

Individual Reflections

ENGR110/210

Perspectives in Assistive Technology

Winter 2023

This document consists of thirty-four Individual Reflections from students who worked on assistive technology projects in the course. Two of them worked on one credit unit individual projects, while the rest pursued three credit unit team projects consisting of three or four students.

The names of the students, their team names, their project names, the names of the project partners (also known as community partners, project suggestors, or users), and the names of service animals have been redacted to protect their identities and maintain their privacy.

Any questions about these Individual Reflections, the projects, or the course can be directed to me.

The course website can be found at <http://engr210.sdsu.edu>

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ENGR 110: Perspectives in Assistive Technology

19 March 2023

Individual Reflection

I would like to begin by describing where I am in my academic journey at Stanford. I am an STS major pursuing a Bachelor of Arts. While I have learned a great deal in the classes I have taken for that major, I felt like I had not gained any advance, tangible skills and experiences that could truly help me beyond college. I took this class especially excited to build something tangible and see my work directly affect someone in a positive way. I did not realize how much work that took and how impactful it could be before taking this class. I also did not realize how extremely fulfilling it is as well.

With that being said, I have no background in or knowledge of mechanical engineering or product design, but I loved arts and crafts growing up, so I came into this class ready to use my hands and learn along the way. From the beginning, I was very proactive in my approach to ██████████ and ██████████ situation. I had several ideas and began working on them immediately. Reflecting back on those ideas, I realize how important it is to start early but also that your first idea may not be your best idea. We completely scrapped that first idea, and while it was almost upsetting to see an idea you were very excited about be unsuccessful, learning from that process and continuing to work to find the right solution felt very good.

As we moved on to other ideas, I gained a lot of new skills. I learned how to use an electric wood saw and an electric drill in the PRL. I learned which adhesive glues worked best for different materials. I learned how to use Adobe Illustrator and the vinyl cutter. We also learned how to use heat transfer vinyl. An interesting thing I learned was that it is difficult to find exactly what you are looking for on the internet if you do not know the technical name. But most importantly, I learned how important the prototyping phases are because you run into problems you didn't think of before. You think something is going to work great, and then something unexpected happens, and you have to start sketching a new design. If I were to do anything differently, I would have kept better notes of my progress with more measurements. I would have also asked for more help from people who have experience with 3D printing and engineering earlier. ██████████ was so helpful in designing and printing a model of our design, but it was too late to pursue it further. If I had known he was willing to help, I think I would have asked earlier.

I also learned a bit about teamwork. Another team member and I took on the majority of the work and felt it was unfair. It was not due to a lack of communication, but I also did not feel I was required to take on a team captain's role and assign work to the others. I wanted it to be collaborative, but truthfully the project was not worked on without the two of us initiating meetings.

Having the opportunity to work with [REDACTED] was a highlight of this project by far. They were so kind, welcoming, and willing to work with us any time and any day. They tried all of our prototypes and gave honest and helpful feedback. We spent some time chatting, eating, testing, and spending quality time on work. I did not expect to work so closely with [REDACTED], as I haven't been in any classes before, but it came as a welcomed surprise. I am very grateful for their friendship and kindness and look forward to staying in contact with them in the future.

Something specific about this class as a whole that opened my eyes was the immense opportunity to make a difference. On the last day of class, someone said something along the lines of "every technology started out as assistive technology." For example, Siri began as assistive technology but is now widely used. The people from the Cerebral Palsy Organization also explained how our product had the potential to be used for children or others without cerebral palsy. The encouraging remarks on our prototype make me excited that others might need and want this, and our work can have a greater impact on people.

If I were to give advice to a future student, it would be to start early and be proactive. I would also advise them to ask for help when needed. I only learned to use the PRL machines by asking the CAs and other students. Lastly, I would say be open to all ideas and don't be afraid to pivot on those ideas.

In regards to lectures, meeting all of the people living with a disability or working in the field of assistive technology was very interesting. However, I think one of the more interesting ones was hearing from peers at Stanford because we can relate in specific ways and experiences. I also really loved seeing some of the products firsthand and having conversations about the process they went through. It was surprising to see the similarities between their beginning stages and ours.

In closing, I have spent my free time this quarter redesigning my degree in every which way to take more classes that can help me gain the skills required to pursue something substantial, like this class. So, I've decided to begin a minor in mechanical design next quarter. I would like to express my gratitude for the opportunity to work on such an impactful project that helped me gain some insight into myself.

March 19th, 2023

ENGR 110: Perspectives in Assistive Technology

Individual Reflection

As I reflect on my experience in ENGR110: Perspectives in Assistive Technology, I realize that the different parts of the process have been valuable in their own ways. Throughout the course, I had the opportunity to hear from various professionals and users, each with their unique experiences, stories, and insights. These speakers helped me understand the challenges and needs of the community better, and how to focus my design on their specific needs.

One of the most memorable speakers was Gayle Curtis. In his presentation on "Creating Assistive Technologies - Understanding the Problem," Gayle Curtis, a UX Design Consultant, emphasized the importance of building empathy with the user and situation in order to gain a better understanding of the problem. According to Curtis, effective innovation is driven by two complementary themes: new technologies or methods that open the way to new solutions, and new insights or experiences that yield a better understanding of the problem.

Using a design thinking approach, Curtis highlighted the importance of ideation, prototyping, and iteration to explore, formulate, and test solutions. He discussed ways to gain an understanding of user needs, goals, and values around a problem, as well as the constraints and requirements of the situations around them.

Another key learning from Curtis's presentation was the value of iteration in the design process. He stressed the importance of testing prototypes and soliciting feedback from users in order to identify areas for improvement. This resonated with me because I have often struggled with the feeling that my designs need to be perfect right from the start. Curtis's approach of embracing iteration and using feedback to drive improvements is a valuable mindset shift for any designer.

Curtis's passion and enthusiasm for design thinking and assistive technologies made him a memorable speaker. He clearly cares deeply about using design to improve people's lives, and his enthusiasm was infectious. Attendees left his presentation feeling energized and excited to apply the lessons they had learned to their own design projects.

Curtis's presentation emphasized the importance of gaining a deep understanding of user needs, goals, and values around a problem, as well as the constraints and requirements of the situations around them. He highlighted the value of empathy, ideation, prototyping, and iteration to explore, formulate, and test solutions. Attendees learned the value of testing prototypes and soliciting feedback from users to drive improvements in the design process. His story was powerful and helped me understand the human impact of assistive technology. It made me realize the importance of considering the end-user in every aspect of the design process.

Another memorable talk was Dr. Miele, an accessibility researcher at Amazon Lab126. His talk, titled "From DIY to Disability Dongles: Spanning Accessibility Space from Indispensable to Irrelevant," was a powerful reminder of the importance of accessibility in design.

Dr. Miele shared real-world examples and counterexamples to illustrate the do's and don'ts of the accessibility design process. It was evident from his presentation that he is truly passionate about creating effective and affordable solutions to everyday problems faced by the blind community, particularly access to digital information. I was impressed by his contributions to projects such as Braille compatibility with Fire tablets and a "Show and Tell" feature on camera-enabled Echo devices that can identify pantry and food items.

As someone who works in design, Dr. Miele's presentation resonated with me deeply. He highlighted the importance of not just considering accessibility as an afterthought but incorporating it into the design process from the very beginning. He emphasized the importance of understanding the needs, goals, and values of the end-users and their situations, and using empathy to drive innovation.

Dr. Miele's presentation also touched on the value of iteration, prototyping, and soliciting feedback from users to continually improve the design process. His talk was a powerful reminder that accessibility is not just a checkbox to be ticked off, but an integral part of creating solutions that truly make a difference in people's lives.

Overall, Dr. Miele's presentation left me feeling inspired and motivated to incorporate accessibility into my own design work. His passion and commitment to creating meaningful solutions for the blind community were truly admirable, and I am grateful for the opportunity to have heard him speak.

Working on a project for [REDACTED] was an incredibly rewarding experience for me and my team. We were tasked with designing a device that would help him align his phone on his wireless charger, as he had difficulty placing it accurately due to his condition.

We started by brainstorming different ideas for the tool, considering [REDACTED] specific needs and limitations due to cerebral palsy. The ideation process was challenging but exciting, as we brainstormed various ideas and sketched out rough designs. We eventually settled on a design that utilized a series of slanted walls to guide Danny's phone into the correct position.

From there, we began prototyping with foam core and hot glue guns, testing out different designs and refining our ideas. Once we had a design that seemed promising, we brought it to [REDACTED] for user testing. It was an incredible feeling to see the joy on his face when he was able to align his phone on the charger easily for the first time. However, it was not a perfect prototype. Some walls were too high, and the color was not right. Seeing the device in action and hearing [REDACTED] feedback was incredibly valuable, and we were able to make several improvements based on his input.

Based on [REDACTED] feedback and our own observations, we continued to refine the design, eventually using 3D printing to create a more polished and functional prototype. Throughout the process, we encountered

engineering challenges and constraints, but we were able to overcome these challenges through creative problem-solving and collaboration. For example, to help [REDACTED] identify where the black wireless charger was on the dark table we were testing, we placed the whole set-up on a neon pink post-it note. This small change was night and day for [REDACTED]. Similarly, when testing, we realized that some of our parts were poorly constrained and moved around a lot during testing. Instead of stopping the testing session to fix those issues, and therefore not testing what we actually wanted to test, we hot glued everything to a piece of paper as a makeshift solution so we could test the actual functionality of the slanted walls and dimensioning of the aligner. Of course, the constraining would have to be addressed, but these kinds of quick fixes allowed us to maximize our testing sessions with [REDACTED].

After several stages of refinement and testing, we had a working prototype. We used 3D printing to create a more durable and polished final product. While the process was not without its limitations and challenges, such as the need for frequent testing and the limitations of our prototyping materials, it was incredibly rewarding to see the final product in [REDACTED] hands.

Through this experience, we learned the importance of user-centered design and the value of iteration and prototyping in the design process. We also gained a greater understanding of the unique challenges and needs of people with disabilities, and the importance of designing tools and technologies that can truly make a difference in their lives.

The team dynamics were also extremely rewarding, as we collaborated closely and utilized each other's strengths to create a successful end product. It was inspiring to see the team's passion and dedication to the project, and I feel fortunate to have been a part of such a meaningful design experience. Our team also consisted of people from various backgrounds, including some who didn't have a mechanical engineering background like myself. It was fascinating to see how everyone's unique perspectives contributed to the ideation process, and it made me realize the value of having diverse perspectives in the design process.

Overall, working on this project was an enriching experience that taught me the value of collaboration and diversity in the design process. It was incredible to see how the product we designed had a meaningful impact on [REDACTED] life, and I feel grateful to have been a part of that process. I came out of this project as a better designer, having learned invaluable lessons about empathy, iteration, and user-centered design.

To answer some of the questions you provided us for reflective purpose, at the beginning of the term, I was hoping to gain a better understanding of how to design for people with disabilities, and I was also interested in exploring the role of technology in creating more accessible products. I was somewhat apprehensive about how difficult it might be to design for others and how well I would be able to understand their needs and requirements.

However, throughout the course, I found that my expectations were more than met. The class provided a comprehensive overview of disability and assistive technology and taught me valuable design methodologies for

creating accessible products. Through various projects and assignments, I was able to apply these principles and gain experience in designing for people with disabilities.

The project we worked on for [REDACTED] was a highlight of the course. It was extremely rewarding to see how our product helped [REDACTED] charge his phone more consistently, and the process of ideation, prototyping, testing, and refinement was a great learning experience.

The course exceeded my expectations and helped me become a more empathetic and capable designer. I feel more confident in my ability to design for people with disabilities and am excited to continue learning and applying these principles in my future design work.

Regarding team dynamics, Throughout the process, we were driven by the desire to create a solution that would genuinely benefit [REDACTED], and this motivated us to go the extra mile in terms of research, ideation, and testing. It was a great feeling when we finally saw [REDACTED] using the tool we had created and how much he appreciated it.

The process of designing for someone with a disability was new and challenging, and at times, uncomfortable. We were acutely aware of the potential impact of our design on [REDACTED] life, and this heightened our responsibility to create something that was truly helpful for him. At times, we felt unsure about whether we were making the right design decisions or not. However, we kept pushing ourselves to consult with [REDACTED] and his caregivers, do our research and testing, and refine the design until we felt confident that we had created something that was truly beneficial for him.

One thing that we did particularly well, is that we always supported one another. There were no bad ideas. There were no fights. There was no team hierarchy. We approached the problem as 4 equals looking to improve [REDACTED] life. This kind of comradery and open-mindedness meant that our team came up with lots of ideas, created a safe environment to learn and ask questions, and ultimately led to a very successful design for [REDACTED]!

Regarding, what came naturally to me vs. what was hard, I would say that as a mechanical engineering student with extensive fabrication experience, the 3D printing and physical prototyping aspects of the project came naturally to me. I was able to quickly design and iterate on the phone aligner using software and tools that I was familiar with, and I felt confident in my ability to create a functional and aesthetically pleasing final product.

However, I did feel a bit uncomfortable when it came to working with [REDACTED] and understanding his needs and limitations. It was important to approach the project with empathy and open-mindedness, and I had to work hard to put myself in [REDACTED] shoes and truly understand his challenges and frustrations. This required active listening, thoughtful questioning, and a willingness to step outside of my own experience and perspective.

Overall, I think the combination of my technical skills and my team's diverse backgrounds and perspectives allowed us to create a successful project that met [REDACTED] needs and made a positive difference in his life.

To wrap up this reflection, I want to reflect on how this course will help me in the future. I believe this course has prepared me for my professional career in several ways. Firstly, it taught me how to design for people with disabilities and how to create products that meet their needs. This is a valuable skill that is highly sought after in many industries, including healthcare, assistive technology, and consumer product design.

Additionally, the course helped me develop my teamwork and communication skills, which are essential in any professional setting. Working on a project with a diverse group of individuals, each with their own skillset and background, allowed me to learn how to effectively collaborate and communicate with others to achieve a common goal.

I think this course has a direct relationship with my career plans. As a mechanical engineering student, I hope to work in the field of product design, and this course has provided me with practical experience and skills that will be beneficial in my future career. Specifically, I am interested in working on projects that have a positive impact on people's lives, and this course has helped me develop a deeper understanding of how to design for people with disabilities.

In addition to this, if I am being more daring with my future, the skills I gained in designing for people with disabilities, user testing, and working effectively in a team, this course has helped me develop essential skills for my future career as a startup founder. As someone with aspirations to launch my own company, I recognize the importance of listening to feedback, putting myself in the user's shoes, and being able to work collaboratively with others to achieve a common goal. The skills I learned in this course are directly applicable to my career goals and will be invaluable in helping me bring my vision to life. Overall, I believe this course has given me the foundation I need to excel in my professional life and has helped me gain a deeper appreciation for designing products that can positively impact people's lives.

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05/20/2023

ENGR 110

Individual Reflection: ██████████

Taking ENGR 110 has been one of the best decisions I have made while at Stanford. It has been a particularly rewarding experience to learn about assistive technologies from the engineers who have developed it, as well as directly from the people that have benefited from it. The guest lecturers in the class have been truly phenomenal and the knowledge I picked up from these presentations have had a significant impact on my team's approach to our prototype. One of the biggest takeaways I have from this class was the importance of getting to know the person who your assistive technology is intended to benefit. It has been super fun to get to know Danny as well as Stanford. Not only was it awesome to become friends with both of them and through my conversations with ██████████ I learned more about his daily activities. Knowing things beyond just his challenges charging his phone such as what his daily life looked like, what his hobbies and interests are, was one of the most critical aspects of the design process.

For example, during one of my conversations with ██████████ he shared with me that it was imperative that we use bright colors for our prototype for two reasons: 1) His visual impairment makes it harder for him to see things that are not bright colors and 2) Bright colors are just *way cooler*. Learning this was a very important part of our design criteria. ██████████ shared this with us during our third meeting with him. Had we not spent the time to get to know him and include him in the design process on a regular basis, we could have missed this simple fix to help alleviate one of the challenges he has charging his phone. The importance of understanding the nuances and details of the lives of the people benefitting from one's assistive technology was something that was underscored in almost every lecture this quarter. Becoming friends with ██████████ allowed us to create technology that will help him and without that element we would not have been able to come up with this same prototype!

I really enjoyed working with my team on this project. We all had such a unique set of backgrounds, skills and interests that I think really meshed well together on our project. It was a joy brainstorming with ██████████, ██████████, Dave and the rest of my team on coming up with possible solutions. I felt like everyone was a really good team player and was supportive in helping each other throughout the entire project. I think one of our biggest strengths as a team was our level of organization and ability to delegate tasks equally!

