Undergraduate Thesis Prospectus

Human Computer Interaction: How Website Developers Improve User Experience

(technical research project in Computer Science)

The Struggle for Safe and Convenient Micromobility in Washington, DC.

(sociotechnical research project)

By

Jared Dutt

October 27, 2023

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Jared Dutt

Technical advisor:	Briana Morrison, Department of Computer Science
STS advisor:	Peter Norton, Department of Engineering and Society

General research problem

How do system designers and system users improve user experience?

Successful systems optimally integrate their human and technical components. A Forrester study estimates that moving from below average customer experience to above average would yield more than $3 billion additional annual revenue for wireless carriers, $1 billion for hotels, and $227 million for retailers (Ross 2014). Specifically, a study by Karampelas (2017) examined the usability of hotel websites by calculating the time and success rate of crucial tasks such as booking a room. Karampelas found that companies with low user ratings for completing tasks were significantly less likely to be reused and recommended to others. In summary, user experience improvements are likely to increase profits and ensure that resources invested are not wasted.

Human Computer Interaction: How Website Developers Improve User Experience

How may a website's designers improve user experience?

This research project is in the Computer Science department with capstone advisor Briana Morrison. It is a solo independent project attempting to uncover some of the most effective HCI techniques used by successful websites.

Poorly designed websites result in companies and organizations losing out on numerous business related opportunities. Users spend countless hours attempting to navigate confusing websites, building frustration and resentment towards those companies. A research study by authors Nah and Davis (2002) emphasizes the importance of Human Computer Interaction principles that further gain trust of the user, which is arguably critical for online business success. Instead of acting as a tool for companies to reach a larger audience and foster

accessibility, disorganized websites diminish user experience and reduce company credibility. In a study examining user interaction with different design components in emails, including a call to action element increased clicks by 371% and increased sales by 1,617% (Paun 2019). The correlation is strong — improving usability results in better user interaction. Modern web development should emphasize Human Computer Interaction principles and user testing should be integrated into development pipelines.

At the conclusion of this project, I will compile a set of core design principles and HCI techniques that are applicable to front end development teams. Incorporating these ideas into the design process will result in a better user experience for website users and in turn better serve them to accomplish their digital world goals. Thus, the next steps in the process would be to explore new ideas in the web design realm while improving the testing processes within HCI.

The Struggle for Safe and Convenient Micromobility in Washington, DC.

How do micromobility proponents in the D.C. area advocate for safer transportation conditions?

How does a minority transportation group achieve their goals in the face of backlash? In the greater Washington Metropolitan area, different transportation modes are forced to coexist while sharing common lanes or intersecting one another, of which the most popular are cars; sixty percent of commuters drive alone as their primary method of transportation (Berkon, 2020). Recently, micromobility has spiked in popularity. The share of people in Washington, D.C., biking to work almost doubled from 2010 to 2015 (Moore, 2017). Conflicts about bike lanes and other new micromobility accommodations are complex. To many drivers, streets are for motor vehicles, and therefore micromobility is a nuisance. As a minority transportation group, how do micromobility advocates advance their agendas for safer travel conditions?

Related Research

Similar research conducted in Canada by researchers Vijayakumar and Burda (2015) assesses the actions major cities are taking to improve cycling infrastructure and their effects on cycling culture. Their study in Vancouver found that early physically separated micromobility lane projects were met with significant opposition. This opposition was based upon the idea that by adding bike lanes and removing parking spaces or car lanes, businesses would suffer from reduced customers and car traffic would increase. When these beliefs did not materialize, future projects were widely supported and received much less opposition. Vijayakumar and Burda (2015) examined how opposition to these projects can transition to support, exemplifying how culture shifts when public opinion shifts. However, this study was conducted while rideshare systems were not as widespread, only existing in two of the examined cities. Rideshare systems have massively increased the number of micromobility vehicles on the road today. Their contribution has become an important factor into the transportation dynamics of D.C. and their impact requires further research.

