Augmenting Voting Interfaces to Improve Accessibility and Performance

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Abstract
Reading disabled (RD) voters represent approximately 1 in 7 voters. Current electronic voting technologies exhibit substantially different error rates between RD voters and non-RD voters. These error rates are not consistent. For example, full-faced voting systems are better suited for RD individuals, while page-by-page systems are better for non-RD voters. We seek to analyze the differences in the voter's performance in order to build interfaces that reduce mistakes and errors for both RD and non-RD voters.

Keywords
Guides, Voting, Reading Disabilities, User Interfaces, Cognitive modeling

ACM Classification Keywords
H5.2 [Information interfaces and presentation]: User Interfaces. - Graphical user interfaces.

Introduction
After registration, problems with usability were the primary reason why votes were lost in the US 2000 presidential election [1]. With between 1.5 and 2 million votes lost the goal of improving voting user interfaces has become a major effort. Systems that prevent people from voting for too many candidates have been shown to reduce errors for less-educated voters [6]. Approximately one out of every seven to

twelve voters in the United States is reading-disabled (RD) [4,5]. We further hope to understand new approaches to voting technology that can not only help people with reading disabilities, but also help non-reading-disabled voters to vote more effectively.

RELATED WORK

Reading disabilities and voting

Our lab has conducted research into both existing voting technologies as well as new technologies. We conducted a study (manuscript in preparation) comparing the performance of reading disabled and non-reading disabled voters. Each voter voted on a full-faced machine and a page-by-page machine. The aggregate results of ballot errors were compared. RD voters with a previously diagnosed reading disability performed significantly better with the full-faced system, while non-diagnosed RD voters performed better on the page-by-page system. The lack of diagnosis of a reading disability is often related to a lower socioeconomic status. The result of picking a voting interface that has a significantly higher error rate for undiagnosed RD subjects is that a socioeconomic class of voters is selectively, even if unintentionally, disenfranchised.

New Voting Interfaces

One of voting systems our group designed is the Low Error Voting Interface (LEVI). LEVI combines several elements from both systems. It guides users through the voting process via both navigation buttons and tabs that indicate the voter's position in the ballot.

Figure 1. The LEVI Interface. Green denotes races that have been completed.

The higher performance of the RD group on full-faced ballots suggests that the grid layout of the races and candidates makes it easier to pick the desired selections. Yet, why is this effect observed for only the RD subjects? It seems that each interface has features that make it better for a particular group. Thus, if one interface is chosen, a group of voters is disadvantaged. For another interface, a different group is disadvantaged. Perhaps there is a way to combine the winning features of both interfaces and create a better user interface for all voters.

CURRENT GOALS

We are conducting research that integrates the data and observations from experiments such as the one we conducted with the RD population. Commercial development of voting systems has not been done in a voter-centric manner, and as a result the existing interfaces can be difficult to navigate for all voters. The user interface community has a great deal to contribute to the development of voting interfaces that address usability problems for both average voters and voters with specific difficulties. We want to effectively create new interfaces that take advantage of the expertise of usability professionals as well as the empirical data we uncover.

We are experimenting with the LEVI interface, and comparing results to other systems. In addition, we are experimenting with both audio and printed voter verified feedback systems.

In addition, the observations from the study of reading disabled voters indicates that we might be successful creating a different type of hybrid voting system that contains many of the features of LEVI, but also contains the physical orientation effects of the full-faced ballot. Such a design would be like having a window onto the current race, but still allow the voter to see where they are in the process. This type of interface would likely have the benefits of a full faced interface, but also guide users through so that they more accurately completely more of the ballot. In the highly prevalent instance of non-diagnosed RD voters, such an interface would prevent them from being selectively disenfranchised, while giving the other voters an equally helpful interface.

QUESTIONS

1. What aspects of each voting technology (full-faced/page-by-page) can be used to create a hybrid that has the advantages of both from a performance perspective?
2. Can we develop a consistent protocol to enable universal testing of new voting user interfaces?

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Biographies

Professor Selker

Ted Selker directs the MIT Media Lab's Context-Aware Computing group, and the Lab's Counter Intelligence/Design Intelligence special interest group, focused on domestic and product design of the future. He is also the MIT director of the Caltech/MIT Voting Technology Project. His work seeks to demonstrate that people's intentions can be recognized and respected by the things we design, and he uses technology-rich platforms, such as kitchens, to examine this premise. For the Caltech/MIT voting technology project, Selker is building and testing technology for improving security and accuracy in voting. Before coming to MIT, he was an IBM fellow and directed IBM's User Systems Ergonomics Research Lab. He has served as a consulting professor at Stanford University, taught at Hampshire College, the University of Massachusetts at Amherst, and Brown University, and worked at Xerox PARC and Atari Research Labs. Selker's research has contributed to products ranging from notebook computers to operating systems; his work has resulted in many products (such as the TrackPoint in-keyboard pointing device found in many notebook computers), and numerous patents and papers. He was co-recipient of the Computer Science Policy Leader award from Scientific American magazine (2004) for his work on voting technology.

Jonathan Goler

Goler is a graduate of the Massachusetts Institute of Technology with an S.B. and M. Eng. in Electrical Engineering and Computer Science. He began research in the Sociable Media Group at the MIT Media Lab, later joining the MIT-Caltech Voting Technology Project. Mr. Goler developed the first prototypes of the Secure Architecture for Voting Electronically (SAVE), and the Low Error Voting Interface (LEVI). He continues to serve on the IEEE 1583 electronic voting equipment standards committee. Later, Goler joined the Synthetic Biology Working Group and built BioBricks database and BioJADE. The BioBricks database is an open repository for standardized biological parts, and BioJADE is a biological circuit design and simulation tool which leverages the parts contained in the BioBricks Database. Goler is currently a PhD student at the University of California Berkeley in Dr. Jay Keasling's lab.

Citations

[1] ANSOLABEHERE S. ET AL. 2001. *Voting: What is, what could be?* MIT/Caltech Voting Technology Project.

[2] BENDER, W.N. 1992. Learning disabilities. In Developmental Disabilities. In *Developmental Disabilities*. P.J. MCLAUGHLIN & P. WEHMAN Eds. Andover Medical Publishers, Boston.

[3] BOND, G.L., TINKER, M.A., WASSON, B.B., WASSON, J.B. 1973. *Reading difficulties: their diagnosis and correction.* Prentice-Hall, Englewood Cliffs, NJ

[4] FLANNERY, KA, ET AL. 2000. Male prevalence for reading disability is found in a large sample of Black and White children free from ascertainment bias. *Journal of the International Neuropsychological Society* 6, 433-442.

[5] HAMMILL, D.D., LEIGH, J.E., MCNUTT, G., & LARSEN, S.C. 1981. A new definition of learning disabilities. *Learning Disabilities Quarterly*, 4, 336-342.

[6] TOMZ, M. AND VAN HOUWELING, R. 2003. How Does Voting Equipment Affect the Racial Gap in Voided Ballots? *American Journal of Political Science* 47, 1, 46—60.