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Executive Summary

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Adjusting Computer Input Device Settings Automatically to Meet User Needs
Report on Phase I SBIR Grant, 6/20/2014
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The goal of this work is to enhance the productivity and comfort of computer access for people whose impairments affect their ability to use the computer keyboard and mouse. In Phase I, we developed and evaluated a software tool for the automatic configuration of computer keyboards. The software assesses current user performance with their keyboard and recommends the appropriate Windows keyboard settings to match the user's needs.

We achieved the following objectives:

Objective #1: Develop a prototype software program.
> **Task 1**. Develop & validate methods of gathering natural data about a user's keyboarding performance, during regular computer use rather than during a prescribed test activity.
> **Task 2**. Evaluate recommendations for keyboard settings made by feeding the natural data into decision algorithms.
> **Task 3**. Implement a basic prototype that makes recommendations and allows the user to activate them.

Objective #2: Evaluate the software with computer users who have physical impairments.
> **Task 4**. Demonstrate effectiveness of the software's recommendations.

This project helps ensure that individuals with physical impairments have the effective computer access they need in order to pursue their educational and vocational goals, providing the flexibility to access any computer, anytime, anywhere. When combined with our current work on mouse settings, the software will provide a complete system, ensuring that all individuals have an appropriate initial configuration and that the settings continue to adapt to each individual's changing needs.

We accomplished all of the project goals. In particular, we developed and validated software, called AutoIDA, which can make appropriate recommendations for the Windows keyboard settings of Sticky Keys, repeat delay, and repeat rate. Recommendations are based on a user's specific typing data, collected during use of any Windows application, allowing the system to adapt to a user's needs in a seamless way, without requiring them to perform any particular or prescribed task.

Milestones achieved for Tasks 1 through 3 include:
> a. Foundational data collection of keyboard events accurate to within 1 ms;
> b. Accurate recommendations for Sticky Keys, with 95% classification accuracy;
> c. Accurate recommendations for repeat settings, with a difference of less than 1% relative to benchmark; and
> d. Two functioning software prototypes that run on Windows.

In Task 4, we evaluated the effectiveness of the first AutoIDA prototype in an evaluation study involving 18 participants: 14 with physical impairments and 4 without. 9 women and 9 men participated; clinical diagnoses included cerebral palsy (4), Parkinson's disease (4), brain injury (3), muscular dystrophy (2), and high-level spinal cord injury (1). The validity of the recommendations made by AutoIDA was high: it classified Sticky Keys use with 93% accuracy, and recommended key repeat delay to within a few milliseconds of a benchmark approach. We had hoped that use of this software would enhance typing speed by an average of 30%; however, average typing speed for our participant group was essentially the same whether users typed with the default keyboard settings (5.5 wpm) or the AutoIDA-recommended settings (5.3 wpm). While use of this software did not enhance typing speed for our participant group as a whole, it did yield the following benefits:
> a. Increase in typing accuracy of approximately 30%;
> b. Prevent about 90% of inadvertent key repeats (with the revised algorithm);
> c. Increase efficiency and accuracy of entering shifted characters.

These benefits cumulate to provide a more comfortable and productive typing experience for people with physical impairments. Participants expressed clear agreement that software such as AutoIDA would be useful to them (average rating 4.1, where 5 = strongly agree).

Not everyone with a physical impairment needs settings that are different from the Windows defaults. But AutoIDA can identify those who do, and make appropriate recommendations for them. With further development, this software can ensure that Windows adapts to meet users' needs, automatically and seamlessly.