While researching the effectiveness of new bike infrastructure in D.C., Goodno (2013) details the benefits from dedicated road space for micromobility users with buffers from motorist traffic. The evaluation of this infrastructure is highly relevant to all participants involved in transportation in the D.C. area as it directly relates to department of transportation projects and bike lanes for micromobility users. Author Monsere (2014) performed a very similar study evaluating new separated bike lanes in five cities and surveyed the residents to better understand the public opinion categorized by their mode of transportation. Lastly, research performed by Johnson (2010) dives into risk factors for on road commuter cyclists and provides insight into the factors micromobility users would want to eliminate for a safer commute.

Main Participants

Four main participants of this conflict are micromobility rideshare companies, micromobility users, motorists, and the state departments of transportation. Micromobility users, mostly bicyclists, want safer bike lanes coexisting with cars (Woolsey, 2023). The Washington Area Bicyclist Association (WABA, 2022) is an advocacy group built upon the idea that streets are for people and they push for "a just and sustainable transportation system where walking, biking, and transit are the best ways to get around". The rideshare companies, namely Lime, Lyft, Veo, and Spin, compete against one another for profit while pushing towards a world less dependent on cars (NACTO, 2019). Lime (2023), which has the largest presence in the D.C. area, aims to build a future where transportation is shared, affordable and carbon-free. The rideshare companies have a close relationship to the micromobility users as many of them depend on the rideshare vehicles to commute. Sharing similar ideas about streets serving micromobility users, the WABA (2022) is partnered with both Lime and Lyft and all value sustainable transportation.

In contrast, motorists (a large participant group) want to reduce car traffic congestion and push to remove micromobility infrastructure when they feel it interferes with their daily commutes (Wagner, 2022). Residents and commuters on Old Georgetown road in Maryland have created a petition to remove newly added physically separated bike lanes. The petition has over nine thousand signatures and states, "reduced by 39% in driving capacity, the road now is constantly congested, with back-to-back traffic even in the middle of the day in good weather" (Martin, 2022). Motorists' reject micromobility infrastructure that interferes with car traffic based on the idea that streets are for cars, therefore they should be prioritized. A separate group that exists alongside the motorists are car manufacturers. The trade association, Autos Drive

America (ADA), represents this participant group by combining twelve international automakers with large presences in America (Andrews, 2023). Operating as for-profit car manufacturing companies, their material interests are at the core of their goals. On ADA's (2022) website, they promote their agenda through values such as American workforce development and positive community impact. Their interests lead to opposition in micromobility projects that remove current car infrastructure which includes the majority of projects in the D.C. area.

Another group that has opposed new infrastructure are the business owners, residents, and real estate developers located on streets with new proposed projects. In downtown D.C. on K street, a new project was set to add physically protected bike lanes while removing two car lanes (Banister, 2023). More than 120 business owners and 2,700 residents in the corridor signed petitions organized by the group Save Connecticut Avenue, which protested the installment of the bike lanes. Save Connecticut Avenue is an organization founded directly on preventing the proposed bike lanes due to fear of lost business from the lack of parking and greatly increased car traffic (Dougherty, 2023). As they state on their website, their core idea is that "if you cannot park, you will not shop" (Dougherty, 2023). As business owners, their material interests are their priority and combined with their ideas that parking is required for good business, they highly value the current car infrastructure of lanes and large quantities of street parking spaces.

Lastly, the state departments of transportation plans infrastructure projects and pursues transport policies that have political support (Mirza, 2023). In particular, when the D.C. Department of Transportation (DDOT) organized their project to overhaul K Street, they included plans to construct bike lanes and restrict car lanes. Upon heavy opposition, they settled to remove the bike lanes late in the development process (Banister, 2023). Along with political support, financial considerations are also taken into account. For D.C., the decision to change

plans was also based on the idea that less parking results in less business and less office space used, both of which equate to less tax revenue for the city (Banister).

