Human Factors Portfolio

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I am a human-centric designer for technology, landscapes, and lifestyles. Safety, efficiency, and enjoyment are the primary goals of my work. This document contains descriptions and links to selected projects from my work and school history. Selecting a project will take you to its description.

Course Related Projects

Tesla Human Factors Analysis - Engineering Psychology

In 2017 I gained access to a Tesla Model X with advanced Autopilot features. Applying engineering psychology, I assessed the vehicle from a human factors perspective. I utilized a front-end analysis for user-centric design and addressed the displays and the controls for the vehicle.

My analysis addressed the physical design of the vehicle, including the dimensions of mirrors and windows, and the physical controls for the vehicle, such as the steering wheel, autopilot stalk, and brake/go pedals. I used my knowledge of ergonomics to assess and make suggestions for future iterations of the vehicle's controls. After delving deep into the menus and subsystems that affect the driving experience, I identified potential hazards for drivers originating from those designs, and I proposed solutions to the graphical user interface and alerting systems that would mitigate some of the risks.

Because the Tesla operating system is fluid and can be updated remotely, the original report is outdated, but I have kept it in the portfolio as an example of my work. In particular, the Autopilot has evolved, and I have expanded the report to address some of the new issues and highlighted the solutions that Tesla implemented that mirrored my initial suggestions from the first report.

I have now been admitted to Tesla's Early Access Program (EAP), which enables drivers to test features that are pre-beta and not yet released to the public. I continue to interact extensively with the new technology and capabilities pushed to my vehicle and provide feedback and suggestions to the Tesla software design team. I cannot add these observations, troubleshooting experiences, and suggestions to my portfolio because of a confidentiality agreement with Tesla. I can, however, report that my involvement with the EAP is ongoing, and the experiences I gain corresponding with the designers and programmers is building my experience with user-testing and actionable feedback for designers. As I continue to test the capability of the systems and make suggestions for how Tesla could improve its users' mental models and therefore safety.

Logistics Facility Displays and Controls - Advanced Human Factors

I evaluated the design and use of technology employed by a logistics company to track and route packages within a facility. I addressed the physical layout and tasks of the primary nodes: functional areas and their associated displays and controls. I examined each component within the framework of a parcel flowing through the facility and the workers using the technology available to them to ensure accuracy and accountability for each package. I used a descriptive functional flow analysis for its comprehensibility to the facility leadership and its ability to pinpoint issues and highlight solutions.

To learn the system in full, I initially applied for a job and was hired as an hourly worker. I took notes, observed workers, and conducted interviews. I learned the metrics used to assess worker and facility performance and focused my attention on the bottlenecks. After two weeks, I went into my manager's office with a list of preliminary recommendations and safety concerns. I explained the discipline of human factors, my motivations for taking the job, and my side goals while working the regular job. He promoted me to supervisor on the spot, and I gained access to more information and parts of the facility, which widened the scope of the project.

My final product improved the situational awareness of the workers and the management, especially concerning the safety of workers and the efficiency of the overall facility and work stations. I incorporated ergonomic, biomechanical, and cognitive elements to make my recommendations and showed mock-ups of improved

displays and work areas. I wrote the report to be understood by the full range of personnel, from introductory level workers up to warehouse managers.

The period of time during which I worked at the facility was known as “peak season” because of the high volume of packages being shipped around fall and winter holidays, so there was not enough time to work on implementing the changes I recommended, but I have maintained a relationship with my former boss and I check in with him periodically to see if he has made any changes based on my recommendations, and what the effects have been. In the future, he may introduce me to the facility engineers and I might be able to more effectively analyze outcomes, or at least get feedback on my ideas from the engineers.

Robot Vacuum Redesign - Human Computer Interaction

Robot vacuums are part of the first wave of physical smart home technology. The internet of things (IoT) is already presenting designers with challenges for effective interfaces, and no company has yet set the standard. Human Factors considerations will factor heavily in this evolving field as both traditional technology companies and startups vie for dominance, and those products that provide the best overall user experience will earn the lion's share of what is already a billion-dollar market.

This piece of the portfolio demonstrates a basic competence in human-computer interaction. The assignment called for a redesign of a few specific aspects of an existing product, but this report goes beyond the scope of the class project to recommend solutions to problems that transcend vacuums by addressing some of the wider goals for robot home assistants.

My intent in the report was to build on current designs to create a robot vacuum that impresses users from the start and accommodates the widest range of users possible throughout its life cycle. First, I built storyboards to imagine each phase of stakeholder interaction with the device. I began the user analysis with interviews of existing customers, capturing reactions to and beliefs about current technology. I found common themes and used online customer reviews to collect data on a broader audience, quantifying and tracking the frequency of comments pertaining to certain design aspects. This allowed me to focus my efforts on the most pertinent aspects of the user experience and establish redesign requirements. I prioritized the elements to redesign based on the frequency of use and magnitude of impact on user experience

and began creating paper prototypes of the controls. I showed potential users the options and walked them through different scenarios, collecting data on well-received layouts and symbology. Using my observations, I created a final design and script that I presented to more potential users and asked them to rate the hypothetical product along multiple dimensions, which will lead to additional iterations and testing..

Final takeaways highlight good design elements and future possibilities for an entire ecosystem of home assistants. I believe that the information I in the report could benefit both existing robot vacuum companies and any companies or designers trying to break into the robotic home assistance market.

