Loss Control TIPS
Technical Information Paper Series
*Innovative Safety and Health Solutions*SM

The Mouse And Other Input Devices

Introduction

The keyboard is generally recognized as the primary input tool for computers since it has been, perhaps, the most commonly used tool. With the proliferation of graphically controlled computer environments and software, the use of the mouse and other alternative input devices has grown. More recently, the mouse has been recognized as a key input tool and, therefore, for its potential contribution to work-related discomfort and ergonomic risk factors.

Other input devices gaining rapid popularity are touchpads, trackballs, joysticks, and pens. Trackballs or mini-joysticks are built in to some desk top and lap top keyboard designs. Voice-activation (or voice-recognition) systems are also gaining in quality, function, and popularity.

Studies have shown that awkward postures during mouse use, like wrist extension and deviation, shoulder abduction, and forearm pronation, are often excessive (Atwood, 1989; Karlqvist, et al., 1994). An increase in reported discomfort and cumulative trauma disorders of the wrists, arms and shoulders of mouse users has also been recognized (Karlqvist, et al., 1994; Pascarelli and Quilter, 1992).

Aches and pains associated with mouse use generally result from the following risk factors:

- Static grip (hand, fingers)
- Static posture (neck, back, shoulder, elbow, wrist, fingers)
- Awkward posture (shoulder, elbow, wrist, fingers)
- Force (hand)

Mouse Products Available

The standard mouse is now available in a variety of shapes and sizes. Some models offer reversed contours for left- and right-handed users, and some are available in small, medium, and large sizes. Most models have two or three control buttons; however, there may be as many as five. The way each mouse operates is based on one of three technologies: *mechanical*, *optical*, or *opto-mechanical*.

A *mechanical mouse* uses moving mechanical parts, such as rollers and balls, and provides resolution equal to or higher than that provided by the other technologies. Mechanical mice tend to require frequent cleanings and wear out quickly.

An *optical mouse* has no moving parts. It uses the light reflected off a mouse grid pad to measure movement. It is extremely reliable, provides better tracking than opto-mechanical or mechanical mice, but is typically more expensive than the other mice.

An *opto-mechanical mouse* combines optical and mechanical technologies to measure movement by using light from optical LEDs and mechanical rollers and balls. Optical mice have been reported to be less precise than opto-mechanical mice, and the requirement of a grid pad has been considered to be a drawback. However, opto-mechanical devices far exceed mechanical devices in durability.

Other Mouse Devices

One type of *cordless mouse* operates on radio-wave technology, sending a low-frequency radio signal to a receiver that is hard-wired to the computer. This system offers an advantage over an infrared cordless mouse since infrared technology requires a direct line of sight.

The *pen-shaped mousepen* is another innovative mouse design. This device, which is held in the hand like a common pen, offers increased dexterity over the conventional mouse. It does not require the use of a graphics tablet, so it can be used on any surface.

Alternative Products

A *touchpad* provides a small, flat surface over which the finger glides to control cursor movement. "Clicking" is accomplished by finger tapping, either directly on the pad, or on buttons provided.

A *trackball* operates, in a sense, like an upside down mouse. Cursor movement and other functions are controlled by moving a ball which rests in a base. Trackballs are available in a variety of sizes. The bases which hold the balls vary in shape and size. Buttons, for "clicking," are located in the base.

A *joystick* directs the cursor by moving a vertical "stick" forward, back, side to side, or diagonally. A joystick generally requires a neutral hand position (thumb up) for operation; however, the actual grasping position will vary according to the size of the joystick.

Ergonomic Evaluation: General Concepts

From an ergonomics perspective, each of these input tools offers its own set of advantages and disadvantages. For example, a keyboard offers the opportunity to split the workload between hands and amongst fingers. Using a mouse concentrates the work in one hand, usually the dominant hand.

No tool is universal for all applications and, ergonomically, the perfect input device does not yet exist. Key factors for consideration in selecting the appropriate tool are design, hardware and software compatibility, and how the device is to be used, including frequency, duration and intensity of use. It is important to know whether the tool will be the primary or only input device used. A trade off may be necessary in positioning multiple input devices, which should be located as centrally as possible and within comfortable reach. It is essential that the individual maintain neutral postures, and remain comfortable, during and after use. Each tool must be evaluated carefully, with consideration of how, where, and by whom it is to be used.

A combination of factors, including posture, workstation design, work practices, and the ways in which the workstation is used, contribute to operator comfort, discomfort, or symptoms of CTDs. Each situation requires individual assessment to determine the appropriateness or effectiveness of a particular product.

The VDT workstation must be considered as a system. Many factors, including furniture, equipment (e.g., keyboards), workstation design, the general work environment, work organization and practices, and performance pressures, must be considered in order to prevent or eliminate risks associated with CTDs.

Recommendations for Using a Mouse

The following suggestions apply to use of a mouse, and many apply to the use of other input devices as well. The goal is to maintain comfortable, neutral postures and to avoid prolonged static postures.

- ☐ Place your mouse close to the keyboard, within comfortable reach.
- ☐ Adjust your work surface to a height that allows the mouse button to be at the same height as the keys of your keyboard.
- ☐ Hold the mouse loosely. A tight grip is not necessary; it will only increase muscle fatigue and tension.
- ☐ Use your whole arm and shoulder to move the mouse. Do not "plant" your wrist on the work surface, leaving all the work/movement up to your wrist.
- ☐ Hold the mouse lightly with all of your fingers. Rest your fingers lightly on the mouse if possible.
- ☐ Keep your wrist in a neutral (straight) position.
- ☐ Use a light touch to click.
- ☐ When not actually using the mouse, rest your hand comfortably in your lap.
- ☐ Perform regular maintenance; keep your mouse clean to assure optimal performance.

Other Recommendations For Input Devices

- ☐ Select the input tool (mouse or other) according to the task (i.e., how it is going to be used). Take individual differences and personal preferences into consideration when possible.
- ☐ When a problem with an existing input device is identified, evaluate the job task, then experiment with alternative devices. Many vendors and manufacturers will provide equipment on a trial basis. Take advantage of this opportunity.

References

1. Atwood, D. "Comparison of Discomfort Experienced at CADD, Work Processing and Traditional Drafting Workstations." *International Journal of Industrial Ergonomics*, Vol. 4, No. 1, July, 1989, pp. 39-50.
2. Johnson, P.W., Tai, R., Smutz, W.P. and Rempel, D.M. "Fingertip forces measured during computer mouse operation: A comparison of pointing and dragging." *Proceedings of the 12th Annual International Ergonomics Association,* Vol. 2, 1994, pp. 208-210.
3. Karlqvist, L., Hagburg, M., and Selin, K. "Variation in upper limb posture and movement during work processing with and without mouse use." *Ergonomics*, Vol. 37, No. 7, July 1994, pp. 1261-1267.
4. Pascarelli, E. and Quilter, D. *Repetitive Strain Injury: A Computer User's Guide.* New York: John Wiley & Sons, 1994, p. 182.
5. Sullivan, Kristina B. "Mice find their niche in graphical environments. (choosing a mouse device) (buyers guide)", *PC Week*, vol. 8, no. 36, September 9, 1991, p. 105.

Visit The Hartford's Loss Control web site at http://www.thehartford.com/corporate/losscontrol/