██████████ visual and physical limitations, including his hand and finger dexterity, have made it difficult for him to charge his iPhone using a wireless charger without the assistance of his older siblings. After doing extensive background research and meeting with ██████████ we were able to create a set of design criteria for our prototype. We knew we needed to create something that worked as a frame to align his phone into the correct spot. We each did our own sketches and shared them with our group. After this we used foam core to be able to fabricate our initial prototypes because it is cheap and easy. This left us with two different prototypes: an angled version and a flat version. After

testing both prototypes with [REDACTED] we decided to move forward with the flat iPhone frame because it hit all of our design criteria and [REDACTED] preferred it.

Our next step was 3D printed prototyping. We utilized the CAD software called Fusion360 which is free for all Stanford students. We made sure that the phone frame was dimensioned to match [REDACTED] iPhone model, the 11 Pro Max and we incorporated lower walls while still maintaining an "open-access design." For our material we decided to use thermoplastic PLA (polylactic acid) because it can withstand a good amount of deflection before breaking and is great for indoor applications.

Once the black PLA 3D printed version was ready, we tested this prototype with [REDACTED]. We recognized that there may be some learning curve (as there is often with any new technology) and made sure to set aside some time to demonstrate to [REDACTED] how to properly use this technology. After a short demonstration, [REDACTED] was able to use the wireless charger successfully! This was very exciting news for all of us! We discovered that [REDACTED] wanted the option to have his phone case on when placing it on the wireless charge as well. The prototype tested was sized to fit his phone without the case, so we took note and edited the dimensions to accommodate his phone case! Moreover, the final phone frame was printed in a bright lime green color to ensure that [REDACTED] could have an easier time seeing and finding the charger. Vinyl stickers were added to the walls for a higher cool factor, and it was personalized for Danny.

Overall, our team was really happy with the outcome of this project. Our goal was to be able to fabricate an assistive technology that would help [REDACTED] charge his iPhone easier and gain some independence! I had a blast working on the project and getting to know Danny and Stanford. I think many of the different lecturers who came in to speak with us had a big impact on our design process. The Film Screening lecture had a really big impact on me. One of the things that was discussed was how things that were initially created for disabilities actually often benefit everyone. This was something that I kept in mind when thinking through making changes to our final prototype. This played a role in our decision to make two prototypes in different sizes. our final prototype. By doing this, more people could benefit from our technology regardless of the size of their phone. t If I were to go through this process again one of the biggest things I would do is take the time to reflect and write a small summary of things I learned from lectures. There were so many great things that I picked up on from this class, but I also feel like there were also some tidbits I picked up on in class that I wanted to remember and may have forgotten. I really appreciated Dave's feedback and collaboration throughout our project. Although we take this class for a grade, it felt less like the focus was on learning and working together to find a solution to a problem.

The touching mission of *Perspectives in Assistive Technology* is what originally drew me to take the class. Throughout the quarter, I found myself consistently motivated to work, because I felt that my work was being done for a good cause. On a more personal level, engineering solutions for people with disabilities resonates with me, because I once struggled with a sensory disorder as a toddler. When I was a toddler, I struggled with a condition that impaired my ability to fully experience life's opportunities. Due to trauma at childbirth, I developed Sensory Processing Disorder (SPD). SPD is a condition where my five basic senses were *hypersensitive* to external stimuli, but my senses that regulate my body's balance and spatial awareness were *hyposensitive*. My disorder would often induce headaches and stomach aches, but after years of physical therapeutic exercises, I have overcome my condition by junior high, and for that, I am beyond grateful. As a computer science major, this class is not required for me – I took it purely out of interest and a desire to learn about assistive technology. It has allowed me to explore assistive technology and its various applications, and the skills I have gained by working on a team will benefit me in my future.

My rewarding experience in this class is largely attributed to the incredible people that I have had the pleasure of working with. I am a member of the [REDACTED]. Our team worked closely with [REDACTED] and the Magical Bridge Foundation to create an accessible addition to the Magical Bridge Playground. During class sessions, I found Dave and the guest lecturers' guidance helpful to understand the criteria necessary to pursue this goal. In addition, I appreciated the ease of communication when our team needed to contact either Dave or [REDACTED]. Our team felt that we had the support necessary if we had any additional questions about our progress.

Over this quarter, I have experienced the design and fabrication process of a prototype for the first time. I really enjoyed working with my team. After my team's first visit to the Magical Bridge Playground, we began to brainstorm project ideas, and I proposed an accessible version of a two-player game that resembled air hockey. Our game would consist of a protected playing field, a ball, a set of paddles for each player, and a mechanism to operate the paddles. Originally, we planned for our

game's playing field to be built into the ground, but after consulting with [REDACTED], we decided to change our design. [REDACTED] informed us that our original design would present a tripping hazard, and since safety is our first priority, we elevated our game to be in the form of a table. As our design continued to evolve, my teammates suggested a new mechanism that would operate the paddles of our game. They suggested that we use buttons to move the paddles, because buttons would be more simple, intuitive, and inclusive for different motion capabilities. Another feature that our team proposed was adding chimes to the end of the paddles to make the playing experience more enjoyable for those with visual impairments.

Following our brainstorming, we took another trip to the Magical Bridge Playground and conducted interviews, where we learned that the buttons were the preferred play mechanism. After our feedback, we finally settled on our prototype idea and began the construction process. Our project idea was very ambitious and having two members of my team being experienced mechanical engineering majors was critical to the success of fabrication. We purchased balls, pinball launchers, xylophone chimes, and springs from Amazon. The rest of the material for the base and button components were 3D printed or made of Duro and acrylic. I spent several hours in the PRL and the Makery learning about 3D printers and laser cutters from my teammates, and I did everything I could to help assemble the final prototype. After my team's hard work, we were excited to see our final functional prototype.

Looking back, I believe that my team thoroughly completed the design and fabrication processes. The only change I would make in our process would be to start the fabrication process earlier. It was a somewhat stressful time when we began fabricating our prototype towards the end of the quarter, but I am relieved that everything worked out well in the end. Having completed the quarter, I believe that this class was one of the most unique and valuable experiences that I have had at Stanford so far.

ENGR 110 Reflection

I first heard about this class my Sophomore year when I was looking for interesting classes to take in the Mechanical Engineering major, and I have been looking forward to taking it ever since. I am very passionate about designing products that have a first-hand impact on the lives of others, so this class seemed like the perfect opportunity to design a meaningful product that will directly impact someone's life. Going into the class, I was expecting to be more intrigued by the project aspect of the class, and less by the lectures. Ten weeks later, however, I can confidently say that I thoroughly enjoyed watching the lectures, even though I wasn't able to be there live for most of them. The world of assistive technology is one that I hadn't been exposed to before, and it opened my eyes to the possibility of possibly working in the space after graduation, especially after the Ekso bionics presentation. In addition, hearing speakers like Sha Yao and Joshua Miele inspired me about the possibilities of making a positive impact through assistive technologies and reiterated the importance of designing *with*, rather than *for* the user.

This expression was truly important for my team and I to build a successful project. I was a part of the "██████████", in which we had the challenge to design an attachable desk for ██████████ WHILL Model M power chair that is easy to assemble, compact, and most of all: cool. Before embarking in the design process, we met with ██████████ at her house in order to get to know her and understand what she truly wanted from our project. This experience taught me how important user interviews are when designing a product. If we would have started coming up with ideas and building prototypes before speaking to Abby, we would have been led astray without a concrete understanding of what she needs. Through our interviews with Abby, we got a better understanding of what she wanted and prepared a list of concrete design criteria. As we started coming up with ideas to solve her problem, we used our design criteria to rank the ideas and put them into a PUGH chart. This was my first time using a PUGH chart, so it was a super valuable tool that I will definitely use for ranking designs in the future. More than anything, I really enjoyed this brainstorming process, because we had the chance to be as creative as possible, rank our ideas, and eventually hone it down to three main ideas

to present to [REDACTED]. Once we had our top three ideas, we created prototypes for two of them based on [REDACTED] feedback, and then once again went back to her house to test them. I also really enjoyed creating these rapid prototypes, since they were quick, easy to make, and they taught us about the validity of both of our top designs. After this second meeting with [REDACTED], we ended up moving forward with the "Crossover between the legs design" due to its higher "coolness" factor. I was excited about this design because it was more innovative and could be used as a general solution for people in various types of wheelchairs. However, I am also a little worried about what materials we would use to fabricate it. We looked around Home Depot for about 2 hours, but only ended up buying a PVC pipe. Although we didn't buy many things, the time we spent there was super valuable to our project's success, since our team was just spitballing and generating a bunch of ideas for how we could actually create our design into reality. This productive discussion, as well as a memorable conversation with a Home Depot employee that calls himself Santa Claus, helped us realize that the fastest and cheapest way to fabricate our prototype would be to design our own custom parts. This led us to utilize Room 36 to laser cut and 3D print the rest of our components. This process helped build my confidence in my design skills, and also was fun because it allowed us to build quick prototypes and adjust our design when something didn't work.

All in all, I really enjoyed working on this project with [REDACTED] and truly learned a lot about the process of designing a meaningful assistive technology. If I could do it over again, I probably would have considered the possibility of making the connecting rod of our assembly a square, rather than a circular PVC pipe. It might have been possible to order a square PVC pipe, which would have helped prevent the stability issues we experienced with the circular attachments. In addition, I would advise future students to get started early on their projects and ask lots of questions to their user, since the key is to design the product *with*, rather than *for* your user.

INDIVIDUAL REFLECTION

Throughout this class, several aspects have contributed to the design process from lectures, examining prior solutions to doing research and evaluating our prototype through testing. Each part of the process has contributed in the following ways:

1. Hearing lectures from different professionals in assistive technology: it is important to be able to understand the needs of the user. While [REDACTED] did give us a lot of information throughout the projects that informed us of her needs for our design, having professionals in the class allowed to further think of aspects many designers do not always put emphasis on while designing such as a product not only being functional but tailored to the user's likes in order for them to actually use it.
2. Doing background research: this was step crucial for our design process because it exposed us to different testing methods that we could use for our prototypes but also allowed us to get more information on users that have tried leg covers before. In addition, we were also able to learn about the kind of materials that we can and cannot use as without knowing could have picked materials harmful to the user.
3. Looking at prior art: Looking at prior art can help to identify existing solutions to similar problems and can provide inspiration for new designs. Since we tried to avoid exactly replicating what is already available, it was helpful to have an idea of what is already available and what about it works or does not.
4. Brainstorming with instructor: being able to brainstorm ideas in our initial design process was helpful in identifying potential design challenges that might not have been apparent otherwise. It was also helpful in refining our goals and the scope of the project.
5. Feedback from first presentations: this was helpful in improving the overall quality of the project. The feedback on the outlook of the presentation, technical writing, presentation skills

and methods of testing prototypes was all valuable as we incorporated it in our final presentation which I personally think went better than our first one

6. Fabricating and testing a prototype device: Finally, fabricating and testing a prototype device is essential to evaluate the effectiveness of the design in real-world conditions. This part was the most important one because our product has an end user that we hope would be able to use comfortably. I was to learn different new designing processes in the lab such as vacuum forming, laser cutting wood with a bend and vinyl cutting. All of these processes could become important for other projects and as a designer I am always trying to learn new methods of manufacturing products.

Overall, each step of the process described was valuable in designing our product and preparing its necessary documentation. I believe that our leg cover would not have been as successful while meeting the needs of our user if it were not by following a comprehensive approach that incorporates feedback from professionals and users, brainstorming session, lectures and all the other aspects mentioned in my reflection.

Name: [REDACTED]

Class: ENGR110

Team: [REDACTED]

Teammates: [REDACTED]

Assignment: Individual Reflection

I first heard of this course last year outside the PRL when I saw my friend, [REDACTED], with two hiking aids. He said he was modifying them to make them more accessible for his team's project partner in ENGR110: Perspectives in Assistive Technology. I thought it was really cool that students got the chance to work on projects with a project partner in the disabled community and produce a product that will directly improve their lives within a quarter. Therefore, winter 2023, I enrolled in the class to do the same.

When I first heard [REDACTED] project pitch, I immediately thought that I wanted to work with her. I was always curious as to how prosthetics were constructed, and I also love drawing and designing. Therefore, when I heard there was a possibility to do an aesthetic prosthetic leg cover, I knew that I wanted that project. After forming the team and having our first interview with [REDACTED], I noticed how important it is to meet with the user before designing a product, because there are many things you wouldn't have thought of as you possess a different point of view. This also ties into the guest lecturer who talked about the five C's when making a product. She said she was giving us the freedom to do whatever we wanted with the project but she wanted the cover to be lightweight, minimalistic (no flames or hot pink) and have a calf-like shape so she would wear leggings.

From there, we decided to cast a leg with plaster then thermoform ABS sheets to create the calf-like shape and add vinyl cut stickers on the ABS for an aesthetic appeal. Then, came the most difficult part in my opinion, figuring out a way to attach the two halves to the prosthetic leg. We were thinking about Velcro straps, magnets, string, but we decided to use shoelaces to add another form of design, like a corset for her leg. When we returned the leg with the finished prototype of the cover, it made me so happy to see how excited [REDACTED] was. She kept telling us the cover was so awesome and that she can't wait to wear it with some leggings. It really made me feel like our team's project made a true difference and satisfied the design criteria.

If I had to do this again, I think I would want to meet with [REDACTED] more in person to gain more ideas about our design process and letting her see our prototypes as the project progressed, rather than mainly communicating through text. If we had more time or a larger budget, I think we would've done more exploring into how we could mirror the shape of her right leg and also how to attach the cover to the prosthetic easily.

In addition to the amazing project that our team worked on, I gained a lot of insight in the assistive technology industry through the various guest lecturers, especially when we heard directly from Stanford students and different companies at the assistive technology fair. They really allowed me to hear different perspectives and all the capabilities of assistive technology. I especially loved the field trip to the magical bridge playground because I was able to see how something present in almost every school was redesigned to be accessible to all individuals. Getting to play was also a huge plus because I'm truly a child at heart but this playground was designed in a way that even seemed accessible for adults to play and not just children.

Before entering this class, I was around 90% certain that I wanted to design toys for a living since they really make me happy, and I want many others to experience that joy. However, after listening to all the guest lecturers, I became inspired and thought that maybe this is what I would want to do in the future instead; creating assistive devices that can make life easier for the disabled community. And when these devices are created, it doesn't just help them, but also multiple other people who aren't necessarily in the community, like audiobooks, grippers to reach items far away, subtitles on shows, etc. Therefore, I changed my master's concentration from Design to Biomechanical Engineering so I can gain a better understanding of the human body's capabilities and needs, to truly inform my design process in this field. From this shift, it's safe to say that this class has truly changed my perspective on life.

Looking at the different aspects I think the relationship that our group built with [REDACTED] and [REDACTED] was ultimately the biggest piece going into the design. We cared about him and wanted to make it as good as possible. I do not think personally there was an interaction from others that helped with the design, but I did thoroughly enjoy the Fair day where everyone came in to show off their respective projects. It was cool meeting people who were so passionate about things and working towards different goals and ideas. The group sizing of 3 would have been a little better just working around schedules. But I would recommend that people just get with people they have similar interests with as it makes the projects a lot easier and smoother. My fellow group members Lucy recommended the course and it fit into my plan, so I hoped in with her. I did not know what I was getting myself into with an engineering course as I had never really taken one before this one. My expectations were blown out of the water though as I loved the course and the opportunities it brought with it. Working in teams is nothing new for me and nothing really is all that uncomfortable. I enjoyed how open our conversations were and people were willing to throw out any idea even if it was normally seen as unique or different. Again, the group size of four made it especially hard in the second half of the quarter with my schedule to meet in person. But we found ways to work in smaller subgroups at times tackling different aspects of the project and coming together in the end with the final product and report. Learning to see stuff from a slightly different lens is always beneficial in my eyes. Understanding why things should be done to include everyone and down the line looking to advocate for that similar stuff. My family, friends and coaches loved the class and were extremely fired up and flexible with me taking the course which was awesome. The most positive was [REDACTED] reaction when the final product came in and he was able to use it with such ease. The most negative was having to change the entire project week 9 as we found out his break would hit the original design. Things we can learn from both is working with people is a two-way street no matter the situation. These things benefit both parties if done right. [REDACTED] was one of the greatest human beings I have ever met. Guy is special in more ways than I can write on this paper and if he ever needs anything he knows I got his back. Nothing disappointing overall the team worked well together accomplishing a common goal. No problems that I need to personally discuss with the course instructor. The most natural thing about our team was again how open the conversation was throughout. Nothing personally was uncomfortable. The biggest challenge was finding time we could all meet, especially in person. No ethical issues. Building relationships and working around busy schedules would be the two biggest takeaways for me from this course. I have learned that the menisci inventor is an adrenaline junky, and [REDACTED] really wants to go to New York. The newest perspective I have towards everything is just the amount of love individuals still have currently. Going back to [REDACTED] that man is unreal when it comes to everything he does for family and there are not enough good things to say about him. I loved the class lectures and the guest speakers as they were all exciting and different. Appreciate this course and every opportunity it gave me. All the best.