References

Andrews, K. (2023, January 10). VW America CEO named Autos Drive America Chair. *Virginia Business*. www.virginiabusiness.com/article/vw-america-ceo-named-autos-drive-america-chair

ADA (2022). Autos Drive America. Advocating For a Healthy and Growing Auto Industry www.autosdriveamerica.org

Banister, J. (2023, April 18). Real estate's road rage over New Bike Lanes has D.C. officials "scrambling." *Bisnow*. www.bisnow.com/washington-dc/news/economic-development/anxious-dc-real-estate-execs-launch-fight-against-bike-lanes-and-city-officials-respond-118547

Berkon, E. (2020, Jan. 24). D.C. has some of the longest commutes in the country. *NPR*. www.npr.org/local/305/2020/01/24/799292338/d-c-has-some-of-the-longest-commutes-in-the-country-what-help-is-available

Dougherty, P. C. (2023, September 18). Want to save downtown? Stop the Connecticut Avenue Bike Plan. Save Connecticut Avenue. saveconnecticutave.org/f/want-to-save-downtown-stop-the-conn-ave-bike-plan

Goodno, McNeil, Parks, and Dock (2013). Evaluation of Innovative Bicycle Facilities in Washington, D.C.: Pennsylvania Avenue Median Lanes and 15th Street Cycle Track. *Transportation Research Record*, 2387(1), 139-148. doi.org/10.3141/2387-16

Johnson, M., Charlton, J., Oxley, J., and Newstead, S. (2010). Naturalistic cycling study: identifying risk factors for on-road commuter cyclists. *Annals of advances in automotive medicine. Association for the Advancement of Automotive Medicine. Annual Scientific Conference, 54*, 275–283.

Karampelas, Y. (2017, Nov. 13). Hotels Usability Study - Desktop. Userfeel.com. www.userfeel.com/blog/hotels-usability-study-desktop-november-2017

Lime (2023). About Lime Micromobility. https://www.li.me/about

Martin, M. (2022, December 26). Remove the catastrophically dangerous bike lanes on Old Georgetown Road in Bethesda, MD. Change.org. www.change.org/p/remove-the-catastrophically-dangerous-bike-lanes-on-old-georgetown-road-in-bethesda-md

Mirza, Z. (2023, May 11). In design: Vienna Metro Station Bicycle and Pedestrian Improvements in Fairfax County. Virginia Department of Transportation. www.virginiadot.org/projects/northern-virginia/vienna-metro-bikeped.asp

Monsere, Dill, McNeil, Clifton, Foster, Goddard, Berkow, Gilpin, Voros, Hengel, and Parks (2014, June). Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S. NITC-RR-583. Portland, OR: Transportation Research and Education Center. dx.doi.org/10.15760/trec.115

Moore, J. (2017, May 18). Surprising stats: How many people bike to work around DC and more. *WTOP News*. wtop.com/local/2017/05/many-people-really-bike-work-around-dc-surprising-stats

NACTO. (2019, Dec. 31). National Association of City Transportation Officials. Shared micromobility in the U.S.: 2019. nacto.org/shared-micromobility-2019

Nah, F., and Davis, S. (2002). HCI research issues in e-commerce. *Journal of Electronic Commerce Research, 3(3)*, 98-113.

Paun, G. (2019, Feb. 28). A useful experience: Why usability is essential to UX design. *Forbes*. www.forbes.com/sites/forbesagencycouncil/2019/02/28/a-useful-experience-why-usability-is-essential-to-ux-design/?sh=296d1d614363

Ross, J. (2014, Jan.). The Business Value of User Experience. Infragistics. download.infragistics.com/marketing/whitepaper/UX/Business_Value_of_UX.pdf

Vijayakumar, N., & Burda, C. (2015). Cycle Cities: Supporting cycling in Canadian cities. Pembina Institute. JSTOR Database.

WABA (2023, March 27). Washington Area Bicyclist Association. About the Washington Area Bicyclist Association. waba.org/about

Wagner, P. (2022, Dec. 29). Drivers furious with New Bike Lanes on Old Georgetown road. *NBC4 Washington*. www.nbcwashington.com/news/local/drivers-furious-with-new-bike-lanes-on-old-georgetown-road/3243649

Woolsey, A. (2023, Feb. 28). Bicycling advocates skeptical of lanes proposed on Merrifield's Ellenwood Drive. *FFXnow*. www.ffxnow.com/2023/02/28/fabb-skeptical-of-proposed-ellenwood-drive-bicycle-lanes-in-merrifield