Computational Design Project Brief

About Me

I'm Xingchen Cao, an MDes first year student. I come from a Computer Science and Interactive Media Arts background. Although I'm quite familiar with human-centered design, this is my first time getting to know computational design and using tools like Rhino and Grasshopper. But I'm excited about the possibilities they offer.

Demonstration of My Cell Phone Stand

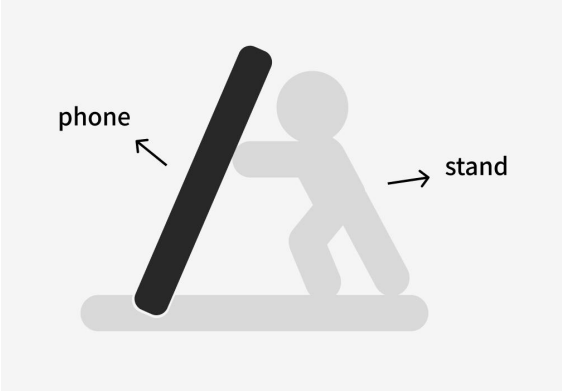
Below are the photos of my printed cell phone stand. We can notice that it's in the shape of a little figure extending both arms forward, pushing and supporting the cell phone.

Challenge Level

The challenge level I chose is Platypus. My “extra mile” in this project is going beyond just adjusting and reassembling the worked example and redesigning the cell phone stand in a brand new form by constructing and combining different geometric shapes from scratch.

Description of the Challenges

Being entirely new to computational design and 3D modeling, I had quite a learning curve. I began by sketching out what my cell phone stand would look like in Figma, during which I envisioned all the components to have rounded edges so that the stand would appear cute, soft and more approachable.



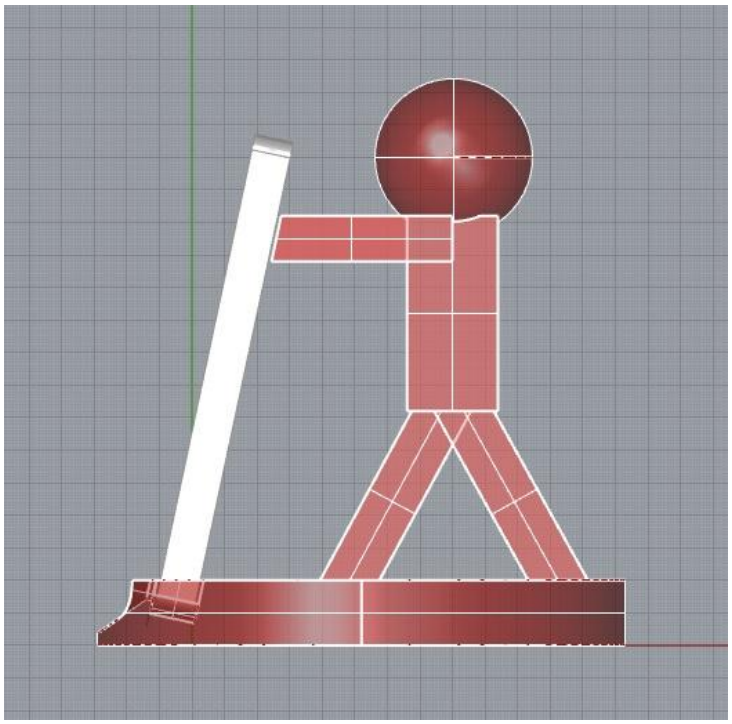
Then I analyzed what the stand would consist of and broke it down into 7 parts that I would build in Grasshopper: the head, the body, two arms, two legs and the base. However when I actually started to do it, I realized that not only the arms with rounded ends wouldn't be able to hold the phone firmly, but the legs would also be buried in the base and consequently the rounded ends can't be seen at all. Hence the original design didn't seem to make much sense anymore. So instead I decided to make all the parts edgy and sharp so that both functionality and visual consistency would be guaranteed.

1. Building Geometric Shapes

The first challenge I encountered, since I had never heard or used Rhino and Grasshopper before, was to create the spheres, boxes and cylinders. I had no clue how to build them. But after following TJ's tutorials and experimenting with it on my own, I started to understand what tools I had and how to use them. And this was how I constructed them: for boxes and cylinders. I first calculated the coordinates of points on a surface according to the ideal position of the phone and used the points to draw the surface, and then I used "Extrude" to extend the whole shape; for spheres, I would also set down the shape by creating 4 points distributed on the surface of the sphere first.

2. Controlling Angle

Having noticed that the model's legs should bend a little bit instead of being completely vertical to the base, I struggled to find ways to do it.



After some exploration, I found two solutions. One is “Rotate”, using which would take extra work when you initially create the object as you need to create another reference object like a point, an axis or a plane, but things would get a lot more easier when you try to adjust the design as you will only need to adjust the degree of rotation. The other is to simply build the surface, which the leg originates from as described above, in a tilted way. It’s very convenient to do so at first but things can get more complicated if you attempt to adjust the legs afterwards, because you need to calculate the coordinates of the points on the surface every time you crave a certain degree.