[REDACTED]

I came out of John Moalli's IntroSem class on Compassionate Design in Fall Quarter to taking this Perspectives in Assistive Technology class in Winter Quarter. Assistive technology was a field I was considering exploring, and I wanted more exposure to the real design process and guest lecturers with an engineering background in this field. In both regards, I got exactly what I wanted. I learned a lot more about the engineering process behind assistive technology design, and I also got to meet some incredible speakers, hear about their work, and talk to them after class about their challenges and their journey into this field.

I come from a more theoretical biology and research background, and I've never been involved in the engineering process before. This was something I wanted to explore but never had the chance to, and in this class I got exactly what I wanted to experience. However, I did also realize that engineering is not my main passion – I'd prefer, in the future, to work in a lab than an engineering facility, finding treatments and cures to these diseases rather than engineering devices and assistive technology to help people. I'm still open to retaking this class as a 3-unit option and continuing more projects down the line related to accessible transportation, but I've realized this isn't my main passion, and I'm glad this class helped me realize that.

I was in the class for 1-unit letter grade and doing a project report was a rewarding experience as well. I think I would've enjoyed the team project as well, but I'm glad I was able to listen in on the guest lecturers while also doing a report and exploring my own individual interests. I think this was a good mix of experiences in the class.

Hearing from the guest lecturers and talking to them after was a really special experience. I talked specifically with Jeff Butler outside of class, and I learned an incredible amount from him – we talked about our shared interests in accessible transportation, but we also talked a lot about the business side of assistive technology and the things we've done before in the past. I've worked on some ALS projects before and I've also been interested in telemedicine and talking to Jeff about these things and hearing his opinion on the future direction this field should take was really insightful. I'm interested in exploring telemedicine more in the future now too, as another form of assistive technology. Hearing about the business side of this field gives me a new perspective I've never considered, and I'm glad I'm able to see things from a practical lens now too. Having this time to talk to guest lecturers after and outside of class was one of the main valuable assets of the class, and without it I don't think the class experience would've been the same.

I was originally very interested in Amyotrophic Lateral Sclerosis (ALS), a neurodegenerative disease. I wanted to branch out more into disabilities because, at the heart of having ALS is really a disability for the patients I've known, and I got exactly what I wanted from this class too. Talking to other people with spinal cord injuries and all the other disabilities broadened my scope, and now I've realized I don't want to focus solely on ALS in the future: I'll definitely want to pursue something neurological and similar to ALS, but my original focus on ALS

was too specific. This class definitely broadened my scope and allowed me to see the bigger picture in this field.

Visiting the magical bridge playground was also really interesting, and I'm glad a field trip was incorporated within the regular schedule of guest lecturers. Hearing from [REDACTED] and the designers of Magical Bridge was insightful, and I realized that assistive technology isn't able to design for everyone – some playground toys would not be accessible for some people, while others were. The guarantee that at least one toy would be accessible for visitors of Magical Bridge was an interesting principle that I've been thinking more about after this class.

I don't know what the class would've looked like if I took it for 3 credit units, but I'm interested in potentially taking the class again for this option. I think I would learn a lot by actually involving myself in a project, although I didn't have enough bandwidth this time to invest time in that. I'm overall glad I took this class, and I think it was an extremely rewarding experience!

ENGR 110: Individual Report

I first learned about ENGR 110, Perspectives in Assistive Technology, at the end of this past Fall quarter. I am an STS (Science, Technology, and Society) major and this course fulfilled an engineering requirement. However, of the six to seven courses I was interested in, I decided to take ENGR 110 for three primary reasons. First, I was interested in learning about assistive technology specifically. Second, after reviewing Carta reviews, I was looking forward to working on a design that would be dedicated to a single user. Finally, I was excited to hear from the weekly guest lectures. The opportunity to hear from community members and industry professionals excited me. Finally, an added bonus was that my friend, [REDACTED], would be involved in the course. While I do not currently anticipate there being a direct relationship between this course content and my career plan, there are several insights I will be keeping in mind for the following years. Specifically, the guest lectures provided me an all-encompassing perspective on how to approach problems, regardless of whether these problems can be foreseen or not. Throughout the quarter, my family and friends would ask how this class was progressing. Every few weeks, I would update them with both information I had learned from class lectures and details regarding the class project. With each update, they would be fascinated and ask more about the details of a few topics.

Shifting towards the class project, my team and I divided the task into three components: talking to the project suggester, researching current market solutions, and fabricating/testing our prototype. Each of these three subdivisions taught me lessons that can be applied to other areas of my life. To start, my team's project suggester was [REDACTED]. Talking to [REDACTED] and [REDACTED] resulting in our team pivoting our project's need criteria. I would view this element of the project as the more rewarding as we were able to develop an amazing relationship with the [REDACTED]. Regarding the project development, this process was highly useful in ensuring our team was creating something that [REDACTED] would appreciate and utilize on a more consistent basis. The next component, market

research, served as brainstorming sessions. This process encouraged us to think of bolder designs that were not currently present in the market. This process gave us useful information on why certain designs would not be compatible with wheelchairs. Finally, our team worked on fabricating and testing our prototype. Though this process was difficult and frustrating, it was also very worthwhile and necessary. Without the constant testing of our prototype, our team would not have been able to make the most efficient and effective design. The most valuable lesson I learned from this component was the importance of iterations. Without multiple iterations, it is nearly impossible to create the most ideal finished product.

When thinking back on the experience of working with a team, I have learned several lessons. First, unexpected circumstances can change schedules and availabilities, making it necessary to start on projects ahead of time. Also, the larger the team, the more likely it is that there will be minor conflicts regarding opinions on how to best proceed. In these situations, it is important to take a step back and focus on the larger picture. That is, I've learned that oftentimes, both opinions are attempting to solve the same problem in a slightly different manner. Working with a team also made me reflect on individual my role and strengths/weaknesses. Because I tend to ideate on my own, I encouraged myself to brainstorm and work ahead of the team meetings, allowing me to contribute to the team in a fairly stressless manner. Overall, I enjoyed working with my three other team members. With this said, I wished we had communicated better on the schedule of the work that needed to be completed. Because our team tended to work on the assignments last minute, we struggled with dividing the work evenly. For example, with our Final Report, two team members did not contribute a considerable amount. By setting group expectations at the start, it becomes easy to hold each other accountable.

Reflecting back at ENGR 110 as a whole, I am very happy with how both my team and I specifically worked. There are only a few things I would change if I were to take this course again. First, I would ask the guest speakers more questions. It was interesting to hear about their life experiences and I wish I would have asked more questions to understand their perspective better. For

example, I loved hearing from Sha Yao and how she managed to get her product to market. I also wish my team had practiced more for the Midterm presentation. All in all, I am extremely satisfied with how this course was conducted and am very grateful to have had so much support from Dave, [REDACTED] and [REDACTED], and my team.

ENGR 210: Individual Reflection

Going into this course at the beginning of the quarter, I had a limited understanding of assistive technology and the breadth of applications, devices, and services that encompass the field. I had some experience with projects and research related to haptic interfaces and gait assistance in prosthetic devices, but most of what I was familiar with involved devices for amputees and prosthesis users. I believe this class truly opened my eyes to the history, future, and various applications of assistive technology while exploring and learning about the design process and challenges involved in designing and implementing these technologies for users. Most importantly, I learned how to design assistive technology with an individual with a disability, and not just for them, including the user and their feedback in the design process.

Overall, I had an excellent experience taking this course both with in-class lectures and the team project. One of the most appealing parts of the course was the guest lectures. At the beginning of the quarter we heard from design consultant Gayle Curtis, where we learned about how to approach and understand a problem when designing. This includes researching the problem thoroughly and looking at the goals of the target user, their capabilities, and the obstacles and constraints in their situation. We learned that this design process involves interviewing the user, observing their activity in the context of the problem, and making a prototype to see how they interact with it. I believe this was extremely helpful for the development of our product for [REDACTED] since this is exactly the approach we took when designing her portable lap tray. We performed this process not once, but several times when we were iterating on previous designs and planning on how to improve the next one. Some other speakers I found particularly interesting were Katherine Strausser who talked about exoskeletons for rehabilitation, and Monroe Kennedy, a mechanical engineering professor at Stanford who works on assistive robots for human-robot collaboration tasks. It was also interesting to hear from Peter Axelson and how he designs to help people with disabilities participate in all aspects of physical activity, including his journey with mono-skiing. I also greatly enjoyed hearing from Sha Yao and how she transformed a motivation to help her grandmother into a commercial product to help people with cognitive impairments increase their food intake. Although the guest lectures greatly contributed to my learning of assistive technology, I believe the project was the most rewarding part of the course since this is where I got to design and test assistive technology for a user firsthand.

This quarter I worked with Seamus and Josue on developing a portable lap tray for [REDACTED], our community partner, to comfortably work on her laptop while sitting in her powered wheelchair when she is away from home. At the beginning of the quarter, we had the opportunity to interview [REDACTED] in her home to gain an understanding of her challenge. We were able to hear the problems she has when working on her wheelchair and her preferences for a device that would help her work with ease and comfort. Additionally, we observed how she operates her wheelchair and had the opportunity to ride in her wheelchair and experience firsthand the environment and space where she would be using the device. I believe this was instrumental in understanding the problem since it allowed us to observe the challenges she faces in person. Throughout the quarter, [REDACTED] was the most important and helpful aspect of our design process. [REDACTED] has been

involved in the project every step of the way and through emails and meetings with her, we were able to get her feedback on our ideas, prototypes, and future work. [REDACTED] responsiveness and detailed comments helped streamline and facilitate smooth progress these past few weeks. It was a pleasure to get to know her along the way and work with her on an interesting design project.

My teammates were also instrumental in the success of this project. Our team worked well together and possessed the skill set to develop a quality prototype for [REDACTED]. I believe some of the things our team did well was starting early, brainstorming ideas thoroughly, and iterating on designs based on user feedback and testing. Starting early allowed us to explore a broad range and large number of solutions when brainstorming possible solutions. This was effective for us to analyze different solutions and evaluate which aspects of certain solutions worked well and which did not. Using our ideas and [REDACTED] feedback, we were able to effectively identify a solution that both our team and [REDACTED] were excited to work on. Our iteration process also worked quite well. Each time we developed a prototype or improved a previous design, we would meet with [REDACTED], test the device with her, and take notes of her comments. This was crucial for ensuring that we were on the right path to fabricating a device that would fulfill [REDACTED] wants and needs. This also ensured that [REDACTED] was part of the design process for her lap tray as well. Our background research also largely influenced our final design. Looking at existing solutions, we identified their limitations but also drew inspiration from aspects we thought could be helpful to [REDACTED]. For example, we drew inspiration for the base plate [REDACTED] sits on from a lap tray device that uses the weight of the user sitting on it to keep it stable. In terms of our prototyping process, the resources by Stanford and the course were more than enough to develop a robust solution. We were able to utilize the PRL for rapid prototyping of initial design concepts as well as developing our final design. The laser cutter, 3D printers, hardware, machine shop and woodshop at our disposal provided us with several avenues for fabricating a final prototype. Additionally, our weekly meetings with Dave to talk about our progress were very helpful in developing our project. Dave was able to offer us helpful insights about our design concepts, explore solutions for design challenges, and help us with next steps for the week.

I believe that my experience with the team project went very well. We created a device that was interesting to build, functional and one that [REDACTED] was especially happy with. I think [REDACTED] greatly enjoyed that the design was something she had never seen before. However, I think there are some things I would have probably done differently. I think it would have been interesting to explore other manufacturing processes for the product. I think it was great to use some processes that we were familiar with which allowed us to save time and create an effective product, but it would have been interesting to learn another process. I also would have liked to go through another iteration of our design to test with [REDACTED]. There were some functional aspects of the lap tray that could definitely be improved and I think it would have been nice to resolve some of those issues with another round of [REDACTED] feedback. In terms of advice for other students, I think the best advice I can offer is to start early and proactively set goals for each week. I think this is important for establishing the problem and design criteria early on but also good for mitigating any obstacles that may arise later in the process. Since the quarter goes by very quickly, I think setting weekly goals allows a team to stay on track and not fall behind, which can happen quickly when the quarter gets busy. I am thankful for the opportunity to work on such a



rewarding project and to work with such an excellent team of students, instructors, and community members.

ENGR 110 Individual Reflection

I first heard about ENGR 110 during my sophomore year, when I declared mechanical engineering as my major. I had planned on committing to the product realization track within the major, especially because the electives sounded super fun and interesting. In particular, I noticed that ENGR 110 fulfilled one of the elective requirements, and I took note of this, since it was a class that could broaden my perspective as a future designer and engineer by doing a group project to solve a real life challenge for someone who has a disability. During my junior year, my roommate brought up this class again, as she had a sister who had a disability and wanted to go into disability rights as a lawyer. I further heard great things about the class from class reviews and from peers and mentors who had taken the class before, so of course, I had to get my hands wet and experience the class itself in all its glory!

My team, the [REDACTED], made taking this class super easy. We were all very passionate about trying to make a difference in someone's life, and as computer science, mechanical engineering, and management science and engineering majors, we all had different perspectives on user design and engineering. We all got along very well too, since we all knew each other before the class had even started. In terms of our project process, we decided to build a new idea for the Magical Bridge Foundation because we thought that it would be really fun to design for multiple kinds of users, and not just one specific person or requirement. We also naturally loved art and creative design, so our goal was to create an idea that focused on tools to create art in the playground, especially an artistic experience in a public space where there would be repeated and heavy usage among stakeholders of all ages, backgrounds, and disabilities. This was how we came to our final idea of having a water canvas in the playground.


One of the most valuable experiences we had throughout our process was getting to interview users at the playground. Visiting the Magical Bridge Playground in itself was super fun, and the playground was always more crowded than its surrounding neighbor playgrounds, which suggested its popularity and ability to create fun for all kinds of kids. I could tell that the design was optimized for a large array of users and assistive needs, such as not having any tanbark on the ground so that wheelchairs could roll around easily. We were able to talk to a lot of parents whose kids had disabilities, and we were able to test our prototypes with them. For example, one boy had autism, but really seemed to enjoy our idea of using water to paint canvases with his finger on a flat canvas. Even interviewing parents was fascinating, since they gave us more perspectives on what kids like and don't like, like how we would not be able to have a "paint cup" of water in the playground due to the risk of kids drinking it. In addition, with all the guest lectures speaking to different kinds of disabilities, we made sure to think about users who were blind, deaf, short, tall, quadriplegic, etc. In the end, we incorporated lots of texture into our

design so that the canvas itself would create more interesting sensations for users. In future iterations, we hope to also think about bright/contrasting canvas colors and scents as well.

The fabrication process was probably the most fun part of the class. Since we were creating our canvases with clay, our team had bought more than 5 pounds worth of clay to create texture on our canvases. It was really therapeutic getting to roll and squeeze the clay into different shapes, smoothing out the cracks with our fingers and water. We got really creative with the shapes and ridges we were trying to form on the canvas, and that creative thinking made our team bond really well and bounce ideas off of each other.

If I were to go through this process again, one thing I would do differently is to understand that 10 weeks is not enough to make anything concrete, and that it takes years to finalize engineering designs. Throughout the course, I was a little disappointed hearing that even after 8 years of being involved with the class, the Magical Bridge Foundation still has not put any team's idea to fruition. Though I understood that there are a lot of budget and time constraints when constructing playground parts, I was skeptical of whether or not any of the team's ideas were considered seriously after the class ends. While I personally had a great experience brainstorming and prototyping our team's idea, especially because it used my engineering and creative thinking skills, I kept on wondering what the Magical Bridge Foundation got out of working with these teams aside from hearing the design idea. Through this process, I realized that not everything is sunshine and rainbows, and engineering for user design needs to be extremely precise in order for it to be mass produced for lots of users. I learned that this was probably why products take years to even start production, and 10 weeks was simply not enough to flush out any designs. However, I would encourage future iterations of the class to understand that what they make may not be used at all. This would be very helpful for students to learn at the beginning of the class, so they don't feel disappointed in the end when their user does not use their design. This would also be the advice that I would give to future students — that 10 weeks is simply not enough time to prototype the idea to perfection.

Overall, this class was an extremely valuable experience for me. I never before thought that there were so many people with disabilities in the U.S., and that so much research and development goes into designing for assistive technology. As the U.S. ages more and more, there needs to be even more research going into this industry and even more brilliant students who are willing to take on the challenge. It's so amazing that Stanford has been offering this class for almost 20 years, and that thousands of students have learned about these perspectives. I have learned that with every single kind of assistive technology out there, years of design have gone into it, and I will always highly respect the engineers who have made the world a better place for those with disabilities.



