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HORIZON SCANNING SR006

HSE HORIZON SCANNING INTELLIGENCE GROUP**DO KEYBOARDS HAVE A FUTURE?****1. Issue**

The number of employees spending a large proportion of their time using ICT seems likely to continue to increase in the future, due to a combination of factors. These include the ongoing shift towards a services or knowledge-based economy, integration of ICT across a growing range of industries/occupations, advances in both hardware and software, and increased use of networked services). Furthermore, computer use now begins in childhood (for both educational use in school and computer gaming outside of school), and evidence suggests that a large proportion of school children already experience discomfort associated with keyboard use.¹

Status: Active Monitoring

2. Relevance to Health & Safety

Musculoskeletal disorders (MSDs) remain the most commonly reported type of work-related illness in Great Britain, with an estimated 1,012,000 people affected.² Keyboard work is one of the most commonly cited causes of work-related MSDs, reported by 14% of those affected.² Increased use of wireless devices has also generated health and safety concerns (e.g. 'BlackBerry Thumb'), as the design of such devices tends to be more concerned with size than ergonomics.

3. What is available now, and what does the future hold?

Alternative designs to the standard keyboard have been available for some time, typically aimed at improving hand and wrist postures, including fixed- and adjustable-angle split keyboards, vertically split keyboards, and keyless keyboards operated by aligning sliding domes with letters.

Other developments include voice-recognition software, virtual (laser projected) keyboards, and tablet PCs (notebook-shaped mobile computers, allowing input with a stylus or digital pen). Alternatives to non-keyboard input devices (i.e. mice) include touch screens and 'gestural' technology (using gloves with reflective beads and infrared cameras to detect motion, manipulate projected objects or data).

A number of recent developments have demonstrated direct brain to computer communication. Chips implanted onto the brain have enabled severely paralysed individuals to communicate by reading the brain's electrical patterns.³ Using this technology, individuals with severe paralysis can quickly learn to move a cursor around a screen, play simple games, select letters shown on a screen and control a robotic arm.⁴ With improvements in hardware, it is expected that implanted chips will be able to process thoughts

¹ Katz et al. (2000) Prevalence of upper extremity musculoskeletal disorders in college students. *Am J Medicine*;109:586-88.

² HSE (2005). *Health & Safety Statistics 2004/05*

³ Abbott (2006), *Neuroprosthetics: In search of the sixth sense*. *Nature*, 442 (7099), 125.

⁴ A separate Horizon Scanning paper on human performance enhancement can be found at: <http://www.hse.gov.uk/horizons/humanenhancement.htm>

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as fast as speech by 2012. A non-invasive version of this technology has also been developed, named the 'mental typewriter'. Users wear an electrode cap that detects electroencephalographic (EEG) activity and analyses specific brain waves. This allows the user to type messages out by focusing on individual letters displayed on a screen. Although the mental typewriter benefits from being non-invasive, it is slower, taking 5-10 minutes to type a sentence. Given the speed of technological advance, however, scientists at Darpa, the Pentagon's scientific research agency, believe that we will all be wearing computers in headbands within 20 years.⁵

Over a decade ago it was predicted that the future interfaces with the computer would involve touch screens and voice input,⁶ yet the traditional keyboard and mouse remain commonplace in most office environments. One of the challenges facing developers of speech-recognition technology is achieving accurate recognition in noisy environments, a particularly important consideration in open plan offices. Although speech recognition software is still far from perfect, IBM proposes to have achieved performance comparable to humans by 2010, and several mobile phones offering a speech-to-text facility are currently on the market. The extent to which users adopt speech-recognition software, however, is likely to be limited by the extent to which they are comfortable with dictating messages aloud. For emails and text messages, this could be limited, particularly in open plan offices.

4. Implications

The most favourable future, in terms of reducing negative impacts on health, would incorporate a wide range of input methods. This would provide the user with the flexibility to use different input methods for different tasks and work locations as appropriate, also reducing exposure to any one potential risk factor (e.g. typing). Current tablet PCs, for instance, enable users to input text using handwriting recognition, an on-screen touch screen keyboard, speech recognition, or a physical keyboard. If interface devices of the future office do move away from the traditional keyboard and mouse, physical symptoms currently attributed to computer use may be alleviated. However, the impact of alternative devices (e.g. touch screens, tablet PCs, voice-input, and so on) is yet to be determined, and will need to be closely monitored. In addition, such (physical) controls will not necessarily reduce MSD prevalence, due the association between psychosocial factors and MSDs, which has been identified as more important than physical risk factors in certain cases.⁷

5. Recommendations

A holistic approach is likely to be particularly beneficial in tackling MSDs, including consideration of the physical work environment, such as alternative input devices for computer users, in addition to psychosocial risk factors. Horizon Scanning Unit will continue to monitor developments in this area.

Zara Whysall, Horizon Scanning Section, HSL

⁵ Surfing the Web with nothing but brainwaves, CNN Money, July 24, 2006.

⁶ Coover (1995), Technological changes in office jobs. In *The Changing Nature of Work*, A. Howard, ed. San Francisco, CA: Jossey-Bass Publishers.

⁷ Harkness et al. (2003). Mechanical and psychosocial factors predict new onset shoulder pain: a prospective cohort study of newly employed workers. *Occup Environ Med*, 60, 850-857.