Human Computer Interface Principles: Interfaces and Political Motivation

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1 ONLINE MASTER OF SCIENCE COMPUTER SCIENCE: THE INTERSECTION OF TECHNOLOGY AND SOCIETY

Technology and society have been evolving and influencing each other in a symbiotic relationship. Society needs are satiated through advances in technology. Conversely, social dynamics influence technological directive.

This can be explored in the context of distance education via online degree programs. This discussion will consider the Online Master of Science in Computer Science (OMSCS) offered by The Georgia Institute of Technology. The shift toward online learning has many **positive** attributes:

1. *Asynchronous Learning*: A student is able to take classes at a time most convenient to their schedule. Free from a set schedule, asynchronous learning offers students who are employed or have family priorities that opportunity to advance their education.
2. *Lower Cost of Tuition*: Many Universities that offer online do so at a discounted rate to their on-campus offering. This can open the door for students who may not be able to afford the cost of a traditional program.
3. *More Accessible for Students with a Disability*: Student with disabilities can participate in online programs more autonomously than a traditional program. Navigating to and around a campus setting is replaced by navigating a computer interface.

For this discussion, I'll focus on item three, *More Accessible for Students with a Disability*. I'll explore both the positive effects and negative consequences of this program. Lastly, I'll suggest methods to mitigate the negative, while keeping the positive effects.

1.1 Online Learning: Positive Effect

The OMSCS program has the propensity to make obtaining a degree *more accessible for students with a disability*. Students having issues with mobility, whether it be challenges with physical mobility, visual or auditory disabilities that

make navigation difficult can attend classes remotely, in an environment customized for their needs.

Another pro is that flexible class schedules allows students with psychological or psychiatric disabilities, post-traumatic stress disorder or cyclical mood disorders the flexibility to map study times according to fluctuations in receptivity. Students with Asperger's syndrome and other autism spectrum disorders, or who otherwise struggle socially, can avoid large classroom settings and instead work in familiar, comfortable settings. Communicating via forums and social media removes the pressure of interacting with others for students who are uncomfortable speaking in front of a crowd or who need time to assemble their thoughts [1].

1.2 Online Learning: Negative Repercussion

Although there are many positive aspects of online programs for students with disabilities, there are some unintended negative consequences that, in some cases, increase the gulf of execution for this audience. Instructors cannot make special accommodations for individual students without accommodation letters from the university disability services office. It is up to students to request such letters and then wait for the accommodations to be put in place. Additionally, digital-based online programs assume students can navigate that content, however, some learning management systems can challenge students with visual, cognitive or other disabilities [2]. Deaf and hard-of-hearing students may also face new challenges, as lectures delivered online may not provide them with American Sign Language interpreters, real-time captioning or transcriptions of speech produced by a person [3].

1.3 Online Learning: Preservation of Positive Effect While Minimizing Negative Repercussion

Keeping the positive effects of online learning while minimizing the negative consequences is rooted in designing interfaces that bridge the gulfs of execution and evaluation. We have already discussed how mobility issues for disables students are better addressed with online learning systems. To bridge the **gulf of execution**, interfaces should be designed to support students with disabilities *know your users*. For example, auto-assign, or make the process of filling out an

[1] Benefits of Distance Learning
[2] Negative Consequences of Distance Learning
[3] Additional Negative Consequences of Distance Learning

allowance for a disability more *discoverable*. Bridging the **gulf of evaluation** requires interfaces to provide varied *audio, visual, haptic, constant* and *immediate* feedback. This feedback would enable users with a disability to comprehend the relationship of actions to achieve their goals. Delayed feedback of just one modality may be lost to the disabled student.