ENGR 110

Perspectives in Assistive Technology

Reflection Paper

Even as noted by Dave, our team had some trouble with progress in the first half of the quarter. Our group really started moving at the start of physical prototyping for our final selected idea. I wish our early prototypes were more elaborate, so that our user feedback would've been more useful to us later on.

The causes behind this delay are numerous, but I believe a key obstacle to our team was the division of labor specifically impacted by our academic backgrounds and project details. With only half of our members being familiar with any type of fabrication, it naturally fell on the two Mechanical Engineering majors to complete the mechanical design work. Our final project proposal ended up being a mechanical system with the bulk of the work being in CAD despite our best effort search for prefabricated components.

I enjoyed the work that I was doing, but I think that there is an added importance for all members to be at least familiar with mechanical design concepts, or if there is a better way to form groups. A major drawback to the division of labor was not only the imbalance among members, but also the imbalance of effort placed on the various components of the project. The reflection paper prompt asks us to reflect on our conversations with professionals, users, and instructor as well as the background research and prototyping process. Because of the need for me to focus on prototyping, I was much less engaged with the other, still vital aspects of designing.

With the way the group forming is set up currently, there is a trade-off between choosing members carefully and getting our first-choice projects. Another question may be added to the introductory questionnaire to indicate familiarity with mechanical design concepts. However, as it stands now, I can see several ways to approach team dynamics such as mine:

- 1) Spend more time in the brainstorming phase to explore concepts that would allow all members to shine. In our case, it would mean selecting an idea with less mechanical complexity with more emphasis on aspects such as visuals or touch.

- a. Of note here is that our remaining team members were encouraged to build on aspects of our design that [REDACTED] and I couldn't spare the time to get to (e.g. planning out details of visuals, exploring textures). However, the project relied heavily on the mechanisms, so this hasn't fully described our team this quarter.
- 2) Lean into the imbalance and have the team members with a greater amount of relevant experience delegate tasks to other members.
 - a. There are a few problems with this approach. One, I think it would be less pleasant to work in such a team, where there is a power inequality. Two, it would still put the most work on those with more experience: it is not an equal contribution effort. [REDACTED] doesn't quite have the same ring to it as [REDACTED].
- 3) Devise ways in which to provide missing information to inexperienced members. This approach relies on the other members' willingness to learn on their own and adds a significant amount of time to the preparation stage. This approach has the added danger of turning into approach 2, where more experienced members take on the most work.

Out of these approaches, I think that the first would've been most realistic for our team. However, it would have meant that our ideas had to be less complex, which wouldn't have been as interesting to me. I'm not sure that approach 3 would have worked out in our case, although it maximize the potential of greatness of the final design.

To be honest, the best way that this problem would be resolved is if all members have the same amount of enthusiasm for the project.

But now for more positive aspects of our quarter:

For our group (and the [REDACTED]) in particular, all lectures ended up being relevant to our design considerations. Our project was not meant for a specific person with a specific need,

so any time a guest lecturer spoke to their individual experiences with living with their disabilities, it was as if we were speaking to yet another potential user for our end design.

Although we didn't go on the class field trip, our own trip to the Magical Bridge was (perhaps obviously) invaluable. Our passion for our idea came from the fact that we did not see conceptually similar installations at the Magical Bridge Playground we visited. Many structures were for individual or group play, but all lacked the inherently competitive edge of player-vs-player games such as air hockey or foosball. I was also reminded of this during Q&A Jeff Butler's lecture, where he mentioned that there was only one competitive wheelchair sport that he felt he could play.

This is all to say that I really did enjoy making our final project. I'm glad I didn't settle for any other option, because it was really fun to figure out the button-spring-linkage-paddle mechanism. I really enjoyed working with [REDACTED] and loved seeing our prototype come together.

A general, very implementable way to improve would've been to make communication clearer—i.e., have a way for the other two to understand what was going on.

Overall, I have learned a lot about group dynamics this quarter, but am happy I pulled through despite setbacks, and gained a valuable partner.

Perspectives in Assistive Technology Self Reflection

I've had a long-standing interest in the assistive and accessibility technology space and was very excited to take this class to gain a wider perspective in the field. During my undergrad at the University of Michigan, I built a couple of projects around assistive technology, such as a physical therapy assisting device and a hands-free controller for playing ping-pong on the computer. However, while these projects intended to help people with disabilities, the main focus was on making a working system for an engineering course as opposed to working closely with the user. I wanted to take this class to learn how to evaluate the needs of people and design for them. Additionally, I hoped to learn about assistive technology from different perspectives (such as the user, designer, etc.) and fields.

The standout lectures for me were the Magical Bridge Playground, Assistive Technology Faire, and Deborah's lecture on "Bridging the Gap between Consumers and Products in Rehabilitation". I liked the Magical Bridge Playground because it was great to experience such a unique space, see it being used, and learn about the care that was put into its creation. I liked how they separated the playground, such as a dedicated spin zone, based on people's preferences and how it was useable by all ages. The Assistive Technology Faire was helpful because it provided exactly what I was looking for, learning about a variety of assistive technology from different fields. I enjoyed learning about the 911Finder watch and TranscribeGlass. I also saw BUDI, which is a project I had contributed to in another class. It was exciting to see how far it had come! Finally, I found Deborah's lecture helpful because it shed light on the relationship between a patient and an occupational therapist as well as the process of introducing a new device to the user. I didn't know that occupational therapists conducted a thorough evaluation of their patients, such as their visiting their homes.

However, the best component of the course was the project and working with our community partner, Abby. One of the most rewarding project work sessions we had was the initial interview with Abby. It was interesting to get a glimpse into her life and the changes she had to make due to her disabilities. She showed us routines that weren't even part of the project but

helped us better understand her needs. For example, she explained how she gets her wheelchair and [Jathan] into the car, how some cars are converted into wheelchair-accessible and little gadgets she uses to make the process easier. We also saw how she used little stick-on colored buttons on important stuff, like settings on the stove, to make it easier for her visually. This is something we incorporated into the project by coloring buttons on the device.

Additionally, I think our team's dynamic added a lot of value to the project. It was great that we had a diverse set of skills, including ME, EE, and CS, because it allowed me to learn more than just skills in my field. Despite having specific areas we each were more focused on, we weren't confined to only working on that part. For example, during the brainstorming phase, we all talked about what the physical and electrical parts of the project should look like. On top of just skills, we got along well, had an even workload, and supported each other throughout the project.

Being an EE and Computer Engineering major, I mainly focused on the electrical and coding portions of the project. Despite this, I've always struggled with soldering, but this project pushed me to get better and learn new techniques. For example, during my visit to Lab64 the lab coordinator, Jeff Stribling showed me how to use flux when soldering the Raspberry Pi to the battery. Also, with the coding, I contributed to reading the GPIO values of the buttons. While I knew how to use GPIO ports, our team decided to use Bash script, which was new to me. I had been meaning to learn Bash, so this was a great motivation for me to finally learn! Overall, this project helped me further improve my skills and gain hands-on experience. With a lot of my other classes focusing on theoretical and mathematical concepts, I found working in the lab enjoyable and plan to get more involved with Lab64 because of this project.

Additionally, due to my team being multidisciplinary, I both taught and learned from my teammates. I worked with [Steven] and [Dmar] for some of the soldering, and this was something new for [Steven]. I explained the process to him as we worked and had him try some skills himself, such as removing solder. An instance I learned from my teammates was with [Breanna]. She made the silicone molding herself but later went over the process with us so that we also

understood. I didn't know that making a mold involved enclosing the shape fully so that you don't know how well it is working until you open it!

A piece of advice for future students would be to listen to your community partner carefully because it allows you to make a more customized solution for them and makes the final result more usable. Additionally, it would be to start early, especially for an electronic-based solution. It took some time for our project to kick off and this made the latter half of the quarter busier. This was in large part due to the electronics. A microprocessor is expensive, and we only get one try, so we had to do extensive research at the start to make sure that our plan was feasible. But this put extra pressure during the implementation phase. However, it paid off in the end! Overall, I am very proud of our project, especially knowing that it will make a difference in Abby's life. I can't wait to hear her thoughts on the final design and for her to use it!

ENGR 110

Individual Reflection

I heard about this course from a few friends who took this class last year and enjoyed it a lot. I took this class to apply my design skills to a real world problem and get an introduction to assistive technologies. I was originally on the waitlist for the 3 unit option so I am extremely grateful that I got off the waitlist and was able to be part of a team project.

I greatly appreciated the variety of guest speakers we heard from this quarter. They really opened my eyes to the expansiveness of the field of assistive technology. The parts of these lectures that stood out to me most were the user testing experiences in the development of these products. Keeping the user centered throughout these design processes is crucial to making a product that actually solves their issues and creates positive impact. The Assistive Technology Faire was a highlight of the course for me because I learned so much from seeing some many different pieces of assistive technology working up close. This was a very unique opportunity to better understand these devices and how they have created avenues to better serve people with disabilities. Our field trip to the Magical Bridge Playground was also incredible. Seeing and playing with these different pieces of accessible play structures was so much fun. I cannot remember the last time that I was allowed to tap into my childish sense of joy prior to this trip. The playground exemplified how assistive technology can be used to access the power of fun for kids and even adults.

One of my favorite parts of the course was the final trade show. I really enjoyed seeing all of the other groups' final prototypes and getting to talk to them about their design process. Seeing their past prototypes was particularly interesting because usually in project based classes, you only get to see the final result and you rarely get a look into their design process so seeing past prototypes was a really cool way of getting a glimpse at all the work they did. It was a great way to celebrate everyone's hard work over the course of the quarter. Additionally, it was really interesting seeing people's reactions to our project. One of the people that visited our table spoke about his brother who works with a service dog and how impactful a device like ours could be in his life as well. Hearing about the possible impact of the product was really inspiring and further emphasized how many opportunities there are within assistive technology to make a

difference. This made me even more excited to see [REDACTED] reaction to the final prototype when we deliver it to her in the spring.

Being able to work with [REDACTED] throughout this process was such a privilege. As a product design student, I have learned about the design process and have conducted user testing for design projects several times, but never had the opportunity to co-design in such a meaningful way as I did in this course. In past projects, the user research and testing we conducted kept the user on the periphery and we were not able to really share with them our design process. With this project, we were able to bring [REDACTED] into our design process and keep her informed of the directions we were heading in at each step of the way. Being able to work with a community partner was such a unique opportunity and really highlighted for me the importance of designing with your user, not just for them. Visiting her home and seeing examples of assistive technology she uses everyday was really eye opening.

I had an amazing experience working with my team. All of my team members were extremely helpful and supportive throughout the entire quarter. Our project had a heavy focus on electronics, which I was a bit intimidated by at the beginning since I have limited experience and knowledge of circuits and electronics, but my team members were so open to teaching me and keeping me in the loop with this component of the project, which I really appreciated. It was really interesting being able to see a bit of the design process from each of our different technical backgrounds. I got to learn a lot more about electronics, circuits, and coding through this project. I also had the opportunity to share a bit about manufacturing and design with them, which I really appreciated. [REDACTED] and [REDACTED] had no prior experience with 3D printing and looping them into how we designed things and the process of 3D printing was really exciting. I appreciated the opportunity to share with them a space that I find really interesting. I have never taken a course that allowed me to work with other students across different departments and technical backgrounds in such a meaningful way. We were all really invested in making a high quality product to make a positive impact in [REDACTED] life, which is a huge part of why we worked so well together. Even when we all got very busy and scheduling became difficult, we were all willing to find time or collaborate in whatever capacity that we could to make it work. [REDACTED], [REDACTED] and [REDACTED] were truly amazing teammates!

For future students, I recommend starting early and making sure to loop in your community partner consistently from the start. [REDACTED] guidance throughout the quarter was incredibly valuable and helped keep us stay on track. Something my team did that was effective was

checking in at the end of every class period since meeting outside of class becomes difficult as the quarter progresses. Even just 10 minutes after class would help us make sure we were all on the same page and talk through any issues we were facing.

This course has shown me how accessibility is often an afterthought when designing commercial products. Sometimes simple changes like a wider grip can make a world of difference in terms of accessibility. In reality, designing while centering accessibility makes the user experience better for a wide range of users, not just people with disabilities. After this course, I want to learn more about assistive technologies and how to ensure I include fundamentals of accessible design in all the products I design moving forward.

ENGR210 Individual Reflection

At the start of the quarter, I had several motivations and expectations for the class. Firstly, I wanted to learn about various types of assistive technology, as well as how to design such technologies that meet people's needs. Additionally, I was eager to learn new methodologies and discover more resources related to people with visual impairment. Given time constraints and credit limitations, I opted to pursue an individual project, even though I was initially concerned about my ability to make progress and explore the topic independently. However, looking back on the past quarter, I'm pleased with the progress I've made and the valuable insights I've gained from the class.

As the daughter of a visually impaired individual, I chose to focus on designing assistive technologies for people with visual impairment. Having lived with my dad, who has been blind since my birth, for more than 20 years, I have observed the challenges and experiences he faces on a daily basis. For example, he struggles with accessing internet resources which is visual-based, appreciating scenery, finding entertainment options, and navigating independently. I wanted to explore resources and opportunities that could potentially benefit my father and others like him, and work on projects that could improve their quality of life.

At the beginning of the quarter, I started my research by investigating wearable assistive devices, entertainment resources, and outdoor activities suitable for people with visual impairments to explore the topic I wanted to focus on. I was surprised and impressed to find that there are many resources available to help visually impaired individuals explore outdoor activities and pursue their passions. For example, I learned about Eric Weihenmayer, the first visually impaired person to summit Mount Everest, who founded No Barriers USA to empower people with disabilities to pursue outdoor activities such as hiking, rock climbing, and kayaking. These stories were both motivating and inspiring, and planted a seed in my mind that perhaps one day I could volunteer with this kind of organization or even organize events to bring my father and other visually impaired individuals to try adventurous activities. In terms of entertainment resources, I found platforms for audio description movies in different languages, braille games, and basketball, among others. However, I found it challenging to gather comprehensive information on all these resources, as they are scattered across different organization websites, and often buried in different tabs. Therefore, one of my ideas was to build a well-established and comprehensive resource website.

To further my understanding of the barriers faced by visually impaired individuals, I conducted four interviews with individuals living with visual impairment. These interviews also helped me to learn more about the Vista Center for the Blind and Visually Impaired. I learned many useful tools and apps, such as Seeing AI, which my father was not aware of, and I introduced these to him to make them useful for him. Talking to the community helped me gain insights and perspectives that I had not considered before. For example, one interviewee shared that it is challenging to navigate roads with non-right corners and to know whether a full cycle has been walked.

Without sight, it is difficult for them to identify relative or cardinal directions, and existing solutions are often limited to providing macro navigation information, such as a broader view of the route direction. Other than that, one of the challenges mentioned by an interviewee was that they often struggle to identify their facing direction when getting off rideshare services. This can make it difficult for them to decide whether they need to cross the road or turn right to reach their destination. Because of that, I decided to start working on a wearable digital compass to provide simple cardinal direction.

After coming up with the idea of creating a wearable digital compass, I sought input from my interviewees and worked with them to co-design the device, incorporating their thoughts and design requirements. "Design products that is actually helpful for the users, and not to design what you think is helpful." This concept was kept bringing up during classes and guest lectures. Talking to users and understanding their needs is not only important for defining the problem, but also for testing and iterating to ensure that the design fits their needs. I appreciate that the group projects showed their testing process and iterations to make sure the design was helpful for the target users. Testing and iterating is crucial in creating a product that truly benefits its users.

Guest lectures provide invaluable opportunities to learn different perspectives in assistive technology. I particularly enjoyed the guest lecture given by Sha Yao, the founder of Eatwell. Not only did I appreciate her inspiring work, which I had learned about eight years ago, but I also had the opportunity to meet her in person. What struck me most was her willingness to put in the effort and persist through failures to bring her graduate research to market and ultimately create enormous positive impacts. Moreover, I was impressed that despite being an art student, she taught herself about injection molding processes and the associated details necessary to start her own company and make her idea a reality. Witnessing her challenges and learning process was insightful, and I found her methodology for commercializing and realizing her idea to be practical and incredibly useful. If I pursue my project or start a company based on my idea, I will try to implement the advice she gave.

In addition, I found Joshua Miele's guest lecture inspiring, and I appreciate his point of view of assistive technology. He stressed that its purpose is not to force people with disabilities to do things in a specific way, but rather to make those tasks just as easy for them as for anyone else. This made me realize that assistive technology doesn't have to replicate the typical way of doing things but can offer alternative approaches that work just as well. This concept was especially relevant to my individual project, a wearable digital compass. While sighted individuals rely on visual cues to determine direction, such as major landmarks, my device uses haptic feedback to provide simple cardinal directions or relative directions of landmarks to those with visual impairments. The goal is to provide equal access to information, regardless of one's abilities.