Work Related Projects

Human-Centric Homestead Design

While many human factors professionals work in technology or research fields, applying the same human factors techniques to less modern domains remains a worthwhile pursuit. Climate change, water shortages, and limited access to natural resources have highlighted the need for efficient housing, sustainable living arrangements, and even new forms of communities. Good design can help provide all of these, and possibly more. A community-based homestead is a good candidate for a human-centric design. People are at the center of communities, and synomorphy theory suggests that spaces in which humans exist influence their behavior. For this element of my portfolio, I worked with a unique community to combine human factors and ecological design to improve efficiency, group dynamics, and quality of life. The people there are pursuing a conscious way of life by living with the land. I used a participatory design process, working closely with the residents to refine and implement the changes that we agreed would be effective. I presented my ideas via correspondence and in person, guiding the implementation of some of the ideas we generated together. I also created a presentation that can be used and updated, to explain the solutions and rationale to new members or those who have come to learn from a functioning eco-community.

The ultimate products from the project were informed by user research, task analysis based on daily routines, and the ability of solutions to fit the ethos of the community. We identified important spaces and mapped functions and activities onto

them to establish patterns. We established the goals to minimize human effort while maximizing yield from the yard and best using the resources available. We defined yield as food grown in the garden and harvested from animals, energetic savings, and happiness. One outcome from the project, for example, included the decision to keep chickens for eggs and potentially meat. Incorporating chickens was a multi-step design decision. First, we weighed the costs and benefits of keeping the fowl. We stepped through the requirements of the chickens - shelter, protection from predators, feed, and water. We also looked at the human activities required to take care of and harvest the chickens. We took stock of available materials to minimize cost, which helped us narrow the build-out options. Based on the available information, we collaborated on a design for a coop that would fit the patterns of use, constraints of the space, and accommodate both human and chicken ergonomic needs.

To test other aspects of the design, I created a 3D layout of the living space that allowed us to visualize the effects of with moving fixtures, changing room layouts, and even knocking down walls without starting a major project only to find it did not achieve the desired effect on the overall space. We used Google Earth and drone surveys to gather additional information about the property for design purposes. The community now has a multi-layered map that will be used to plan future gardens, construction projects, and even photovoltaic systems based on the trajectory of the sun at various times of the year.

My continuing efforts with the community have led to a shared understanding (mental model) for future solutions based on human factors design heuristics and a

living document for reference and knowledge accumulation. It will be interesting to see the long term evolution of the community.

“My Doctor Ben” Website Consultation

For this project, I established a relationship with a holistic medical doctor, Dr. Ben Kaplan-Singer, who was interested in optimizing his website to improve customer interaction and thereby increase his conversion rate. I worked with him and a front/back-end web designer as a human factors consultant, using design heuristics, human-computer interaction principles, and psychology to redesign the website’s user experience.

Dr. Benjamin Kaplan-Singer’s business is focused on providing care through lifestyle restructuring, incorporating diet, wellness practices, and utilizing appropriate supplements and medications. Potential clients find him through mutual connections, his website, and, possibly, advertising. While look and feel were at the top of his list, I actually began by learning about the stakeholders within the overall process - Dr. Kaplan-Singer, his staff, potential clients, etc. After some active listening and increasingly open dialogue, we had a plan to move ahead, with a special eye to the overall user experience.

Dr. Kaplan-Singer and I worked to refine his website’s requirements and even considered alternative sources for his online presence. Then, we worked backward from the client’s first meeting with Dr. Ben. We constructed storyboards, and I began to find ways to streamline the process. Each stage of the interaction mattered differently: landing on the home page, reading about the services, navigating the pages to learn more about Dr. Ben’s business, and understanding the new-patient process. We

developed strategies to reduce the number of clicks and allow users to access the booking page more quickly. During the process, I continued to improve my understanding of his potential clientele, even creating and discussing client personas. It was interesting to teach some human factors concepts along the way when Dr. Ben had questions about the “root causes” of my thinking.

The project continues, I remain in contact with Dr. Ben, and we are redesigning a potentially overhauled website that will support upcoming developments in his business.

Targeted Analysis Projects

OSHA Farming Website Analysis

My intent in this report was to provide constructive criticism of a current tool used for accident prevention in farming, the Occupational Safety and Health Administration (OSHA) website. I created the analysis for an advanced safety class as a final report to also demonstrate my understanding of safety tools and their improvement. It is also an example of services I could provide to organizations seeking to improve their web presence, especially for certain groups of users. To create a truly human-centric design to reach the desired audience, I took special care to analyze the functionality of the OSHA website from a farmer or farmworker's point of view. It identifies requirements and stakeholders to guide the analysis, and on this foundation provides analysis of tools and materials available to the intended users.

This report shines light on what is one of the most dangerous professions in the United States, but one that receives little attention from safety professionals. Farmers and farm workers may be the most in need of guidance as they perform their tasks in rural locations where they often cannot receive rapid treatment. Professional human factors and safety professionals need to be able to identify areas outside the traditional areas of their work to find niches where they might be able to truly help people who need it the most, perhaps pro-bono, or by creating nonprofits. Taking a holistic approach to human activities across the board can help make the world a better place, no matter if the work is lucrative or not.

The information contained in this report could help farmers and farmworkers do their jobs and run operations more safely by ensuring the OSHA website is appropriately designed to provide adequate support and guidance.