

## Design Process

For this project, I focused on familiarizing myself with the 3D printing process and editing my webpage template. In general, this required becoming comfortable with the code editor software Sublime, finding 3D printing designs on open-source websites, and learning about common points of failure for prints. While I had 3D printed and coded before, my experience was limited to simple prints and coding software with intuitive syntax, like MATLAB or Scratch. This project exemplified how much I could accomplish without the experience needed to build a website from scratch or design something in CAD. With only the knowledge necessary to copy, paste, delete, and download files, I can now 3D print almost anything and publish professional-looking websites. The ability to work around skills you don't have yet allows you to not only design and create things you wouldn't be able to, but it also provides incredible background knowledge if you want to master those things you don't quite understand. This is important in engineering disciplines because the challenges you might face are often ones without known solutions, and you may be forced to cut, copy, and paste previous ideas into something new.

## 3D Printing

My experience with 3D printing before this project lacked a hands-on attitude. Often times, 3D printing has been a cool demonstration by my high school teachers. I was only exposed to what the design looked like on a computer and how that compared to the finished product. What I didn't realize before was how involved the process actually was. Rather than just sending a file over, pressing play, and coming back in an hour, 3D printing requires detailed knowledge of how your printer operates, its capabilities, and common points of failure. For my first print, which was a name tag, I understood that it was a simple job. I loaded the files onto the machine and walked away. However, it became painfully clear that I couldn't do that every time. My second print was a torture test to find out whether or not our printer could perform with sharp overhangs and small details. My first test was a spider with legs jutting out at strong angles. After I simply walked away, the print failed horrifically. Moreover, it was due to a lack of adhesion with the printing plate. The issue represented a failure not with the printer but with my lack of diligence when preparing the printing bed to be used. If I had properly cleaned it, the spider may have survived. In addition, I ran into some confusion when preparing the printing files I had downloaded off an open-source design site. I first had to learn the difference between 3MF and STL files. Knowing that 3MF files worked best for the Prusa Mini, the printing machine I used, I had to search through repositories for these kinds of design packages. However, after I found a print I liked, I unknowingly copied the entire zip file full of multiple versions of one print, and my software was confused as to why it was printing things on top of each other. These two small failures taught me that printing is not as plug-and-play as I imagined. While much more accessible than industrial CNC metal machining, it is still an involved process that requires careful attention at every step. After my torture test, I downloaded

only the specific size of assistive device designed for my printer size, made sure to prepare the bed, and watched the first layer to ensure adhesion.

### Assistive Device

The main goal of this project was to find, download, and print an assistive device. These devices are designed to make daily tasks easier for those with some physical challenges. They can also be generally used for people like me, who want to be lazy and print cool things. The main constraints for this part of the project were time, print size, print complexity, and filament type. Firstly, these prints had to be completed within a week. The deadline meant that some of the more complicated designs might have been riskier choices, as they required multiple prints or a lot of assembly. Since the Prusa Mini is a relatively small machine, it was not feasible to produce large prints. In addition, I wanted to ensure my prints wouldn't fail and would work well. To accomplish this, I opted for simpler prints comprised of solid pieces without intricate details. Finally, I had to make sure the prints were designed for PLA filament. PLA is a very common material, but the open-source design websites where I looked for my prints included everything from laser-cut pieces to machined metal components. I had to make sure the design I chose was meant for 3D printing and specifically recommended PLA filament. After taking all of this into consideration, I chose a bottle opener designed similarly to a heavy-duty pair of chopsticks. The open-source file had multiple sizes of openers, so I had to search through the zip file for the size that would fit on the Prusa and function for most bottle cap types. This print was ideal considering my limitations, as the design was small enough for the Prusa Mini and simple enough to allow the device to be bent and squeeze the bottle cap. This design worked very well and printed with no issues and few flaws. In light of this, I next want to print something more complex: maybe requiring assembly, multiple prints, and might tackle a more complex problem.

## Webpage Editing

To first learn more about the templates I was working with, I watched LinkedIn Learning's tutorial on editing Bootstrap sites. Bootstrap is a website that allows you to download webpage files for free. Combined with an editor like Sublime, you can edit these files and customize the template however you wish. In my case, I chose the simple "freelancer" template. One of the biggest challenges I faced was how I would add another page to the bare-bones template. The template comes with the structure needed to link two pages together with buttons and links, but I wanted a new separate page to house my design project overviews. My solution involved copying one of the template pages and connecting it to some text in a separate page. Then I could edit the page I copied as much as I wanted. I altered the copied page to include pictures of prints I made, along with short descriptions and a link to download this write-up.

Editing webpages is surprisingly easy. With a basic understanding of how the code is structured, you can make templates look unrecognizably unique and personalized. However, I encountered other challenges when things just didn't look how I thought they would. While a basic understanding is all you may need, it does mean that sometimes you have to play around with the code until it looks right. When presented with an issue, sometimes it's impossible to know what's happening and how to fix it without either trial and error or serious coding skills. Without the latter, I was left with the frustrating task of changing numbers and moving code around until it worked. Blind fiddling is not a hopeless endeavor and will get you to a finished product.

However, to create something truly new or edit templates efficiently, coding experience is invaluable. Personally, I'm very happy with my website, and I'm excited to continue fiddling until it's truly unrecognizably mine.