Overall, I deeply appreciate the learning opportunities in this class. As an engineer and designer, it reminds me to embrace different and think from different perspectives while designing products. As both an engineer and a designer, it serves as a reminder to approach product design from various perspectives and to embrace diversity. Through

this class, I have gained a deeper appreciation for assistive technology and the positive impact it can have on people's lives. In fact, I am now more inspired than ever to devote my future career to developing technologies that make a positive impact in the world.

[REDACTED]
Dave Jaffe
ENGR 110
20 March 2023

Individual Reflection

Value of Design Process

Each component of the design process proved helpful in its own way throughout the course of our project. Hearing from different professionals and users in class was very insightful and helped build a foundational understanding of the challenges those with disabilities face and different methods of approaching and addressing those challenges. In particular, I felt the talks by Gayle Curtis on understanding problems in the context of assistive technologies and by the various Stanford Students and Faculty with disabilities on different perspectives were most helpful in designing a prototype that could be used by the general public.

Doing background research and observing competitor products was also valuable. Before designing something from scratch, it was eye-opening to see what solutions already existed on the market and how we could even improve on those solutions. While conducting the research, we were also able to take inspiration from unique sources (e.g., calligraphy practice boards → water canvas) to generate novel ideas.

Interactions with Users, Community Members, Guests, and Professionals

We met with [REDACTED], CEO and Co-Founder of the Magical Bridge Foundation, who provided valuable insights on the history and current design of the Magical Bridge Playgrounds. Understanding that we needed to design a durable, functional, *and* enjoyable prototype for a large number of users with various abilities was crucial. Her comments helped guide our work and informed how we approached testing with people at the playground. The feedback we received from interviewing children and parents and the Magical Bridge Playground was perhaps one of the most valuable parts of the design process. We were able to see what worked, iterate, and re-test our prototype to ensure our design criteria were mostly satisfied. By observing what people did, and not just what they said, a better prototype

was developed. Both [REDACTED] and our interviewees' feedback helped us make the pivot from designing universal paint brushes to focusing on our Magical Canvas.

There were a few key moments during our interviews and testing that were especially impactful. First, one of the children with autism who tried our prototype was playing on the swings and didn't want to get off when we initially approached. However, upon seeing the water and canvas prototypes, he immediately ran over and wanted to try our prototype. This was an extremely validating experience. We also had multiple parents that said the inclusion of "finger painting with water" was extremely interesting and alleviated the majority of concerns they had regarding mess, safety, and the need for oversight. Each of these interactions was exciting and motivated us to create a better prototype for our next iteration of testing.

Future Process and Things to Do Differently

If I were to go through this process again, the main thing I would do is engage [REDACTED] and the Magical Bridge team more. Near the beginning of the quarter, we had more frequent interactions with the team by visiting the playground, checking in on progress, and brainstorming together. However, in the second half of the quarter, we relied more on going to the playground to do interviewees and less so on [REDACTED] expertise, which was a shortcoming on our part. We should have better leveraged [REDACTED] understanding of the space and aligned better on expectations.

Regarding support from the teaching staff, I really appreciated the availability of the team throughout the week and after classes to discuss blockers and questions we had. I would tell future students to engage heavily with their community partner(s), try out multiple prototypes (pivot quickly) before settling on one, and make the process fun! The community partners are part of what makes this class special, so don't waste the opportunity to maximize those interactions. We could have also constructed a better final prototype if we tested multiple ideas at once (e.g., paintbrushes *and* canvas at the same time). Lastly, this process was also very fun, so be sure to not lose sight of that.

Additional Questions & Considerations

How did you hear about this course? Why did you decide to take it?

A friend of mine mentioned they took this course as a lecture series last year and highly recommended it! Having taken another course on accessible design in the past, this course was particularly intriguing.

What did you or your team do that seemed to be effective or ineffective? What can/did you learn from this?

Our team was great at testing out our prototypes and making iterations, however, the initial brainstorming and idea selection process was more difficult. We had a lot of ideas but did not fully commit to one until a little later in the quarter. Being more aggressive with idea selection would be helpful in the future, especially when working with limited time.

In what ways do you think the course further prepared you for your professional career? How does this course relate to your career plans? Is there a direct or indirect relationship?

As someone who wants to pursue product management in the near future, the process of talking to users, brainstorming, ideating, project managing, and soliciting feedback will be incredibly useful. Moreover, with every product I hope to develop in the future, I always want to be building it from the lens of accessible design!

ENGR 110: Perspectives in Assistive Technologies
Lecturer Jaffe
20 March 2023

Individual Course Reflection

ENGR 110: Perspectives in Assistive Technologies, is one of the most important classes I have taken at Stanford. The content learned in this class should be a requirement for all majors, especially for disciplines that intend to create products or technologies that others will interact with worldwide. I went into ENGR 110 thinking I understood what it means to have a disability. Nonetheless, the lectures provided by David Jaffe, along with the community members taught me more than I ever could have imagined. We were exposed to invisible disabilities like ADHD or brain injury and visible needs like quadriplegia, paralysis, cerebral palsy, and more. The members made it known that working on products to help with a particular disability is truly not enough. A powerful technology must be fabricated with the individual(s) who would benefit the product. Engineers are quick to find a problem to solve but forget that there is often an important context that will be missed if the design process does not include input from someone with a particular disability.

I will remember many lectures for years to come, but some of my favorites have to be the robotics technology we learned about that can aid in walking for quadriplegics. In addition, we saw community members come together to share their startup ideas or demonstrate the robustness of their wheelchairs by running into columns during class. These lectures shared the importance of thinking outside the box when developing a prototype. Yes, there is often a specific challenge to overcome. However, many other factors could lead to an even better design.

A wheelchair user may want their wheelchair to get to class every day. How do we make that accessible? How should the wheels break? How can you design high-impact cases or prevent the user from falling forward and getting injured? These are questions designers may overlook due to their misunderstanding of the context. This course was an experience like no other, and I am so happy to have stumbled upon it. I had never heard of ENGR 110 from another student. I, on the other hand, will share my experience with everyone around me.

Going into ENGR 110, I was apprehensive about having to work with a community member due to the busy schedule that a typical student engages with. However, I quickly learned that when projects have important and tangible applications, it becomes very easy to create time to do that project well. This class was such a joy and I felt that everyone in the community was there to improve the lives of others to the best of their abilities. The learning environment was a space of comfort where engineers and non-engineers came together to work on something powerful.

My team, [REDACTED], was such a pleasure to work with. The powerhouse group consisted of two engineering students and two non-engineering students who worked together with [REDACTED], our community partner, to help him with charging his iPhone. Our team's diverse backgrounds aided in our design process because we effectively leveraged each other's strengths. While working with [REDACTED], we found it extremely useful to stay on a consistent schedule with clear communication. [REDACTED] brought light to certain design choices we did not think about, highlighting the need to have disabled people provide the necessary context. I also enjoyed our ability to design together and share our respective insights into the process of making a prototype. This project reinforced the value of teamwork when everyone puts their best effort forward.

I can say I am leaving ENGR 110 feeling fulfilled and thankful. I truly wish Stanford could find a way to share the knowledge this class gracefully gave to us with every student. For future students, I would suggest that they stay diligent when fabricating their prototypes. Work on the project each week and develop consistent communication with your teammates! [REDACTED], [REDACTED], [REDACTED], and I did well with these skills, making the process easy and enjoyable. I do not have any apparent things I would do differently if I were to relive this experience. As demonstrated by all of the teams this quarter, engineers and non-engineers can come together to fabricate prototypes with potential when we directly work with individuals with specific needs.

As someone who has never taken an engineering course before, this was an incredible learning experience for plenty of reasons.

1) Centering Disabilities

As someone with a disability, I have never taken a course where there was so much engagement with supporting people with disabilities which makes me sad. Of course this class is centered on creating assistive technology, but the way that the curriculum was presented reflects a lot of intentionality that I really value. I felt uplifted in this course as speakers who came left a moving impact on me.

2) Design Thinking

I have never engaged in the design process, especially not one that involves creating something for a person. I learned so much about the role of engineers in helping create a better life experience for people. Through creating Hify Sleeve, I learned so much about the immense amount of assistive technology that is yet to be created. I am constantly questioning my role in the STEM field, pushing myself in courses like these has built a base knowledge that I can utilize in my future projects to provide insights to my future teams.

3) Team Dynamics

This team experience was very different to others, I have never been in this type of dynamic prior. I had to learn to be patient, as I was not capable of tackling more work than I did. I think I have learned that there are just different priorities for people, and that there will be times in your life where you have to take a fall for something that isn't fully your responsibility. It is a part of the learning process, because you will always have to work in teams. I personally have learned that I have to be very intentional with my team selection when given the opportunity but, also I believe that I could have been better at facilitating. Given my family being housing insecure, dealing with ADHD and Bipolar medication issues, in addition to having a passing in my family. I genuinely believe I did my best. I have to come to terms with this, and reflect that although I have always been an A student, there are times where you have to give yourself grace. I do not know exactly what my teammates are going through, in fact, I assume we all just had a really tough quarter.

Thank you, Dave, I am so grateful for your energy, time, and patience. I recognize I was not the best student this quarter. I really was not my typical self, but despite personal circumstances I felt very safe reaching out to you. Amidst chaos in my life, I really appreciate your serenity. You believed in me, did not pity me for my circumstances, instead pushed me to keep moving forward. That is really powerful to me. I wish you the best.

ENGR110 Reflection

It was a wonderful experience to be able to be a part of this class and community and gain so much new exposure to assistive technology. I loved getting to listen to different guest speakers every session who presented on such a wide range of topics and wide diversity of technologies. It was also a wonderful experience to get to see what other projects that everyone in the class worked on and the design process for all of the prototypes made.

I think the guest speakers were most useful for just broadening my knowledge and exposure to different ideas, though they weren't directly related to what we were working on or really any of the projects. My team worked with the Magical Bridge Playground and we were able to interview members of the Magical Bridge foundation as well as playground-goers and families and other members of the Palo Alto community. It was interesting and useful to get to listen to real feedback from people who our ideas would directly impact. It was also useful to be able to test and prototype with playground-goers. It was more difficult to do background research because it was hard to pinpoint an idea initially – because we had to come up with an idea ourselves instead of having a specific one in mind, I feel like we weren't able to go in depth or breadth enough. If we had a single idea to start with we might've been able to do more research and background work and go more specifically.

The most rewarding part and the most interesting interaction was to work and playtest at the playground with people who were able to test our project with. It was really fun to watch the kids at the playground interact with our canvases and see how excited they were to try the things that we made. It was also really helpful to get feedback from the teaching staff and [REDACTED] and hear from the other playground team as well.

I would try to do more research if I were to do things differently and try to go deeper in the prototyping process. I think our difficulty started in the beginning because we didn't really know what idea to go with and felt rushed at deciding on one. Had we had an idea in place for us already, I think we would've been able to do much more targeted and specific research and work directly with the stakeholders. It would be more seamless to work directly with one person as well and be able to tailor is perfectly to their wants and needs and get to test things out as we went, instead of creating a general-use interactive exhibit for the public because that takes into account so many more perspectives and it's harder to create something that targeted.

My team worked on the leash project with [REDACTED] and [REDACTED]. None of us have mechanical engineering background, so there was a lot of learning involved, but I'm happy with the results we achieved.

In terms of the class sessions, I think the most directly useful lecture for the team project is Dave's lecture on respecting and interviewing project suggesters on week 2 Tuesday. When working with [REDACTED] and [REDACTED] after class sessions, especially when there are multiple groups trying to get their work done at the same time, there are people who would walk up to [REDACTED] wheelchair and just start trying to fit prototypes on the wheelchair without saying hello first. I don't think this would happen if [REDACTED] is an able-bodied person. I also noticed people's tendency to talk to [REDACTED] about project needs first and talk to [REDACTED] more as an after thought. I feel this tendency improved over the course of the class as people got to know [REDACTED] as a person more, but there are still areas for improvement. [REDACTED] and [REDACTED] are both great people to be around. Everyone loves the energy [REDACTED] brings, and I hope people can appreciate [REDACTED] more as well.

The rest of the class sessions are less directly useful to our project, but I appreciated them a lot as well. It was cool to hear about the different perspectives. Among the guest speakers, Josh left me the greatest impression. It particularly resonated with me when he said when he went to college, he did not get involved with the community of people with disabilities because he wanted to live the "standard human experience." I was also amazed by the community he had at Berkeley considering it was back in early 2000's. In comparison, in my home China, Gaokao for blind students only first happened in 2014, and there were only five blind students taking Gaokao in 2022. I also know that there exist a lot of problems with K-12 education for d/Deaf students in China, while in America there is even a university for d/Deaf students. On top of that, there is basically no attention to invisible disabilities, while here in the US I'm proctoring a final exam with extended time and reduced distraction accommodations right now. There is such a long way for China to go in terms of access to education for students with disability, and I think it's so important to close the gap, as like Josh and some other speakers mentioned, it's important to have people with disability in workforce to

have more universal designs, which is not possible if students with disabilities struggle to even get into colleges in China.

Several other speakers also opened up new perspectives for me. I remember Mary's work on making space travel accessible. This is such a cool concept to me because we are having accessibility in mind before space traveling actually become a thing for the general public instead of making accessibility an after-thought.

For the designs where it's too late for accessibility to not be an after-thought, it's where the team projects come into play. I'm especially proud of coming up with the idea of using magnets and taking advantage of the fact it's hard to pull off magnets vertically but much easier to peel off. Though, this design relies on the fact that [REDACTED] is a very disciplined service dog, so the attachments don't have to be very strong to keep her under control. I hope someone can come up with an accessible method of leash attachment that is strong enough for any dogs and make it into a real product.

Reflecting on the team experience, I think my teammates are great and put in their work, which is more often not the case when you form a team with people you don't know before. I think this is partly due to the nature of the course, so people who take the class are typically people who care about the subject and want to do well. Though, I think our experience would have been better if we had someone with mechanical engineering background. Our classmate [REDACTED] helped us with a 3D printed prototype after the final presentation. I think it was great and we probably could have done that ourselves if one or some of us knew how to do that prior to the class. I didn't attend week 1 classes due to COVID isolation, so I have little idea how most of team matching happened, but I think it would be great to have a way for people to indicate their expertises for better team matching. For me I could only see the students' project choice ranking on the course website and try to email people who ranked projects I liked high. I remember waiting a while for the first group of people I emailed to get back to me that they already formed a full team then panicking everyone would already have a team. I hope there's a way for

students positive for COVID or otherwise unable to join the class in-person to attend remotely so the experience would be better.

Overall, I really liked the class experience and would definitely recommend it to other students. I know a lot of students try to do some personal projects so they look better for job applications, and projects in this class can be a great choice for them to showcase professional skills and make a positive impact at the same time. Hence, I hope there will be more advertising efforts for this class.

ENGR110/210 Winter 2023

Individual Reflection of Class and Self

THE MACRO

All through the engineering curriculum, I have never taken a class that so wholly satisfied my desire to positively impact someone's life through my work. Working with a project suggester from the start of the quarter enabled me to create a piece of assistive technology that really hit the mark and enabled her to live a happier, fuller life. It may sound a bit preachy but it's true that my efforts in this class did enable my project suggestor to experience more of life and march unafraid into situations that were previously off limits to her. For the opportunity to make that impact, I am extremely grateful.

For the amazing, passionate guest speakers I am also grateful. Meeting people that are so involved and important in the assistive technology space gave a sense of depth and gravity to the field. It always felt as though each lecturer had spoken to the last; threads of each talk seemed to lead back to the intention for growth.

THE IMPORTANT

I have spent the past quarter interviewing community members, brainstorming, doing background research, hearing about prior projects, fabricating and testing a prototype device, presenting in class and writing papers. Throughout it all, one thing stood above the rest in terms of project criticality, course understanding, and personal satisfaction: learning. Every step of the

way I learned something new. I learned about robotics, wheelchairs, prosthetics, audio-visual software, user experiences, design intentions, triumphs, failures, and passion from the guest speakers. I learned about needs, hope, adaptability, and perseverance from my time working on the project and speaking to my project suggestor. I learned what it meant to be an engineer with so much experience that he could teach a seminar on assistive technology from Dave. I even learned a little about chocolate chip cookies.

In reflection, I do see that perhaps at its most fundamental element, the class should hinge on learning. That is, after all, what school is about. I think while that's true, the reality is that so many classes in higher education centralize benchmarks and flashcard level memorization. While in another class we may have been quizzed against a book on circuit board connections or cantilever beam bending or vibration dampening, in this class we were tasked with coming to understand our subjects and exercise our knowledge to create something real. Perhaps even further beyond something "real": something impactful. Again, it seems like positive impact is at the cornerstone of all that engineering sets out to do. Yet this is only one of two classes I've taken that produced from my learning and hard work something impactful. Whether that says more about me or the course, I'm not sure. What I do know is that learning everything I could in ENGR110 allowed me to overcome an engineering challenge and produce something I'm truly proud of.

