SWYPE VRS. CONVENTIONAL ON-SCREEN KEYBOARDS: EFFICACY COMPARED

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ABSTRACT

This study explored the relative typing speed and accuracy afforded by the new input method Swype as compared with the conventional on-screen keyboard, ScreenDoors 2000 on desktop computers. Sixteen subjects completed 9 typing trials with each of the keyboards, and the average of the last two trials was averaged to establish typing speed.

Results showed that the prototype Swype was as fast as the standard on-screen keyboard running with word prediction, but that users overwhelmingly favored using Swype. In this study, Swype was used in it's largest format. Anecdotal evidence suggests that, on cell phones, smaller keyboard sizes for Swype are preferred, and further research needs to be done to evaluate this for desktop computers.

INTRODUCTION

In general, alternative computer input progresses by slow refinement of existing technologies and approaches. Where the conventional keyboard was sized to be used by a person of average stature, expanded and mini-keyboards are sized to meet the needs of individuals with limitations in motor control or range of motion. The keyboard modifier keys are, by design, pressed simultaneously with character keys to produce capital letters or punctuation, and to print or format documents. For single-digit typing, the modifier keys are made "sticky," so that pressing a modifier and printable character key in succession has the same effect as pressing them simultaneously. In all of these cases, the basic operation is similar to the standard keyboard, and a person who knows how to use one knows how to use all.

Occasionally, a new input technology is developed for those who cannot use more conventional input methods. Morse code (Clement, 1961; McDonald, Schwejda, Marriner, Wilson, & Ross, 1982) for computer input was developed for individuals who could not use the conventional keyboard. Speech input (De La Paz & Graham, 1997; Karat, Halverson, Horn, & Karat, 1999; Murata, 1999) has been advocated for individuals who cannot use the conventional keyboard, but with limited success (Koester, 2003). Darci Code, as embodied in the Darci Too[1] (Lynds, 2000), used patterned movements of a joystick to provide text input for a person with only a single limb segment. In these cases, the technology was provided to make input possible for a person with a disability, and there was no expectation that it would be as fast or efficient as conventional typing, were the individual capable of such.

Very occasionally, an input method is conceived for use by able-bodied individuals which also is usable by those with disabilities. In these cases, the expectation is that the input will be as fast or as efficient as conventional typing. One such input has been developed primarily for use on the small

[1] Darci Too, WesTest Engineering Corp. 810 Shepard Lane, Farmington, Utah 84025. Phone: 801-451-9191. http://www.westest.com/darci/index.html

screens of smart phones, but is becoming available on larger screens as well.

Swype is a unique input method which appears similar to a conventional on-screen keyboard, but functions very differently. To generate text using a conventional on-screen keyboard, the user presses and releases each key in succession. With Swype, the user presses the first key of a word, then drags a path over each letter of the word, releasing over the last letter.

Since this input method is usable by able-bodied individuals (using fingers) or individuals with disabilities (using, for example, head pointers), it is important to understand how it compares with more conventional input methods. That relationship is the subject of this study.

METHODS

Subjects

Sixteen able-bodied adults with minimal experience using on-screen keyboards were recruited from a small college campus. Subjects were able to sit unsupported for 20 minutes, able to understand spoken language at normal volumes, and able to read 12 point type.

Instrumentation

Swype

We were able to obtain development copies of the Swype Input Method for use in this study from the developers (Kushler, 2010). Although we were testing the most recent developmental build, not all of the features were fully implemented at the time of this study.

ScreenDoors 2000

For this study, we used ScreenDoors 2000[2] as our on-screen keyboard. Since ScreenDoors 2000 is produced by the same group that is developing Swype, it was felt that this would minimize any possible manufacturer bias. It must be noted, however, that ScreenDoors 2000 is not fully Windows 7 compatible. We were only able to run it in the administrator account under which it was installed, which does not reflect appropriate real-world conditions.

There is reason to believe that typing with a head-pointer may be different that typing with the mouse. To control for this, all input was completed using the HeadMouse Extreme[3] for mouse position, and an AbleNet Jellybean[4] switch for mouse clicks. Because keyboard size could affect typing speed, the Swype keyboard and ScreenDoors were adjusted to be the same size, and both were positioned at the bottom of the screen, not overlapping the Word document. The ScreenDoors keyboard was set up with word prediction active, with a five word prediction list located above the active keyboard area.

Each subject was asked to type a series of passages from the novel Anne of Green Gables by L. M. Montgomery. Each typing session was of 20 minutes duration, and the source text was given in sequence to help maintain interest. Each subject typed 9 trials

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2 ScreenDoors 2000 V 2.3; Madentec, Inc., 4664 - 99 Street, Edmonton, Alberta, Canada T6E 5H5, http://www.madentec.com/products/screendoors.php, Phone: 780-450-8926

3 HeadMouse Extreme; Origin Instruments Corporation, Grand Prairie, TX; Phone: 972-606-8740; http://www.orin.com/access/headmouse/

4 Jellybean Switch; AbleNet, Inc., 2625 Patton Road, Roseville, MN 55113; Phone: 800-322-0956; http://www.ablenetinc.com/Assistive-Technology/Switches/Jelly-Bean

using Swype and 9 trials using ScreenDoors 2000. In order to control for learning effects, eight of the subjects used ScreenDoors first, while the remaining subjects used Swype first.

At the beginning of each session, the subject was seated at a computer workstation with the keyboard and mouse moved out of reach. A source document was placed on a copy stand to the left of the monitor, a blank Word 2010 document open on the screen, and the Jellybean switch placed centrally in front of the monitor. The subject was wore an IR reflector cap[5] from NaturalPoint, and was free to move the jellybean switch to a comfortable position before beginning to type.