2 COMPUTER SCIENCE: THE INFLUENCE OF POLITICAL MOTIVATIONS ON TECHNOLOGY

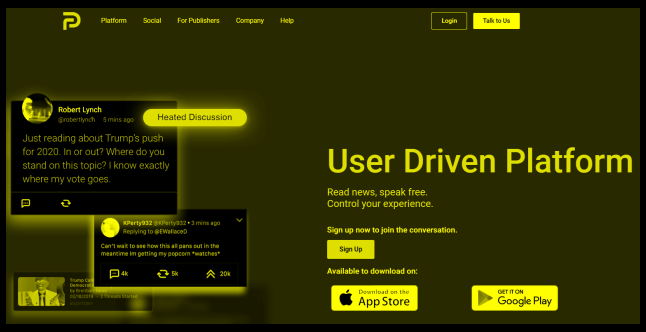

Figure 1: Social Media: Parler

Since its inception, *social media* has always been in the crosshairs of political designs for social change. The foundation of social media, **the internet**, even in its earliest forms, was influenced and designed by politically motivated government agencies and social institutions. More recently, social media platforms and services, developed by private, for profit institutions have evolved to leverage the power of the internet. The focus of this discussion will be on how political motivations are influencing the direction and design of social media platforms.

2.1 Stakeholders and Their Influence on Social Media Technologies

There are many stakeholder, both direct and indirect that have motivations for influencing the design and direction of social media platforms.

- **Primqar, Direct Stakeholders: Users, Influencers**:
  Social media influencers are users that have attracted a large following of other users. Influencers can use the power of their large base of users to attract advertising and sponsorship money from companies looking to advertise on social media platforms. Influencers are motivated to keep the social media platform open, with minimal moderation. Influencer receive income from posting on social media that is typically based on the number of views a post receives. Any censorship by the social media platform has the negative consequence of potentially shrinking the influencers base of users and more directly reducing the number of views an influencers post receives. This correlates to a lower income for the influencer.

- **Secondary, Indirect Stakeholders: Governments**:
  As social media has become a global entity, governments around the world have their own motivations for the direction of social media. Touching on all the motivations of each government is beyond the scope of this discussion, however, there is a common thread that runs through most of this political spectrum. That is, most governments seek to regulate social media in some form. Some of the less restrictive regulations may seek to tag the post of controversial posts. More restrictive governments may seek to limit or even ban access to social media. This is in conflict with the motivations of influencers.
- **Primqar, Direct Stakeholders: Advertisers**:
  Advertisers use social media to promote their product to users. To reach target audiences, advertisers may leverage social media influencers to reach target audiences. Given this relationship between advertisers and influencers, one might expect their motivations for uncensored social media posts would align. In some cases, this may not be the case. Social pressures and conscious may influence the direction of advertising on social media platforms. Recently, many large companies have pulled back from advertising on social media platforms. Their intent is to influence the social media companies to provide more oversight and filtering of controversial posts.

The nebulous nature of social media is driven, in part, by the diversity of the stakeholders and their motivation to influence the direction of this technology. This discussion briefly touched on motivations that were in conflict from just three stakeholders, There are many examples additional stakeholder *investors, creditors, founders, employees, suppliers, etc.*, that may have motivations, both in alignment and incongruent with each other.

An example of political motivations driving the design social media sites can be seen in the social networking site, Parler see figure 1 on page 3. Parler is promoted as an alternative to Twitter and particularly marketed to political conservatives. Parler has minimal moderation and does not engage in fact checking of user posts. This is in contrast to Twitter. It will be interesting to see which approach, perhaps both will be more successful. In either case, the winning technology will have effectively been decided by the motivations of the stakeholders.

3 ACM CHI CONFERENCE

The ACM CHI Conference on Human Factors in Computing Systems is the premier international conference of Human-Computer Interaction. This section will explore two papers that I found interesting with respect to the design of Human Computer Interfaces (HCI).

3.1 Hybrid-Brailler: Combining Physical and Gestural Interaction for Mobile Braille Input and Editing

The Hybrid-Brailler Paper [4] is an example of designing an interfaces that bridges the gulf of evaluation for visually impaired users. This is accomplished by providing multimodal feedback to users. This technology also reduces the gulf of execution for the visually impaired users by knowing the preferences for this audience. Mobile touchscreen interfaces lack of tactile cues commonly results in typing errors, which are hard to correct. The authors of the paper propose a Hybrid-Brailler, an input solution that combines physical and gestural interaction.

