posters suggestions to walk stairs instead of taking the elevator. Policies encouraging longer workdays with extended lunch periods for exercise on company grounds (complete with showers and lockers) were more the norm than exception. Unfortunately, the significant number of emotional stress alleviation methods did little to encourage management in the direction of stress

prevention. Perhaps the multiplicity and variety of avenues for emotional relief complicated incorporation of feedback on the level of overall or focused stress within the organization. Certainly there seemed to be no attempt merely to complement existing stressors with new stressor tasks.

What pattern of techie behaviour then applies the lessons here learned? The coping senior techie arranges her workstation to provide comfortable viewing through progressive trifocal (distance-computer-near) lenses which have been sculpted to provide the greatest field-of-view in working ranges. She leverages this range of vision to provide intentional turns of the head and neck, attempting to prevent static exertion of the neck. She types with both hands, arranging the equipment to support natural flexion and allowing not allowing the wrists to act as fulcrums. She intentionally interrupts extended typing by making good use of the mouse, and intentionally interrupts extended mousing by using keyboard shortcuts for navigation or editing. She walks briskly to and from meetings, where the social interaction may affect her sense of social respect. The walking should include stairs ("up one, down two"), especially when a meeting is perceived as stressful. She takes breaks which include short walks with upright posture and intentional turning of the head, with viewing outside the windows to change the position of the eye muscles affecting focus and light-gathering. She takes advantage of corporately sponsored counseling and fitness programs. In sum, she acknowledges, no, *honors* the non-technical physiology which not only enables but directly participates in the highly technical work.

And what lesson exists for management? A manager untrained in ergonomics of techies may assume that such behaviors as walking around and looking out windows, taking the 'slow' stairs instead of an elevator, and not "sticking with the faster keyboard" rather than mousing within documents, or "going back" to the keyboard instead of non-stop mousing within hypertext are activities counter-productive and 'time-wasting,' This attitude denies the dual truths that most techies are working harder invisibly, assessing and mentally optimizing possible solutions, than they will ever work physically on any given day and that healthier techies are more productive and less costly at a window than sore techies filing for workers comp.

Techie work is no less mentally strenuous than a good chess game, with iterative what-ifs and heuristic gymnastics. Looking out the window as ducks swim across the corporate retention pond may seem unproductive, but the information systems technology worker's mind does not always settle where the eyes gaze, and even if it should light on the ducks, waterfowl at leisure are exemplary models of avoiding static exertions, contact stress, and emotional stress.

Citations

[i] DeRango, "Office Workers' Productivity Enhanced by Ergonomics", Upjohn Institute, Jan 2003. http://www.upjohninst.org/publications/newsletter/kd_103.pdf

[ii] Equivalence class is a term borrowed from software testing, which borrowed it from mathematics (http://www.wikipedia.org/wiki/Equivalence_class or http://planetmath.org/encyclopedia/EquivalenceRelation.html).

[iii] None of these companies listed have any control over, responsibility for, or accountability as to the contents of this paper.

[iv] "Ergonomic Risk Factors: Computer and Office Workers ", *Blink, Jun 2003*. http://blink.ucsd.edu/Blink/External/Topics/Policy/0,1162,5048,00.html?delivery=&coming_from=

[v] *ibid* verbatim, new format punctuation and capitalization

[vi] Expression coined from industry jargon, documented at http://slashdot.org/askslashdot/00/11/13/2249200.shtml and http://ct.monster.com/articles/jargon/

[vii] Kroemer , Kroemer , and Kroemer-Elbert, Ergonomics: How to Design for Ease and Efficiency (2nd Edition, 2001)

[viii] University of Michigan, "Ergonomic Solutions: Keyboard work station design issues", 2000 (http://umrerc.engin.umich.edu/jobdatabase/Background/JobEx1/OfficeEx1.asp)

[ix] Markovitz, *et al* "Comparison of Bifocal and Progressive Addition Lenses on Aviator Target Detection Performance", 1995, American Optometric Association (http://www.aoa.org/clincare/aviation-comparison.asp)

x Fawthrop, "VDU Glasses for the elderly and those with poor vision also other visual problems encountered when using computers", 1997-2000, http://www.hyphenologist.co.uk/vduglass/

[xi] Joines, "The Aging Workforce Goes Under the Microscope ", *The Source, 2002, The Ergonomics Center of North Carolina (*http://www.theergonomicscenter.com/NewFiles/aging0101.html)

[xii] Local 34 American Federation of State, County and Municipal Employees (Minnesota), "VDT Workstation Guidelines", undated (http://www.afscmelocal34.org/vdt_workstation_guidelines.htm)

[xiii] Iowa State University Department of Environmental Health and Safety, "Contact Stress",2002 (http://www.ehs.iastate.edu/oh/contactstress.htm)

[xiv] *ibid*

[xv] Warren Sheppell extract from *Workplace Today* title "Worker Health Deteriorates: Studies", May 2003 (http://www.warrenshepell.com/newsroom/news-20030501.html).

[xvi] IBM Business Consulting Services, "Attracting and Retaining IT Talent in a Dynamic Economy: The 2002 High Tech Worker Survey Report", 2002 (http://www.itworldcanada.com/multimedia/pdfs/high-tech-workers-survey.pdf)

[xvii] Empathion, Inc. "Emotional Benefits of Exercise", *The Arthritis Digest, 2001 (http://www.thearthritisdigest.com/news/2000/oct2000emotionalbenefits.htm)*