THE LOGISTICS

Time flows uniquely in ENGR110. While in other classes week 3 and 4 may feel optimistic and comforting, this class feels like a world finals chess match. From the start, you're on a tight clock and you know what you have to do to win. Before you know it, mid term reports roll around the

corner and your first round of user testing is under your belt. After you blink, you're standing in front of the class giving your final presentation. You shake your head and rub your eyes and. It's week 1 again. You look around the room at your classmates. You hear from all the project suggestors again. You know you're on a tight clock and you know what you have to do to win.

My advice for someone taking this course is the same as Dave's: start early and don't stop until you've made something that makes you proud.

CONCLUSION

Standing just past the finish line, what is it that I feel? When I look inward now, I see that I have achieved what this class gave me to achieve. All I've built has been built on the framework of this course. The personal values I've carried into this course have been mine all along and perhaps that's why I stand here now, proud of my work. This class is a great vehicle for students to exercise their will and values to innovate and realize a change in the world, however large or complex.

Coming into Perspectives in Assistive Technology, I didn't know exactly what to expect but I was hoping to learn about advances in assistive technology and the potential impacts they could have on people's lives. What I got out was much more, which will shape how I think about design and technology in the future, even outside of assistive technology. From the very beginning of the course, we focused on the user and how the language we use and the devices we design can either hurt or help people. People don't want pity or to feel like they need to be helped, they want to be independent and improve their quality of life and that should be the goal of assistive technology. One of the most important lessons was that assistive technology can help everyone, regardless of who it was initially intended for. Thoughtful design should be inclusive of all people as we observed at the Magical Bridge Playground. All of these lessons can be applied to the work I do no matter what field it may be in.

For me, the various speakers we had in the class provided valuable insights into the design process. It was interesting to see the different ways people identified problems and how they scoped those problems. Dr. Katherine Strausser, for example, was working on an exoskeleton technology that could solve a myriad of problems for a general user. On the other hand, Gary Berke focused on creating technology for a specific problem and user. Meanwhile, Peter Axelson created solutions to problems he himself was experiencing. Hearing all of these different ways of identifying and thinking about problems really helped give me a more holistic view when working on my own team project. We later got to see the end of the design process with the Assistive Technology Fair. At the Fair, I got to see the fruits of the design process and how people took an initial problem and came to an eventual solution. It was fun to see all of the creative solutions I probably wouldn't have come up with. It was also interesting to try out different technologies and I

came away thinking about how many of them could benefit all people and not just those they were initially designed to help.

The most interesting part of this course for me was working on the team project. Unlike most other engineering classes I've taken where we've looked to create a general, scalable solution, in this course, we focused on a single user and making something that specifically benefited them. This required a new way of thinking that's centered on a single user. In some ways, I found this easier as there was less of a need to assume what people would want as we could just go directly to our project suggestor to determine their preferences. When all of the potential projects were initially pitched, I was immediately drawn to [REDACTED] aesthetic prosthetic leg project as it was at the intersection of form and function, allowing for artistic creativity while also utilizing my engineering skills. Working with [REDACTED] was a very enjoyable experience. She was very supportive and enthusiastic about everything we did and as a student, she understood the stress we were under and helped us scope our project appropriately. Working with my team was also enjoyable. Some of us barely knew each other at the beginning of the project but we worked together well and became good friends by the end. I enjoyed working with my team through the entire design process. Even though I'm a mechanical engineering student concentrating on product realization, this project allowed me to explore four new processes I had never done before. Through this project, I learned thermoforming, laser cutting, vacuum forming, and vinyl cutting. These skills will be valuable for many future classes and work-related projects. The most fun part for me was designing and making the vinyl overlay as it challenged me to come up with a design that would satisfy Mary based on the preferences she expressed in the interview. Though the project was overall a very rewarding experience, there are several things I wish we had done differently. First, I wish we

would have begun working in earnest on the project earlier. As the end of the project neared, we were scrambling to get our first working prototype meaning we didn't have a lot of time to iterate. Part of the problem was that we were all in the capstone. I think doing both projects was manageable for me but if I could offer advice to future students, I would suggest that they ensure their teammates aren't all in the capstone. Finally, I think if we had met with Dave more, we would have gotten more insights that could have helped us avoid some of the problems we encountered.

In summary, I learned a lot from this course and thoroughly enjoyed it. Though the course is about assistive technology, I think the most valuable part was learning about people and thoughtful, inclusive design in general. Getting to talk with and hear from so many different people from a range of backgrounds has reshaped the way I think about design and how I interact with others, making me a more intentional engineer. I'm proud of the product my team delivered and the new friendship I have with [REDACTED]. Overall, this course will have a lasting impact on everything I do going forward.

This class was my first engineering course here at Stanford. I was both nervous and excited to try my hand in a whole new field and the project I chose to work on was a nice level of difficulty for a beginner in my opinion. I worked on the leash attachment with [REDACTED] and [REDACTED] and [REDACTED]. I am so thankful to have met these individuals because I feel like we will continue to be friends outside of class, and they have given me a lot of perspective on the kinds of problems wheelchair users face everyday. Making sure the chair will still fit through doors, not inhibit the break or block any crucial parts of the chair were things I would not have become privy too without [REDACTED] feedback and participation in this process. Also [REDACTED] tells some great stories and jokes that I was happy to hear.

I am also proud to have picked up some new skills thanks to this class. First I got my safety certification in the PRL, a place I had no introduction or need to use prior to this class and I was surprised by the amount and variety of projects that were being made there. Many of them were for leisure and it was exciting to interact with community members who are very knowledgeable in the tools. The vinyl heat press, sewing machine and wood cutters were the devices that I learned how to use during my time in this class and I feel that most of them are just good life skills to have. By the end of the class I was also being introduced to 3D printing from our classmate [REDACTED] which was extremely helpful and an exciting prospect for future projects. By the time the course ended I was happy to look back at the first prototypes we created and see how much more streamlined they had become thanks to these skills. Now I have an excuse just to go to the PRL and build things that I find interesting or fun in my free time.

The guest speakers that visited throughout this quarter had some great advice that helped steer the development of our project. The main takeaway from almost every speaker was that you have to involve the person you are designing for in the process in order to create something truly valuable for the user. It is easy to say this but can be

harder to do in practice and most of the time the major changes we made to the prototype were after testing things with [REDACTED]. He pointed out issues with it, we got a chance to observe and make changes we saw fit and I feel this kind of teamwork is crucial to all design processes regardless of whether you are dealing

I was excited to hear from individuals who knew nothing about the project on the last day of class when we tested the prototypes with everyone around because it was a fresh perspective on the approach we took to the leash. Many people said that the product we developed would be helpful for many other wheelchair users with different disabilities or similar disabilities to [REDACTED] because it can give users access to an experience they would not have otherwise. For example, someone mentioned that a child who has a dog, perhaps not a service dog, does not usually get the opportunity to walk their dog and this leash attachment could change that. It was exciting to see our project in action because it was nurtured from an idea to a real life, helpful product that has potential for more.

As far as group dynamic I was bummed to have a group where every member was not participating equally. Many of the tasks from the start of the quarter like brainstorming ideas and drawing them up, all the way to the end of the quarter such as being in the PRL and actually making the prototypes were taken on by myself and another teammate. I did not bring this concern to the teaching staff during the quarter because it was not for lack of asking for participation, it was more so a lack of effort in the execution and I felt that could not be resolved by teacher involvement. Something I would like to see in the class in the future are a few more days to work on the project in class. I think this would generally help with group issues like mine where finding time outside of class was very difficult and led to group members not being on the same page later in the course.

If I were to redo this course, I would have looked into how to 3D print earlier. I think my lack of experience scared me away from some devices that could have made our project stronger and I wished I had taken a stab at it sooner. Currently the course

material is not directly related to the professional goals I have set for myself. However I am intrigued by the crossover between business and assistive technology that we saw in multiple places across the quarter. The fair was a great place to see some start up's in action and the robotics guest speaker opened my eyes to an entirely different professional space than I have been looking at. While I do not think I will switch my internship plans over to an assistive technology based one right now, I will keep my eye out for opportunities that crossover with more of my interests and see how I might play a role in creating change.

ENGR 110
Professor Dave Jaffe

Individual Reflection

Overall, I had such an amazing experience taking this class! This was my second time taking a class that was centered around learning about different types of disabilities. My first class was CHEMENG 90Q: Dare to Care: Compassionate Design where we mainly focused on brainstorming ideas for solutions, and building our presentation skills. It was a good overview of some of the topics that were discussed in this class and I'm really glad I was able to be a part of both of these classes as they focused on different things. I thought that taking ENGR 110 after the introsem was a great way to drive deeper into some areas I was interested in. The one thing I really enjoyed about this class was the ability to be able to make something physical and also work in a team environment. I mainly took this class to 1) learn more about the variety of areas with accessible design and 2) create a meaningful project that will help others and I was able to meet both of these goals from this class!

I had a fantastic time working with my team members and working with the Magical Bridge Playground. By having the different guest speakers come into the classroom to discuss the area they have worked on, it gave us valuable insight into the brainstorming process for our group because it allowed us to consider different ideas. We also got the opportunity to meet with [REDACTED] and take a tour of the Magical Bridge Playground to get an idea of what are some possible ideas we could work on. We got to understand their mission alongside seeing the types of people that visit the playground. I think the most valuable aspect of our project was fabricating and testing our prototypes with different materials and asking for feedback from people at the playground.

We were able to narrow down the scope of our project to something that was able to be reasonably complete by the end of the quarter. In addition, we were able to understand the major pain points for users that attend the playground and areas of improvement that they wanted to see for their future visits.

During one of the interviews we had at the Magical Bridge Playground, a parent mentioned that they were very concerned about the idea of water being present in a cup at the playground as their child might go up and drink it. After this conversation, we rethought the way that water was placed in the playground and also the idea of having a paintbrush. We were able to make several adjustments after our visit with the removal of the idea of a paintbrush as it would be difficult to secure it safely to the fence on the playground, and we also got rid of the idea of having a cup with water for painting. We decided to move forward with using fingers to water paint and conceptualizing different ideas for how the water would be placed out in public such as having a sponge wall or a water fountain. These types of interviews on the playground were influential in the design and development of the project!

If I were to go through this process again, I would have tried to get more time interviewing more children at the playground, especially the older ones. During this project, we ended up mainly conversing with parents and their young children as we didn't feel comfortable going up to children that were not with their parents. I think interviewing a wide range of children would have helped us with more ideas for our project as we would have gotten different types of perspectives. In addition, my team and I should have organized meetings as a team more often but it was different as we were all seniors, we all had various senior capstone classes and other duties that prevented us from having the best schedule to constantly be meeting when we could have separated the work individually.

██████████

ENGR110 - Individual Reflection

This class was my favourite class I've taken over my four years at Stanford. Going into the class I knew several students in the class and ultimately chose to work with my friends ██████████ and ██████████. I've taken a number of classes with ██████████ and our group projects always turned out well so I wasn't worried about us both being STS majors and him having little engineering experience. What I didn't realize was that ██████████ also had limited engineering experience as well. Adding ██████████ to our team made sense as he studies ME and we needed someone with that expertise. Throughout the project however, there was an uncomfortable dynamic between our team members. Early in the project, the three of us without engineering skills felt we had to overcompensate and took on a large part of the workload. Additionally, our team struggled with communication as ██████████ communicated solely with me, ██████████ hardly communicated or did anything other than build our prototypes and even while ██████████ helped me try and coordinate, a lot of stress was added to my plate. I went into this class expecting to have productive project meetings each week and planned to dedicate hours to the project, and I expected my efforts would be mirrored by the team. Overall, I enjoyed working with my team but I was rather disappointed about how things like our presentations and reports came together. We had an incredible time working with ██████████ and ██████████ and created relationships I will cherish forever, making everything worthwhile.

In high school, I was a member of my school's Best Buddies chapter, but since then I have had few gratifying experiences like being a part of Best Buddies. This class

reminded me of that passion I have and was incredibly gratifying though. I think there are a few moments in a student's education that can shape them and their future, and this class was one of them for me. I came to class each week excited to learn about new technologies and hear the stories of our guest speakers (despite having been awake for almost 12 hours at that point of the day). The structure of the class allowed us to have an engaging learning experience and learn content that is taught nowhere else. While our project didn't relate directly to any of the high-tech technologies discussed in class, we gained valuable perspectives which allowed us to approach our project from different lenses.

Our team was beyond lucky to work with [REDACTED] and [REDACTED]. From my experience, it can be easy to be absorbed into the bubble that is our university. I've taken countless classes where I finish the quarter having learnt content but didn't grow as a person or even a student. Something funny that I discovered over the course of the quarter was that *everyone* knows [REDACTED] and have had a meaningful interaction with him. After class and chatting with [REDACTED] and [REDACTED], I usually went to dinner with my teammates and having missed practice for the class I was always asked how my class was. Every dinner I'd sit down and look forward to talking about [REDACTED] and [REDACTED] or even just talking about how cool the class was. By the end of the quarter, I had convinced a couple of teammates to take the class next year!

If I were to take this class again, I think I would approach it with more confidence. While my CAD skills are limited, I think I bring a lot of passion and creativity to a team. If I had another year here, I would definitely take this course again if not for the project, but for the people. This course attracted a unique group of people with diverse

backgrounds and I really enjoyed seeing not only the thoughtful solutions teams came up with over the quarter, but hearing about their learning experiences and seeing the relationships they grew too.

ENGR 110

20 March 2023

Final Reflection

I had an amazing quarter in this class and I will remember my experience for years to come. Throughout my experience in the class and team project, I have come to realize the true value of the process toward our final product. Reflecting on my experience has allowed me to appreciate the value of the various stages in our project, which included doing background research, interviewing project suggesters, brainstorming together as a team, looking at prior solutions, fabricating and testing a prototype device, and implementing feedback.

Working with [REDACTED] was my most memorable experience. I learned so much from testing and iterating with him. At first, the nature of [REDACTED] cerebral palsy made designing difficult because his limited hand dexterity and low vision were conflicting parameters for designing a leash attachment. It took a lot of testing of initial prototypes to get our idea to the right place. I think the most important part of designing for someone like [REDACTED] is designing with him instead of just designing for him. Many of the guest lectures have echoed this sentiment, and I believe that this is the core value of our project.

The different interactions in the class, including interactions with project suggesters and their families, guest lecturers, and professionals, contributed significantly to the results of our design. Each of these interactions provided a unique perspective, and their input was vital to the success of our project. The most rewarding

interaction for me was working with [REDACTED] and [REDACTED]. It was inspiring to see how our work could make a real difference in their lives. Hearing about the process from guest lecturers who created products helped us make sure we were approaching the process in a meaningful way.

If I were to go through this process again, I would emphasize the importance of team communication. I think I did my best effort to contribute to as much of the building process as possible, but two of my group members are very close friends who lived together. They commonly worked together on the project in their free time, and I would come along and work with them whenever possible, but there were some times when their work was not communicated to the group. I believe that we worked well together, but I would have liked to work with the group more. I did come into the PRL many times and helped with the physical product. I also made myself useful by helping with written and presentation materials for the reports and presentations. My background in public speaking helped our team succeed in our midterm and final presentations.

Reflecting on my experience, I would advise future students to be mindful of time. I believe my group did an excellent job of working hard on our initial prototypes early on. I also think that initial iteration is really important, especially for groups with less mechanical engineering backgrounds that need a lot of experimentation, like my group, where no one had a mechanical engineering background.

In conclusion, I am grateful for this experience, as it has taught me so much about designing for and with people who have different abilities. I also appreciate the importance of structured reflection, as it has allowed me to step back and make sense of my experiences in new ways. The process of designing the leash attachment for

██████ was a rewarding and inspiring experience, and I hope that our work can make a real difference in his life. ██████ and his family were so kind and grateful for our hard work which made the experience all worthwhile! Also, Dave supported and guided our team to success throughout the quarter with his years of experience and wisdom!

██████████
21 March 2023 -- ENGR 110

Individual Reflection

The impact of Perspectives in Assistive Technology on me...

It was a privilege to be part of *Perspectives in Assistive Technology* this quarter. The project I engaged in on behalf of ██████████ was stimulating and captivating. Much of the impact this class had on me derived from the project of course, but much came from the guest lectures. There are few opportunities in the real world, at least in my experience, to speak with people candidly about their disabilities. This class presented a unique and formative opportunity to hear from people challenged in different aspects their lives by a world built for the able bodied, a world that in countless ways is indifferent to their particular needs.