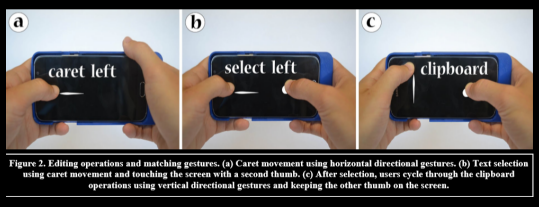

Figure 2: Hybrid-Brailler Interface

Prior to the widespread adoption of mobile touchscreens, visually impaired persons would use a physical keyboard that was adapted for Braille. This device provided a tactile means for visually impaired users to interact with digital devices. The lack of kinesthetic feedback on a touchscreen forces blind users to drag their finger across a flat keyboard, while receiving auditory feedback, to find the intended key, resulting in a slow typing process. The Hybrid-Brailler is an input solution that combines physical and gestural interaction to provide fast, accurate, and flexible non-visual input. The reductions in the gulfs of execution and evaluation have improved the task of text-editing visually impaired users by improving their speed while reducing errors.

I found this paper interesting as it relates to my research into designing a better

[4] Daniel Trindade1, André Rodrigues2, Tiago Guerreiro2, Hugo Nicolau1 1INESC-ID, Instituto Superior Técnico, Universidade de Lisboa 2LASIGE, Faculdade de Ciências, Universidade de Lisboa daniel.trindade@tecnico.ulisboa.pt, afrodrigues@fc.ul.pt, tjvg@di.fc.ul.pt, hman. 2018. Hybrid-Brailler: Combining Physical and Gestural Interaction for Mobile Braille Input and Editing. The ACM CHI Conference on Human Factors in Computing Systems.

microwave interface for visually impaired users. Also, the visually impaired audience has unique requirements, that, if addressed, have the potential to benefit a wider audience. That is, more efficient interfaces for the visually impaired can lead to better interfaces for non-visually impaired users as well.

3.2 SteeringWheel: A Locality-Preserving Magnification Interface for Low Vision Web Browsing

The SteeringWheel Paper [5] presents a physical interface design to enable visually impaired users to more efficiently navigate digital media via web-browsers.

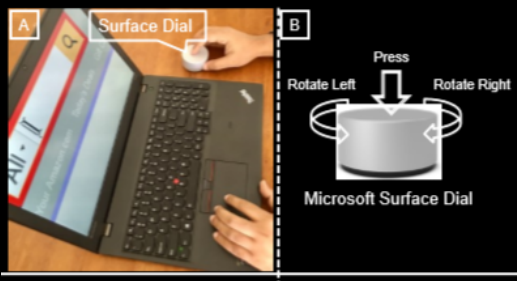

Figure 2. (A) A low vision user using SteeringWheel with Surface Dial. (B) The Surface Dial and its gestures.

Figure 3: Steering Wheel Interface

To navigate digital media, screen magnification is widely adopted by visually impaired users. These users typically have some vision, but not full-vision. Screen magnification causes loss of spatial locality and visual cues that commonly define semantic relationships in the data displayed on a web-page. Reconstructing semantic relationships from magnified views dramatically increases the cognitive burden on the users. This has the effect of reducing the usability of magnifiers.

SteeringWheel, a semantics-based locality-preserving magnification interface addresses the aforementioned limitations of current screen magnifiers. SteeringWheel incorporates knowledge about the semantics of different web UI elements and inter-element relationships, thus preserving spatial relationships between elements.

