Including Users with Motor Impairments in Design

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INTRODUCTION

For people with motor impairments, access to, and independent control of, a computer can be an important part of everyday life. However, in order to be of benefit, computer systems must be accessible.

Computer use often involves interaction with a graphical user interface (GUI), typically using a keyboard, mouse, and monitor. However, people with motor impairments often have difficulty with accurate control of standard input devices (Trewin & Pain, 1999). Conditions such as cerebral palsy, muscular dystrophy, and spinal injuries can give rise to symptoms such as tremor, spasm, restricted range of motion, and reduced strength. These symptoms may necessitate the use of specialized assistive technologies such as eye-gaze pointing or switch input (Alliance for Technology Access, 2000). At the same time, specialized technologies such as these can be expensive and many people simply prefer to use standard input devices (Edwards, 1995; Vanderheiden, 1985). Those who continue to use standard devices may expend considerable time and effort performing basic actions.

The key to developing truly effective means of computer access lies in a user-centered approach (Stephanidis, 2001). This article discusses methods appropriate for working with people with motor impairments to obtain information about their wants and needs, and making that data available to interface designers in usable formats.

BACKGROUND

In a recent research study commissioned by Microsoft, Forrester Research, Inc. (2003) found that 25% of all working-age adults in the United States had some form of dexterity difficulty or impairment and were likely to benefit from accessible technology. This equates to 43.7 million people in the United States, of whom 31.7 million have mild dexterity impairments and 12 million have moderate to severe impairments.

If retirees had been included in the data sample, the number of people who would benefit from accessible technology would be even higher as the prevalence of motor impairments, and thus the need for such assistance, increases noticeably with age (Keates & Clarkson, 2003). As the baby-boomer generation ages, the proportion of older adults is set to increase further.

The global aging population is growing inexorably (Laslett, 1996). By 2020, almost half the adult population in the United Kingdom will be over 50, with the over-80s being the most rapidly growing sector (Coleman, 1993). Governments are responding to this demographic change. Antidiscrimination legislation has been enacted in many countries such as the United States with the 1990 Americans with Disabilities Act, and the United Kingdom with the 1995 Disability Discrimination Act.

These pieces of legislation often allow users who are denied access to a service to litigate against the service provider. They are mechanisms for enforc-

ing basic rights of access. A complementary "carrot" approach to this legislative "stick" is the change in governmental purchasing policy. In the United States, the Section 508 amendment to the 1998 Workforce Investment Act stipulates minimum levels of accessibility required for all computer systems purchased by the U.S. Federal Government, the world's largest purchaser of information-technology equipment. Many other national and regional governments are adopting similar purchasing policies.

Research Methods for Improving Accessibility

To provide truly accessible systems, it is necessary to examine the user experience as a whole and to adopt design best practices wherever possible. To this end, standards are being developed, such as the forthcoming British Standards Institute BS7000 Part 6, "Guide to Managing Inclusive Design," that focus on wider interpretations of accessibility throughout the complete lifetime of products.

In addition, heuristic evaluations of prototypes can reveal fundamental physical-access issues. Accessibility standards like the U.S. Section 508 guidelines (http://www.section508.gov/), or the W3C Web Accessibility Initiative Web Content Accessibility guidelines and checklists (Chisholm, Vanderheiden, & Jacobs, 1999) are readily available to assist with establishing the heuristics. Examples include testing whether keyboard-only access is possible and examining the size of targets the user is expected to click on. Addressing these issues in advance of user testing will allow the maximum benefit to be gained from the user sessions themselves.

Ideally, users with disabilities should be included in product design and usability testing early and often. Many user-interface designers are not adequately equipped to put this into practice (Dong, Cardoso, Cassim, Keates, & Clarkson, 2002). Most designers are unfamiliar with the needs of people with motor impairments and are unsure how to contact such users or include them in studies. The following sections outline some specific considerations and techniques for including this population in user studies.

SAMPLING USERS

For traditional user studies, the users would typically be customers or employees and would often be readily at hand. However, when considering users with a wide range of capabilities, it is often necessary to commit explicit effort and resource to seeking out potential participants.

Good sources of users include charitable organizations, social clubs, and support groups, which can be found in most towns and cities. However, even when sources of users have been identified, effort still needs to be expended in trying to identify candidate users who match the user-sampling profiles. Sample sizes are inevitably small since volunteers must be reasonably typical users of the product in addition to having a physical impairment.

Sampling Users by Condition

There are many possible approaches for identifying and sampling potential users. The most obvious is to identify users based on their medical condition. The advantage of this approach is that someone's medical condition is a convenient label for identifying potential users. Not only are most users aware of any serious condition, especially one that affects their motor capabilities, but it also makes locating users easier. For example, many charitable organizations are centered on specific medical conditions, such as cerebral palsy, muscular dystrophy, or Parkinson's disease.

The disadvantage of this approach is that many of these conditions are highly variable in terms of their impact on the user's functional capabilities, and so a degree of user-capability profiling is still required.

Sampling Users by Capability

The alternative approach to sampling users is not to focus on their medical condition, but to instead look at their capabilities. The advantage of this approach is that the accessibility of the resultant product should then be independent of the medical condition. The disadvantage of this approach is that more user-capability profiling is required at the outset to establish where each user sits in the capability continuum.