I will admit that the impact the lectures directly had on my specific technical contributions to the design of our covering for ██████████ prosthetic leg was limited. But that is not at all to say that the lectures did not have tangible contributions to our project. I will forever remember so many things brought to light by our guests during their talks. Dr. Lindsey Felt enlightened us about the 22 channels that allow hearing to be achieved via cochlear implants. I had no idea how subjective the tuning of sounds is when played into the implant wearer. Peter Axelson described some of the more significant difficulties when flying for persons who are wheelchair bound. I had not considered tip-over likelihoods of the thin wheelchairs that are used to escort people down the aisle inside of the airplane or that the cargo compartment doors on many aircraft are simply too small to fit a motorized wheelchair. These are among many issues I was alerted to this quarter that can be essential to considering how targeted engineering, assistive technological advances, can change the world in ways that benefit all of our lives.

That said, the instructive stories brought to class by the guest lecturers complemented my contribution to the development of a solution meeting ██████████ needs. ██████████ was

focused. She needed a casing for her prosthetic leg that would convey a look more like a normal leg and could allow her a certain creative expression. That immediately dictated the shape of our design. We also understood inherently that the casing we provided Mary would have to be lightweight, durable, and inexpensive. Our project was reasonably well scoped from the get-go. It is why I advocated that our team engage this class as an opportunity to learn about a form of manufacturing that almost no one gets exposure to in the PRL, that is, vacuum forming.

There were plenty of projects taken up by other groups that would have benefited significantly from hearing about the lives of our diversely abled guests. The task given to the group working on an addition to the magical bridge playground was a project with a wide scope. Every guest lecture could contribute to designing an engaging game for all ages that considered color blindness, deafness, limited dexterity, cognitive ability, and more. Projects such as the magnetic leash for [REDACTED] also could benefit from hearing how many types of people use their wheelchairs and what their wheelchairs are subjected to when not in use. The device for [REDACTED] could certainly benefit from our guest who competes in Olympic-level quadriplegic basketball or learning about the extensive impact testing to which Peter subjects many wheelchairs.

While I am pleased with this class experience, there are of course things I would change about my own engagement in the class, if I were to do it again. First, I would take notes during all the guest lectures. I only began taking notes during lectures about key messages from the speakers in week three of the quarter. Unsurprisingly, doing so kept me more engaged during the guest lectures and increased the salient messages and observations that I took away from each talk. Second, I think I would have picked a more broadly scoped project. I very much benefitted from and enjoyed working with [REDACTED] and was impassioned about what we were doing for her. However, my interest in doing something requiring unbounded creativity to fulfill a broader and more diversified problem and its application was peaked when hearing about the work executed by several other groups.

While I was relatively successful in accomplishing my portion of our group's project without pressing it against the end of the quarter, not frontloading the work in this class is the common mistake I saw being made by students. A wonderful attribute of *Perspectives in Assistive Technology* is that the students taking the class come from a variety of programs and departments on campus. That, however, means that many students are unfamiliar with the unforgiving deadlines of major engineering projects that manifest as late-quarter deliverables. Anyone can take this class and be successful. Everyone who does so will learn a lot. But time management while curating a substantive deliverable for this class is a daunting challenge for all.

I had a very positive quarter in this class. [REDACTED] seemed to love the concealing and personality-rich product that we developed. After the product demonstration event on the last Thursday of class, [REDACTED], [REDACTED], [REDACTED], and I discussed that the pride and accomplishment we felt from this class was unlike any other course we have taken. We didn't just work hard, learn new things, and complete our project, we tangibly contributed to the betterment of someone's life. I see that as the most significant value this class offers.

Thank you for providing us, your students, an eye-opening class, the lessons from which will be with me for my lifetime.

Perspectives in Assistive Technology, Individual Reflection

I have been eager to take this course since my freshman year when I first heard of it through my upperclassmen friends. At the time, I felt that I lacked the necessary experience in engineering to take on such a course. As I progressed through my studies, I continued to consider the class, intrigued by the prospect of designing products in the assistive technology space. It wasn't until last summer when I was presenting my SURF project on a vibration bracelet for human motion guidance that I decided to enroll after Dave approached my poster and suggested that I take the class.

As the course began, I quickly realized that my expectations for the course had been misguided. Rather than simply participating in a product design class, I was quickly exposed to a range of perspectives and experiences outside the traditional product design space. I had the opportunity to hear from people in industry who were involved in the engineering of complex electro-mechanical assistive devices, as well as from individuals who used assistive technology every day. These diverse perspectives expanded my understanding of what it meant to design a product with a user's needs and preferences in mind. I learned that even the best-engineered product could be rendered useless if it failed to account for the lifestyle and preferences of its intended users. The structure of the class was equally engaging. From guest speakers to team presentations and product fairs to field trips, the experiences of the course were varied and provided ample opportunities to learn about different experiences and perspectives in the assistive technology space. However, the most valuable experience of the course to me was the team project.

I was fortunate to work with a well-rounded team that included individuals with backgrounds in product design, mechanical engineering, computer science, and electrical engineering, and our project was a great opportunity to demonstrate the abilities that each of us brought to the table. Every aspect of building the device that we set out to build was covered. With my background in mechatronics, I got to play the role of the person that linked the teams

together. This was a great opportunity to learn how team dynamics can look like in my future career. My academic career so far consists of taking many classes at the intersection of these fields, focusing on mechatronics and low-level computer interfaces but also mechanical design. Therefore, I found myself helping each of the members on the team with their tasks. I was the lead in selecting the internal components since I had more experience in consumer electronics and was heavily involved in the design and assembly of the housing and electronics. This experience was very new to me since I had always played a more specialized role in my team projects, but it was a great experience that validated my interests. Checking in constantly with the teaching staff and our project suggestor also greatly helped us push our project forward, and knowing that we could ask the teaching staff for help at any point made us feel supported throughout the process. Overall, this experience taught me the benefits of working with a committed team that has members with diverse skill sets. Without these qualities, I do not believe that our project would have been as successful or enjoyable.

When my friends outside of the course asked me about the classes that I was taking this quarter, they would commonly ask me about this course specifically. I would always answer with a general course description and tell them about the project that my team and I were working on, and they would always be very surprised by how different this class was from anything they had taken in the past. Most majors, including the ones within the School of Engineering, require little to no interaction with anyone outside of the course. Most of the learning is done within the boundaries of a textbook and homework problems, and there is rarely any discussion about the societal impacts of what we are learning, let alone interaction with anyone outside of the course staff and other students. This course challenged me to consider the broader implications of my work. It was the first time in my academic career that I had the opportunity to interact with individuals who would ultimately use the products I was creating. After every speaker that came to the class and every conversation we had with [REDACTED], I would have to reflect on my thoughts on the project and how I envisioned it going forward, which I think is an extremely valuable lesson to get out of the experience.

Omar Ramos Escoto

As the course came to an end, I was struck by how much I had grown both as an engineer and as a person. I had gained invaluable insights into the world of assistive technology and had learned to think more broadly about the impact of my work. Most importantly, I had the opportunity to work with a group of talented and dedicated individuals who shared my passion for creating technology that could help others. I can confidently say that the course had a profound impact on my growth and development not only as an engineer but also a person. Understanding that there is more to a product than how well it is engineered completely changed my perspective on developing technology.

[REDACTED]
Dave Jaffe
ENGR 110
20 March 2023

Individual Reflection

This past quarter in Perspectives in Assistive Technology has made me appreciate teamwork and helping a community member. Working with team members [REDACTED] and [REDACTED] and our community member [REDACTED] was a great experience which improved my brainstorming and communication skills. The problem [REDACTED] presented of not having a mobile support for her computer while on her wheelchair seemed like it would already have a simple solution, however, the existing solutions were not sufficient. I enjoyed the brainstorming and prototyping process, and I was glad that we were able to provide [REDACTED] a final product with her feedback.

During the quarter, I heard from different professionals and users during lectures which helped shape my perspective on the importance of assistive technology. I was not aware of how great an impact assistive technology has on people's daily lives. My team's interviews with [REDACTED] were informative and guided our design decisions. For example, we received feedback from [REDACTED] for which prototype she liked the most between our two designs (the between the legs support over the foldable lap tray). We also asked for her color preference, height of the lap tray preference, and preference for assembling the design. In addition to interviews, it was helpful to brainstorm with Dave. Our team was stuck on realizing one of our brainstormed ideas (the between the legs design), and Dave helped us make the optimal simplifications. For example, we simplified both the base component and the lab table by eliminating hinges and reserving hinges for future iterations.

One of the challenges of this project was obtaining background information on [REDACTED] wheelchair and improving our prototypes. Since her wheelchair, the WHILL Model M, was no longer in production, it was difficult to gather the exact dimensions. To solve this, our team contacted WHILL to receive a manual, and we made our own measurements of [REDACTED] wheelchair. Another thing I learned was how to be creative with prototyping. During our second iteration of the between the legs design, we realized that the base plate was not thick enough to prevent the table from wobbling. Since our current baseplate already had holes in it, we put threaded inserts into the holes of the current baseplate and into an identical baseplate to screw them together and double the baseplate's thickness. I valued the creative aspect of our design and being resourceful when prototyping, but what I valued most was interviewing [REDACTED] and testing our prototypes with her.

One of the interactions in class which I thought was most relevant to our project was hearing from Ralf Hotchkiss speak about wheelchair fabrication in developing countries. This interaction was valuable for us because it helped us think about the durability of our product and how accessible it was to make. Ralf spoke about the common problem of wheelchairs tipping over and his solution of using special front wheels. I found this very creative, and I liked how his design can be made almost anywhere with common resources. For my team's project, I think it would be helpful if future iterations could use common plumbing PVC pipe connectors instead of 3D printed parts so that the design is more accessible to make. Other speakers such as Professor Monroe Kennedy III, helped open my perspective on the capability of assistive technology. I thought it was inspiring how he used machine learning to help with artificial limbs and walking path prediction.

If I were to go through this process again, I would do more engineering analysis to find the proper dimensions of each component of our design based on yield strength and a factor of safety. For example, we could calculate the required thickness of the baseplate by doing a bending moment analysis which may have reduced our time prototyping. I would also like to have an outside perspective give input on our design so that we could catch any errors we overlooked while designing. What I would keep the same would be meeting with Dave for advice, testing our prototypes with [REDACTED], and continuously improving our final design. For future students, I would recommend having an open mind when brainstorming solutions and to avoid being fixed on one option. I would also recommend meeting with your teammates often to collaborate on our project.

In conclusion, I greatly enjoyed learning about perspectives in assistive technology and working on a team project this quarter. I learned the value of testing prototypes with users and being resourceful when prototyping. I also learned when it is appropriate to make design simplifications and reserve changes for future work. It was a pleasure working with Dave, my teammates [REDACTED] and [REDACTED], our community member [REDACTED], and all those involved in this class. This class was memorable, and I think this experience will help me with engineering in the future.

ENGR 110: Manufacturing Processes and Design
20 March 2023

Individual Reflection

Design Process

Coming from a background in Mechanical Engineering, I faced design challenges before in my project classes, where we had to design mass-optimized parts to support a certain amount of weight, incorporate different materials into a design for additive manufacturing, laser cut a non-rectangular box to be assembled without glue, and the list goes on. However, it is pretty rare as well as an incredible opportunity to be able to design with a user in mind like we do in this course.

It is one thing to solve a problem by meeting specific criteria, and it is a whole other ballpark to make something for someone else to use. One of the coolest moments in the class for me was visiting the Magical Bridge Playground with [REDACTED], learning about the place we were designing for, and being able to explore and see what a day at the park was like. It was inspiring to see [REDACTED] efforts to bring together anyone and everyone in the community, and something I had not realized before was that this was a broad user group that we were designing for. (This was a cool aspect of our project but also a challenging one.) Not necessarily in the sense that we were not making a customized product for an individual person, but [REDACTED] often challenged us to look at our device from as many perspectives as we can. How would a person with low vision interact with our device? What about wheelchair users? What about people and children with autism, parents with young children, and teenagers?

A part of making a device inclusive is designing *for* people across all of these differences, and the Magical Bridge Playground is a testament to the difference that it makes when accessibility is a design criteria and not an afterthought. This is one of the biggest takeaways from working with the Magical Bridge Foundation as a project partner, that inclusive design can bring everyone closer together.

Class Interactions

In order to successfully design for our users, there had to be a level of empathy and understanding involved. I think the structure of the class where we would hear from a number of guest lecturers paired really well with the work we were doing outside of the classroom on our projects. At the beginning, getting feedback from [REDACTED] was really helpful. She pointed out the tripping hazard of the very first iteration of our design and got us thinking more broadly about our users.

However, I think that the feedback [REDACTED] could give us could only go so far. The limitation of trying to design for everyone, or at least for as many types of people as possible, meant that we had to get that input as well during our user feedback stage. [REDACTED] was our ambassador and connection to Magical Bridge, but she was not a stand-in for everyone at the playground (something that was not obvious to me at first). For me, the most helpful interactions were the one-on-one interviews I conducted after our midterm presentation with my friends and family. I was able to take the time to explain our device, get in-depth feedback, and talk through different aspects of our design. It was also nice to exercise thinking about accessibility to include everyone, of all abilities, and that includes our own age groups and people that we ourselves are close to.

If I were to do this all again...

I would look for ways to get feedback from people throughout the design process once we narrowed down our idea to the two-person ball game. Once midterm season was among us, our team dedicated about a week towards getting user feedback, but I think that slowed down our progress toward building our device. On the flip side, it was difficult to work together as our schedules started to conflict more with one another's as the quarter got busier during that time amidst exams, and user feedback was something that we could do asynchronously. I do not have any regrets about how the quarter went, but this project in particular was challenging since we had to make a lot of the parts from scratch and were not able to depend on ordered parts as much as we might have liked.

Teamwork

Something I wish was not the case for our team was that we had a large range of abilities and familiarity with building and design. [REDACTED] and I (both seniors in ME) were more than happy to show [REDACTED] (CS) and [REDACTED] (IR) around Room 36, and it was really exciting to introduce them to the space and teach them some things about engineering! For instance, we showed them how to make rapid prototypes with pink foam, foam core, and cardboard for the midterm report and presentation. However, when it came time to build our project, [REDACTED] and I really could not depend on them to help CAD, laser cut, or 3D print parts. They were usually willing to offer help, but even when it came to ordering parts, they lacked the background knowledge to be able to select springs and other hardware for the project.

They were decent partners from a teamwork aspect. We got along well, and it was a fun experience overall. It was mostly our different backgrounds that put a limit on what each of us could contribute, and that was something that was difficult to find ways to work around. For example, [REDACTED] took care of ordering the parts from Amazon, but [REDACTED] and I compiled all of the product links. [REDACTED] came in late to help laser cut materials, but I was walking him through the steps as we went and had to prep all the files on my own. This is not necessarily critique of [REDACTED] and [REDACTED] — again, they were fine partners — but I think this was something built into the class with students from other fields of study, and I wish I had known to try and even out the level of experience in our team just for the sake of us all being able to contribute more equally.

(One moment that I think illustrates this well was when [REDACTED] was helping me laser cut. After a few hours, [REDACTED] left because he was getting tired. On one hand, this is understandable because he did not have the training to use the laser cutter on his own and was mostly watching as I set things up, but on the other hand, I was left alone to complete this key portion of our project. I was also tired and would have liked to have gone home as well, but the principle behind that action that rubbed me the wrong way was leaving early and expecting the project to still get done for him. There was not much else I could have done in this situation — for example, assign any work to [REDACTED] or [REDACTED] that they were capable of doing — besides pick up the extra work that needed to be done to complete our project.)

To another point, I felt as though it added an extra toll on myself having to teach and guide our team through how to go through the design process to help accommodate things and move us along as a team. I would not mind if there was ample time and energy in the quarter, but things get busy. At times, I felt that if I was not the one to keep tabs on things (sending reminders, making sketches, breaking things down into to-do lists), our team would not make progress, and it became draining. Even though [REDACTED] and [REDACTED] did not have much of a background in engineering, I do wish that they took more of an initiative to contribute rather than wait to be assigned tasks and that their contributions took less editing from [REDACTED] and my end when it came to both the report and the presentation slides.

It took additional effort to pull them in to contribute, and the contributions were even minimal at times. [REDACTED] fell through on agreed project progress more than [REDACTED], and [REDACTED] was generally checked-out this quarter. All in all, I would say it was a combination of lack of experience as well as a lack of proactiveness personality-wise that fostered the discrepancies in contributions across our team. I am happy with how our project came out, but the more in-depth I think about who put the time and energy into our project as a whole, I get increasingly frustrated once I separate who [REDACTED] and [REDACTED] are as kind people from how helpful they actually were as teammates. The fact that we even had a final device, I attribute to [REDACTED] and my dedication to finishing the project.