SteeringWheels magnification interface uniquely leverages a simple set of rotate and press gestures with audio-haptic feedback provided by a physical dial, an off-the-shelf Microsoft Surface Dial, see figure 3. By knowing the user and leveraging direct manipulation, the gulfs of execution and evaluation are reduced for visually

[5]Syed Masum Billah1 Vikas Ashok1 Donald E. Porter2 IV Ramakrishnan1 1Department of Computer Science, Stony Brook University, NY, USA sbillah, vganjiguntea, ram@cs.stonybrook.edu 2Department of Computer Science, University of North Carolina at Chapel Hill, NC, USA porter@cs.unc.edu. 2018. SteeringWheel: A Locality-Preserving Magnification Interface for Low Vision Web Browsing. The ACM CHI Conference on Human Factors in Computing Systems.

impaired users.

This paper was interesting because it proposed a physical interface and focused on direct manipulation to achieve a reduction in the gulfs of execution and evaluation. This is in line with one of my design concepts for a microwave interface.

Figure 4: Physical Interface Concept

4 HCI CONFERENCES

This section will discuss two papers from two major conferences related to Human Computer Interface research.

4.1 The ACM/IEEE International Conference on Human-Robot Interaction

The ACM/IEEE International Conference on Human-Robot Interaction [6] is a premiere, highly-selective venue presenting the latest advances in Human-Robot Interaction.

The Housewives or Technophiles Paper [7] discusses the importance of knowing your user. Empirical data detailing demographic and usage trends is gathered through a survey of 379 iRobot Roomba owners. The authors chose Roomba to gather user feedback into how householders respond to robotic products that replace blue-collar work in the home. This insight is beneficial for future development of home robotic products. Empirical understanding in domestic robots is particularly crucial because they are likely to be the first robots applied in everyday lives, and hence influence the shaping of publics perception of robotic systems.

This paper was an interesting study on how to design and analyze a survey. This

[6] ACM/IEEE International Conference on Human-Robot Interaction

[7] Ja-Young Sung1, Rebecca E. Grinter1, Henrik I. Christensen1, Lan Guo. 2008. Housewives or Technophiles?: Understanding Domestic Robot Owners. The ACM/IEEE International Conference on Human-Robot Interaction.

information is relevant for needfinding and requirements gathering with respect to my current project to design a better microwave interface for visually impaired users.

4.2 The ACM Symposium on User Interface Software and Technology (UIST)

The ACM Symposium on User Interface Software and Technology (UIST) [8] is the premier forum for innovations in human-computer interfaces.

The StateLens Paper [9] presents an interface that reduces cognitive effort and allows visually impaired user the freedom to explore the interface without causing system error. Visually impaired people frequently encounter inaccessible dynamic touchscreen interfaces that are difficult, frustrating that are often impossible to use independently. Touchscreens are inherently visual so a visually impaired person cannot read what they say or identify user interface components, A visually impaired person cannot touch the touchscreen to explore without the risk of accidentally triggering something they did not intend. StateLens reverse engineers state diagrams of existing interfaces to recognize user interaction with the interface. This three-part reverse engineering solution makes existing dynamic touchscreens more accessible for the visually impaired user. Recognizing user interaction allows the user to experiment, which has the effect of reducing the users gulfs of evaluation and execution respectively.

Figure 1. StateLens is a system that enables blind users to interact with touchscreen devices in the real world by *(i)* reverse engineering a structured model of the underlying interface, and *(ii)* using the model to provide interactive conversational and audio guidance to the user about how to use it. A set of 3D-printed accessories enable capacitive touchscreens to be used non-visually by preventing accidental touches on the interface.

Figure 5: State Lens

This paper was interesting because it proposed a novel approach to reduce the gulfs of execution and evaluation for visually impaired users. This is in line with one of my design concepts for a microwave interface.

[8] ACM Symposium on User Interface Software and Technology

[9] AnhongGuo,JunhanKong,MichaelRivera,FrankF.Xu,JeffreyP.Bigham. 2019. StateLens: A Reverse Engineering Solution for Making Existing Dynamic Touchscreens Accessible. The ACM Symposium on User Interface Software and Technology.