Running head: COMPUTER DISPLAY ENHANCEMENTS

Computer Display Enhancements and their impact on Rehabilitation

Michael G. Fiore, BSE, MBA

Rehabilitation Engineer

The Sierra Group

November 7, 2006

Introduction

The line between rehabilitation and technological advancement continues to blur. For less than $1000, the desktop computer that I can purchase today is an order of magnitude more powerful and capable than the one I could buy just 18 months ago. More powerful, not just in terms of it's processor, memory, and storage, but it also has noticeably enhanced graphic and display characteristics. Today's office technology comes standard with high-speed graphic processors and LCD (liquid crystal display) panels. Nvidia's 7800 GTX graphics card is more than 10 times faster than it's 6800 GTX card – which was only on the market for 6 months.

Gone are the days of the 'big box' low-resolution (800 x 600) analog monitor. As the business world gets ready for the pending release of Microsoft's Windows Vista Operating System – which promises to deliver enhanced user experiences that further connect today's office worker to their computer through the invisible umbilical cord of 'information' - display advancements that enhance performance and usability are at the cutting edge of technological innovation. According to the Worldwide Web Consortium (W3C), nearly 78% of all computer users have display resolutions of at least 1024 x 768 (as of July 2006). This is up from 51% from just 3 years ago – this is a solid and practical measure of the upgrade trend that is occurring on desks everywhere. All of this is occurring at a time when nearly 1 in 2 members of the US Labor Force is above 40 – the very age that I bought my first pair of 'readers' from the drug store. The US Bureau of Labor Statistics offers that I am certainly not alone, and concludes that this 'aging' demographic will continue to occupy a larger slice of the workforce in the decade to come.

LCD Panel Usability

Research on the visual performance of active matrix TFT (thin film transistor) displays, a type of LCD panel, in which each pixel is controlled by one of four transistors, and analog CRT (cathode ray tube) monitors demonstrate that for each of the age groups tested, visual fixation times and fixation frequencies were enhanced for the active matrix displays (Ziefle, 2001). Fixation refers to the phenomena of how we overcome our natural need for rapid visual shifting, or saccadic vision, when using our sharp central vision for tasks such as reading, using a computer, or watching television. To the extent that fixation (both time and frequency) is enhanced, simply means that our ability to focus on intended elements is greater and that the natural distraction of those elements (namely flicker, image quality, consistent brightness, etc.) - are minimized. In his study, Ziefle offers that while the visual performance for all tested groups was better on the TFT panels, the visual benefit for users in the 40-65 age group increased by 37%. People in this age group (people like me) performed 37% better on visual tasks just by replacing their CRT and low-resolution LCD with a high-resolution digital TFT (LCD) display. Also, LCD's offer a flicker-free visual environment that can decrease visual search times when looking for fixed targets embedded within a screen full of text – a fact that is becoming more critical as the amount of information on our desktops explode. Research suggests that for small low-contrast characters, visual search times can be improved by almost 22% just by selecting the right display (Naesaenen, 2001).

All of this makes absolute sense. Better image quality through enhancements to video graphic capabilities and larger, more refined displays can increase and enhance prolonged display viewing for all age groups creating a Utopian computing experience – case closed and problem solved. So where's the impact to rehabilitation?

The Impact to Rehabilitation

The computing trend to supply devices with 19" high-resolution LCD panels and 512 MB of Video Memory as standard features has created a host of accommodation benefits for many workers – whether they realize it or not – but it has also highlighted new opportunities that are, in my experience, often overlooked. The three that I will touch upon are: 1) typing proficiency, 2) macros/keyboard commands, and 3) basic ergonomics.

It continues to amaze my wife that I will use a hammer to beat on an aberrant screw until its falls off of a wall due to the mechanics of metal fatigue caused by my gorilla-like effort rather than to reach for my Dremmel® and quickly and easily complete the task. I have longed ceased to be amazed by my actions (or inactions). Having the right tool, doesn't mean that I will use it correctly – or all at. All of the lauded visual benefits of today's LCD panel are lost (or severely compromised) if the fundamental of input – typing accuracy – is not considered. My experiences clearly indicate that innovation without a re-emphasis on typing skill fails to capitalize on the inherent technology advancements. Within the last 6 months, I have given 25 copies of Mavis Beacon Typing CD's to adults who thought that their input skills were above reproach. All of these individuals were marginally proficient typists – they used what can be described as a hybrid form of the classic 10-finger touch typing method that Mavis extols – a creation of their own design. In all cases, these professionals, accomplished in their vocational pursuits, spend half of their time leaning forward in their chairs while staring at their fingers. To the extent that screen enhancements through macros and customized toolbars (that can enhance efficiency) and ergonomic supports are part of a rehabilitation solution, these tools are reduced in their overall value when you spend time looking at your hands and not at the high-resolution active matrix digital display. If I can remove the back of your chair without you knowing it – it begs the

question, what benefit does the office technology offer if the fundamental mechanics of input are compromised?

At 40, I see myself as indicative of the larger demographic. My only typing training occurred in high school (10th grade) and while it certainly acquainted me with the functions of the IMB Selectrix, it did not prepare me for what would be a technology revolution - where the need to visually manage information while communicating on a plastic QWERTY keying interface would dominate my personal communication spectrum with the outside world – oops. I am not a touch typist – but I'm in a support group. I recognize in my own office space what I see when I work with others, that the technical advancements that make the information flow more efficient and pervasive require more and more from the fundamental skills of digital communication.

Conclusion

In 1965 when Gordon Moore (of Moore's Law) quipped that the number of transistors that could be mounted on a circuit board would double every 24-months. He foretold the geometric march of technical advancements. With these advancements have come features that offer accommodation access to an increasingly large part of the population. Variable font sizes, color and contrast settings, spelling and grammar checks, integrated speech input and output, and a host of other tools that were once accommodations are now just standard features that allow us to customize our 'user experience'. The recent technology trend towards larger, more robust displays that use more video memory supports the new software that seeks to add more to our visual dashboards – more information needs more space and better clarity to support smaller fonts and graphics. Moreover, while this trend continues and the research clearly points to the pristine visual benefits of these enhancements, the usability test and practical experiences of

many will still be controlled, and in some cases thwarted, by the 26 plastic keys that render the universe of information accessible. In the search for the ideal ergonomic and adaptive workspace solution, the central question that can help to determine rehabilitation success will soon be – are you a touch typist? The line between technology and rehabilitation gets blurrier every day.

References

Naesaenen, R. (2001). Display quality and the speed of visual letter search. *Displays*, *22*(4), 107-113.

Ziefle, M. (2001). Aging, Visual Performance, and Eyestrain in Different Screen Technologies. Proceedings of the Human Factors and Ergonomics Society – 45th Annual Meeting, Volume 1, St. Paul, MN, October 8-12, 2001. Pages 262-266.