A Highlight Moment

One of my favorite moments from the class was when two other students in the course came up to our table and commented on how cool of a project it was and what a great cause we were contributing to. Imagining something like our game being built at parks, schools, and other public areas would be incredible, and seeing [REDACTED] excitement and interest in our device meant so much to me after dedicating so much time and effort this quarter on trying to deliver something of value to her and the foundation. With quarter-long projects I think it can be easy to get bogged down in the details of “how do I get this part to function properly?”, “what dimension do I make this?”, and “how are we going to pull this all together in the end?” that taking a step back at the end of it all and reminding ourselves why we were inspired to do the work that we did is so important. The fact that our own peers and classmates were able to do that for us

was a really beautiful moment, and I am so thankful for their kind words and that we had the chance to learn from and inspire one another in ways like this.

David Jaffe
ENGR 110
20 March 2023

End of Quarter Individual Reflection:

My team, the [REDACTED], collaborated with the Magical Bridge Foundation on a two-player goal scoring table game that leverages inclusive design. Hearing from our guest speakers and our community partner, as well as having the opportunity to visit the Magical Bridge Playground was a very formative experience. Before this, I was naive to the need for inclusive design and assistive technology because it wasn't something I was taught about in classes. This class opened my eyes to how many people benefit from inclusive design and how keeping accessibility in mind in the design process can help include many more community members.

The brainstorming process was very important in leading us to our final prototype because it allowed us to talk through the constraints we might encounter. The first was scale because it would be too difficult to create a life-size prototype of the design we had in mind. The 3D printing and laser cutting of parts would take too long or even be unfeasible for certain mechanisms and it would be too difficult to transport, as we were working from 3 different maker spaces. Our second constraint was our liberty to bring together a cohesive design with premade stock parts. Ultimately, we decided it would be best to build the prototype from scratch so that we could direct the vision of our project to a greater capacity and make it more accessible. Safety was another constraint. Originally, when discussing our idea with our teacher

and community partner we realized that it would actually be a tripping hazard to build the design into the ground and have components sticking out.

Background research was very helpful in teaching us how to make our design more inclusive. For example, I learned about colors, sounds, and motions that would be soothing to people with autism, high-contrast colors that could be detected for those with low vision, and also the need for sounds, so that people with low vision could track the game. I also learned about ADA standards and how to make our project wheelchair accessible and detectable for people with low vision and the blind.

Testing prototypes assisted us in evolving our design. Our original design was only 2 flippers that hit the ball back and forth with a choice of 2 different handle mechanisms and a button mechanism. Prototyping helped us realize that we needed additional components, such as a reset mechanism and a sloped play surface for gameplay continuity. While user research helped us finalize our button mechanism and aesthetic choices to keep playground goers the most engaged. User research raised additional concerns we had not thought of, such as the need for a cohesive theme and how a design we originally thought would be the most inclusive (handle mechanisms that could be used at different heights) was actually the least inclusive. Handles require more upper body mobility, and greater physical exertion, and detract focus from the actual gameplay. Thus, we decided to use the button mechanism instead.

An experience that resonated with me was when we talked to our community partner about different things we had to keep in mind while building, such as preventing over-stimulation, using the right colors, incorporating a theme, using tactile materials, etc. This made me realize how many different components went into building inclusively. When I realized this I became very impressed with how the Magical Bridge playground came together to create

such a cohesive, safe, and fun space for all community members. Especially, after visiting the ADA-compliant playground a few meters away from the Magical Bridge playground, I was astounded that inclusive design wasn't at the forefront of building things. Not only does the Magical Bridge playground not exclude any community members, but by creating a more accessible space, they pushed the boundaries of what a *fun* space could be.

If I could do anything differently after this experience, I would segment my work better. As my team members and I all had busy schedules and wanted to be active in all parts of the design process, we ended up having many late nights working on the project. In retrospect, dividing up some of that work better could have helped in making our design process a bit less stressful. My advice to future students is when you form a team, make sure everyone has a wide range of experiences! My team members and I came from different academic backgrounds, and I honestly believe that this made us a more innovative team.

Individual Reflection by [REDACTED]

I really enjoyed ENGR110: Perspectives on Assistive Technology because it was fun, engaging, and taught me a lot about people with disabilities. Because of the course I also become more appreciative of the capabilities that I do have. The number of people our class heard from put into perspective how everyone lives different lives and struggles with different things whether is a physical disability or invisible one. The course also allowed me to learn about other people's experiences with disabilities and the challenges that they face in specific. In fact, a lesson that I learned was that people with disabilities really don't want their disability to define their entire lives. This was something that I've heard about before but it was different when I heard people sharing their stories.

One of the speakers that stood out to me was Santina Muha. She is an actor and film director. I loved hearing how she creates films to educate people who have misunderstandings about people with disabilities. The film that she starred and worked in was very fascinating. It made me laugh and I was really engaged. The lecture Santina spoke at was one of my favorites!

The diverse group of speakers ranging from professors to community members to business entrepreneurs keep the class very engaging. Most of the speakers brought in different perspectives and I loved hearing about their careers. I was impressed by speakers who despite their disabilities were able to be extremely successful. It was also very motivating to hear about how the speakers overcame the challenges they encountered because of their disabilities. Overall, the speakers such as Joshua A. Miele were very fascinating to listen to. I was especially captivated by the work and research that the speakers were doing in the field of assistive technology. The speakers definitely gave me perspectives on assistive technology!

I also really enjoyed working with my team! I think we were a great team and worked really well together. Each of us has a different set of skills and we were able to use our different skills to contribute to our project. I loved how we were able to collaborate on our project. It was truly teamwork that allowed us to drive our project to completion. I didn't know any of my teammates before the start of class so I was also able to make new friends and learn from them. Two of my teammates are studying Mechanical Engineering, so they helped my other teammate and I get comfortable in the maker space of the Mechanical Engineering department. In high school I took a woodshop class so I was able to help a lot with creating the prototypes and making sure that we had initial iterations of our design ready to test. Overall, it was easy to get along and work with my teammates. We all brought valuable skills and ideas to the design process that ultimately helped make our technology for Danny possible.

I also really enjoyed working with my project suggestor [REDACTED]. He was very open to testing our different designs and expressing his dislikes and likes about the prototypes. [REDACTED] and his older

brother, [REDACTED], were approachable and easy to work with. However, during the quarter, [REDACTED] left for Texas to visit family and that created some complications for the design process of our team. [REDACTED] was gone for some weeks, so we couldn't test our prototypes. But we shifted to focus on other aspects of our project to make use of our time. I learned that not everything will go according to plan but it's important to make the best out of the situation. At the end we were able to move forward with our design process, but this was one of the first challenges that our team encountered.

As I previously mentioned, our team worked very well together but we still encountered some challenges. Our biggest challenge was successfully 3D printing our designs. The 3D printing machines can be difficult to work with because they can get broken fairly easily. We had several issues with how our designs were printed. So, we needed to print on two different 3D printers. This took more time than we anticipated because we thought the process of bringing our designs to real life would be much smoother. However, after several iterations we were able to resolve the 3D printer issues and create an awesome design that [REDACTED] would ultimately like.

Our team was really busy, as most Stanford students are, so finding a time to work was a challenge we needed to navigate. Given our different schedules we tended to work on the weekends when we had time to visit the maker spaces on campus and meet in person to work on our project. During the times that we met to work, we were very productive and communicated well with each other. Having a team that was ready to work made working together a fun and enjoyable experience! I don't have many project based classes like this one, so I had a lot of fun working with my classmates and [REDACTED].

One of my favorite experiences from the class was visiting the Magical Bridge Playground! During that week, I had many midterm deadlines and I enjoyed going off campus for an exciting and educational field trip. I hadn't visited or played at a playground since high school, so I really enjoyed visiting it. Because of the field trip, I was also able to spend time with my classmates like [REDACTED] who I usually only greet at the beginning of class. So, this field trip was also an opportunity to get to meet more of my classmates. In addition to all the fun I had at the playground, I learned vastly about what makes the Magical Bridge Playground more accessible and interactive than the standard ones in America. I can personally attest to how inclusive and engaging the design of the playground was. If I were a kid, I'd ask to go back every weekend!

Another meaningful experience in the class was when different companies like Beeline Reader came to present their assistive technology products. My teammate and I spoke to a Stanford medical student that was looking to launch an app that could offer free physical therapy to children. I engaged in a conversation with him and learned how assistive technology can be used to also reach other populations. It was also really interesting to learn about different people's technology ideas and how they see it benefiting people with disabilities. Throughout the course

many people came up with many innovative ways to help others. As I continue taking classes at Stanford, I will continue to think creatively and innovatively about problems because as many speakers in the course demonstrated, it's creativity and innovation that make a great product!

Lastly, working with [REDACTED] to help him charge his iPhone and achieve greater independence was a very rewarding experience. Our team worked very hard to make sure that we could create a technology that could help [REDACTED] on a daily basis. We think our design accomplished this and we are very proud of it too! We hope that [REDACTED] makes great use of our design. Additionally, I also appreciate Dave bringing in really awesome speakers and community organizations to speak to our class. I was inspired to create change in so many ways because of the speakers and assistive technology that we learned about!

ENGR 110: Perspectives in Assistive Technology
Individual Reflection

I am incredibly grateful that this class exists and that I took it. The guest speakers came from varied backgrounds and areas within assistive technology and covered such a breadth of things that I didn't know, from factual information to different ways of thinking and designing. Working on the team project was an invaluable experience: working with [REDACTED] has been an amazing learning experience and great practice for the real world, and working with my teammates was so eye-opening to other subject areas and also a lot of fun - they're super cool people! Getting to make something that can and will be used by an actual person is so much more motivating, rewarding, and meaningful than creating projects for my CS classes that sit stagnant on my computer afterwards.

One of my favorite parts of the class was getting to hear from a variety of individuals with different disabilities. I haven't known many people with disabilities in my life, and I've never really felt comfortable asking those I do know to talk about their disability and how it affects (or doesn't) their life. Working with people who want to share and explain their experiences and are open to questions helps me to get a sense of what other people's lives are like. It's the closest I can get to understanding what it's like to be "in their shoes." While the guest speakers usually weren't directly relevant to our project, the fact that many of the guest speakers and project suggestions have been involved with the class for multiple years means that their presentations were well-practiced and captivating. The class feels like a community, which was entirely unexpected but such a pleasant surprise.

Working with [REDACTED] in particular was so wonderful. Her experience with the class meant that she was able to guide us through the basics of her abilities and show off her collection of assistive technology. She was easy to talk to and always willing to share information beyond what we really needed for the project, and

was so kind as to bring us into her home, give us snacks, and introduce us to various friends in the assistive technology space. I really appreciated her guidance through the process — her understanding of what we would need to know and do made the design process so much easier and smoother than in any of my previous classes.

I signed up for the class without knowing that the "engineering" label meant physical engineering and product design (which was probably an oversight on my part). I was very intimidated when I saw previous projects, since I have zero knowledge of how to build physical things; I was worried that I wouldn't be able to make anything useful. Dave's reassurance in the first class was helpful, but more than anything, it was my cross-discipline team that made me feel optimistic about being able to deliver a prototype I felt proud of. Working with people from very different fields was so interesting and eye-opening and cool and every other positive adjective I can think of — I had no idea of what was feasible to make, and certainly no knowledge of how to do it. [REDACTED] and [REDACTED] seem like such experts in how to turn a design into a prototype and were endlessly patient with my incessant questions about how they did things. [REDACTED] and I worked closely on the electronics and code. We each knew the very basics of the other's area of expertise, and so it was really fascinating to discuss and plan the feasibility and utility of different design considerations. Our team worked so, so well together, and I am so glad to have gotten the opportunity to work with each of them.

The kind of work that I did for this class had me practicing skills that I don't often use. The coding for our prototype was incredibly simple — the system administration and audio engineering were much more time-consuming, and not tasks that I perform with any frequency. Because my role in physical prototype creation didn't come into play until rather late in the process, I took charge of managing communication with [REDACTED] and the course staff, a task which I hate doing but know is important. I think that my group appreciated me taking this on, and I feel like I've improved at it as a result of all the practice I got over the quarter. I also got to do some "blue-sky" ideating, which was a process (and term) that is de-emphasized in CS design, in my opinion.

In conclusion, the class provided both broad informative knowledge and the opportunity to practice processes and skills, both of which I found incredibly valuable and fulfilling.

██████████
Prof. David Jaffe
ENGR 110

Individual Reflection

I grew up in the small town of Brookings, Oregon. It's a quiet town on the coast with about 6,000 people. Growing up there were two major industries: logging and fishing. From a young age, it seemed like most people's fathers did one or the other. One of my classmates was Mia. I remember usually being excited about school events where parents were going to be present because her dad had something that no one else had, a prosthetic arm. I later learned he had lost his arm below the elbow as a result of an industrial accident at the local sawmill. As a young child interested in all things mechanical, I was so fascinated by his hook.

As I grew up, this initial interest was the seed for my current interest in assistive technology. When I graduated high school, I would usually tell people that I wanted to do something with prosthetics after getting my degree. Once arriving at the university, though, I quickly became busy with my introductory coursework, and that once bright flame dimmed. That was until taking ENGR 110. Seeing it on the approved courses list for my major and hearing about it from some students who had taken the class, that childhood excitement was reignited and continued to burn brighter with every lecture.

The lectures, while fascinating, are not the focus of the class, though. The best part of ENGR 110 by far is getting to work alongside a person with a disability to design and develop something that will improve their lives. My team was assigned to a person with severe cerebral palsy. He had recently received a service dog and had trouble giving the dog water while outside of their home. In my time as a mechanical engineering student, I had spent a lot of time designing things for myself, but this experience was different. So many of the assumptions I usually had when designing a device became invalid. There were many times we, as a team, had to go back to the drawing board. Throughout the design process as a whole, getting to have our client interact with prototypes and give us feedback was by far the most helpful part of the process. Everyone is different and having him there to test things out as our device developed made sure we were tailoring best to his needs. Another key component to our design methodology came about from early discussions with our professor regarding the importance of examining already existing solutions for those with disabilities as well as similar devices for the able-bodied.

My favorite moment by far from the course was having our client try out the final design for the first time. We strapped the specialized bottle to his wheelchair and watched his face light up as he dispensed water for the first time. He seemed so honestly thrilled. We decided to leave him with the device for a few days before creating the final version, so he could give us some feedback on any other changes he would like to see. Talking to his brother and caretaker after that trial period, it warmed my heart to hear that he didn't want to give it back even for a day to

make the final version. The entire process from start to finish was very personally enriching.

Another interesting element of the course was my team. Despite this being an engineering class, I quickly found out that I was the only engineering student on my team. In addition, the other three members were also student-athletes. This put me in a position to really improve my communication skills. So far, in my engineering classes, I have only had design projects where my partners were all using the same vernacular. It was really great for me to learn how to work through that disparity in technical expertise. I couldn't just mention "the moment about the member" or "the cantilevered deflection of the component" and have it be valuable to our discussions. I really enjoyed getting to introduce them to some engineering concepts. That's not to say I was the only contributing member, though. One member came up with something I never would have thought of that became really important: the color of the device. It turns out that our client also has some vision impairment. By choosing a fabric color that was fluorescent orange, we were able to ensure him being able to see the device to interact with it. My teammates were also much better than me at talking with our client and teasing out what would become user and engineering requirements. As a result, I think the combination of our skills ultimately ended up creating the best possible result.

The last thing I want to touch on is the guest lecturers. Throughout the course, a new individual would come and talk to the class at each lecture. They might be an industry professional, a doctor, or a person with a disability. Each would share their knowledge of the field of assistive technology as it applied to them. Getting to hear and see the vast amount of perspectives on assistive technology was incredible. One of the most important things that was highlighted was some of the deep issues currently facing people with disabilities, both in terms of access to assistive technology as well as the gap between designers and users. When going through our design process as well as listening to the speakers it became clear that so much of the barrier of assistive technology is based on just how customized and low volume the industry is. In my previous manufacturing classes, we studied the design of components that are being produced by the thousands or greater. The inability to leverage economies of scale when making most kinds of assistive technology is clearly felt by the users through exorbitant costs. This class really highlighted for me just how much distance we still have to come in terms of raising up those with disabilities as a society for everyone's benefit.

In conclusion, I would like to say that I recommend everyone at Stanford take this class, especially if you are not an engineer. Disability is something that nearly everyone will face in their lifetime whether as a result of birth conditions, injury, or old age. This class does an amazing job of shining light on the difficulties faced by those with disabilities by getting to hear directly from them in lectures as well as working alongside them during the main project of the class. This class has really helped me look at the world through a different lens. It is common now for me to be using something and wonder about the implications for those with various disabilities when before it wouldn't have crossed my mind. I think this class has really helped me

develop an appreciation for what I am able to do as an individual and engineer, and it feels to great to help someone!