The subject was instructed, "When I say go, I would like you to copy this text as quickly and as accurately as you can using [ScreenDoors, Swype]. Are you ready? Go!" At the word "Go," the subject began typing, and a Salter Digital Glass Timers timer was activated to count down from 20 minutes. After 20 minutes, the timer signaled the end of timing, and the subject was instructed to stop typing.

Each typing trial was saved for analysis of speed and accuracy.

Data Analysis

Because of the variability in typing speeds from session to session noted in prior studies of this kind, the typing speeds for the last two trials with each keyboard were averaged for all comparisons. The final typing speed was compared using a matched-pairs t-test.

Typing Speed

There were no significant differences in typing speed noted between the two keyboards. Over the course of this study, the average typing speed with ScreenDoors was 7.6 words per minute, while that with Swype was 7.3 words per minute. Because we felt that the motor plan using Swype might require more learning, we compared the slope of the typing speed data between the two input methods. Steeper slopes would indicate faster learning of the input method. Again, the slopes were not significantly different between the two, indicating that the requirement of learning to use a head-pointer and any on-screen keyboard was greater than any difference between the two keyboards.

Accuracy

We have not completed error analysis at the time of this writing, but will have that data in hand at the RESNA conference.

Human Factors

Nearly all subjects in the study reported that using the Swype keyboard was much more enjoyable than using the ScreenDoors keyboard. The ability of the keyboard to correctly produce the correct word even when pointer movement was imprecise intrigued subjects, and may have limited performance with this keyboard.

RESULTS

The results of this study do not support claims for faster typing, at least initially, with the Swype keyboard. There were no significant differences between typing speed using Swype, a new input method, and ScreenDoors, a more conventional on-screen keyboard. However, our subjects all preferred using Swype over ScreenDoors. This preference may have been due to the novelty of the input method, and may fade over time. However, typing speed may also increase over time due to practice, so the net balance cannot be determined without extended study.

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5 SmartNav Hat; NaturalPoint, Inc., P.O. Box 2317, Corvallis, OR 97339; Phone: 1.541.753.6645; http://www.naturalpoint.com/smartnav/store/accessories.html

It has been reported that, when using Swype on a cell-phone, setting the keyboard to a smaller size can increase typing speed. This potentially provides a differential advantage to Swype. It has been demonstrated (Anson, 2010) that typing speed increases with increasing size of on-screen keyboards because of increased ease in targeting the desired key. However, Swype uses a disambiguation method that requires only an approximately accurate path to select the correct word. Thus, a smaller Swype keyboard may reduce the required travel while not increasing the demand for precise movement. This has two potentially significant effects on typing.

First, for many individuals with disabilities, large degrees of head movement may produce fatigue. Allowing smaller excursions could, therefore, allow an individual with limited endurance to type longer. Second, on-screen keyboards compete with the task being performed for screen space. If the keyboard can be smaller without limiting productivity, then more space is available for work. More research needs to be done to determine the optimum size for the Swype input method when using a head-pointing input device.

CONCLUSIONS

This study has shown that the late prototype of Swype is as effective for text input as ScreenDoors 2000, when both are sized the same. Our subjects reported enjoying using this keyboard more than the conventional on-screen keyboard, as well. If this preference applies to individuals with disabilities as well, this would represent a strong indication that clinicians providing computer access should include Swype in the options presented to the clients who may be candidates for on-screen keyboard use.

Further research needs to be done evaluating Swype at different sizes, to find if the observation of Swype use on smart phones generalizes to desktop computers as well. In addition, we need to explore the effects of continued use on input speed. The motor skill of using Swype is substantially different than that of using a conventional on-screen keyboard, where the path to the keys does not matter. As this movement pattern becomes more practiced, speed might increase significantly more than the observed gains with conventional on-screen keyboards.

The current results validate the concept of Swype for users of head-pointing systems. Clinicians should now begin considering its use with their clients. As the technology evolves, it may become an even more highly recommended input method.

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BIBLIOGRAPHY

Anson, D. (2010). *The Look-At/Look-Through Interface: A Conceptual Test.* Paper presented at the RESNA 2010, Las Vegas, NV.

Clement, M. (1961). Morse code method of communication for the severely handicapped cerebral palsied child. *Cerebral Palsy Review, September-October*, 15-16.

De La Paz, S., & Graham, S. (1997). The effects of dictation and advanced planning instruction on the composing of students with writing and learning problems. *Journal of Educational Psychology, 89*, 203-222.

Karat, C.-M., Halverson, C. A., Horn, D. B., & Karat, J. (1999). *Patterns of entry and correction and large vocabulary continuous speech recognition systems.* Paper presented at the Proceedings of CHI, Pittsburgh, Pennsylvania.

Koester, H. H. (2003). *Abandonment of Speech Recognition by New Users.* Paper presented at the RESNA 26th International Annual Conference, Atlanta Georgia.

Kushler, C. (2010, Sept. 8, 2010). [Permission to use swype].

Lynds, J. (2000). Darci Too: Universal Computer Access Retrieved Nov. 22, 2011, from http://www.westest.com/darci/darcitoo.html

McDonald, J. B., Schwejda, P., Marriner, N. A., Wilson, W. R., & Ross, A. M. (1982). Advantages of Morse code as a computer input for school aged children with physical disabilities. *Computers and the Handicapped.* Ottawa: National Research Council of Canada.

Murata, A. (1999). Identification of an Acceptable Mixture of Key and Speech Inputs in Bimodal Interfaces. *International Journal of Human-Computer Interaction, 11*(4), 339-348