3. Merge and Solid Union

This was my biggest challenge. I initially used "Merge" but found that the exported model couldn't be sliced by Cura. I searched online and figured out that maybe "Solid Union" was the correct command, and it worked. That's when I understand the difference between them. When you use "Merge," the input geometries are simply grouped together into a list. They remain as separate entities within the list, and their individual properties and identities are retained, making them disconnected meshes that can’t be sliced. When you use "Solid Union," the input solids or closed surfaces are combined in a way that they merge into a single, continuous solid. Any overlapping or intersecting parts are resolved, and the final result is a watertight, solid object.

All the challenges were closely related to my challenge level, for I wouldn’t need to experience all of these if I chose to merely adjust the given example rather than to build something new entirely.

Personalization

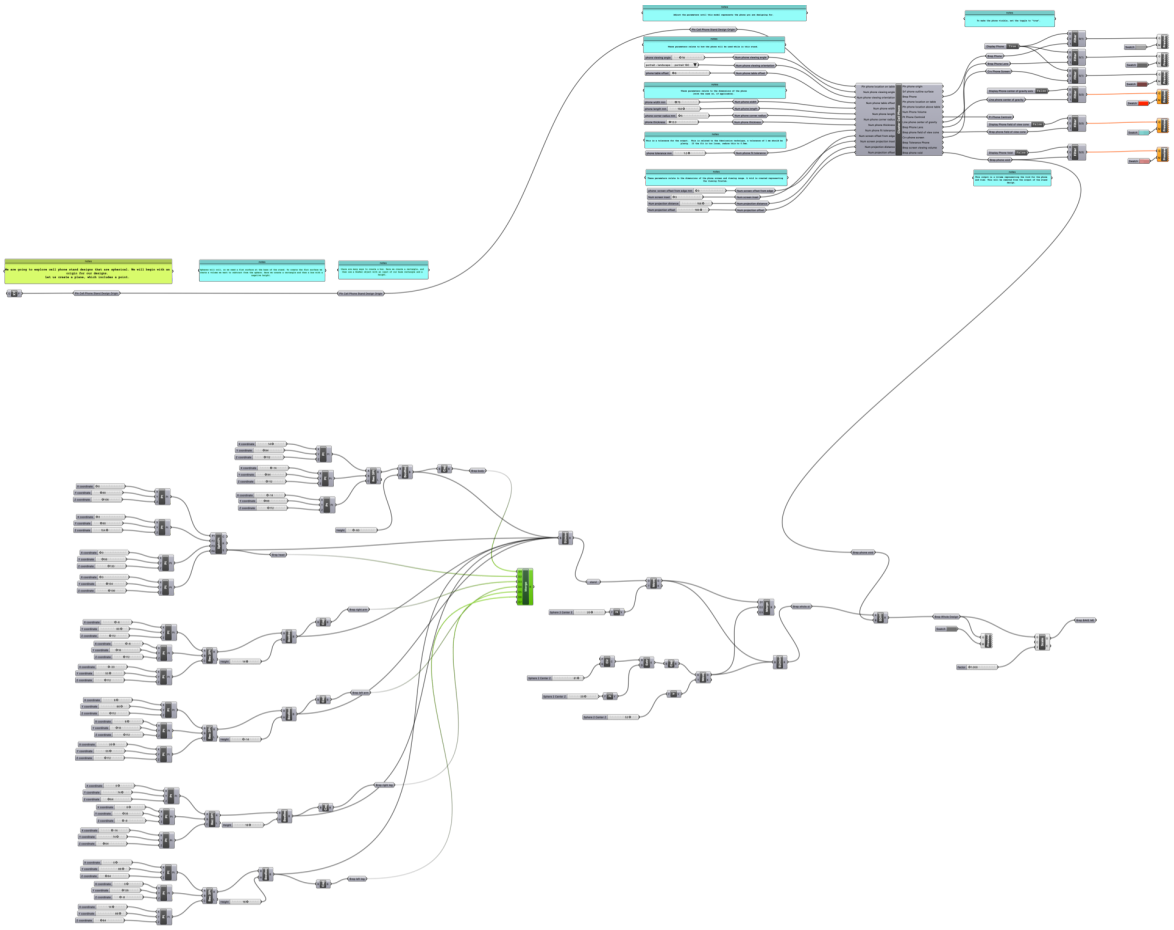
The new design is inspired by The Myth of Sisyphus, where he is condemned by the gods to roll a boulder up a hill for all eternity, only to have it roll back down each time he nears the top. I find this myth fascinating because the repetitive and seemingly futile task serves as a representation of my life, where I often struggle to seek breakthroughs and meaning in the meaningless everyday mundane. And I envision my cell phone to be one of the boulders I’m pushing: I spend a lot of time on it every day, maybe too much, I’d say. It’s a temporary escape from reality, an excuse to avoid small talk with strangers in an elevator, and most importantly, a device on which most of the things I do are meaningless, draining my energy. I try to spend less time on it, hoping to accomplish things that are more meaningful than browsing through social media posts and playing video games, but I just can’t live without it. And that’s how my cell phone stand comes into shape: it provides a perfect metaphor for how I see my phone right now.

In terms of how I rewired the Grasshopper file and built a custom design system, I did the following. Needless to say, I built the shape of the cell phone stand bit by bit from scratch without using any existing components. But I kept the phone model in the given example with

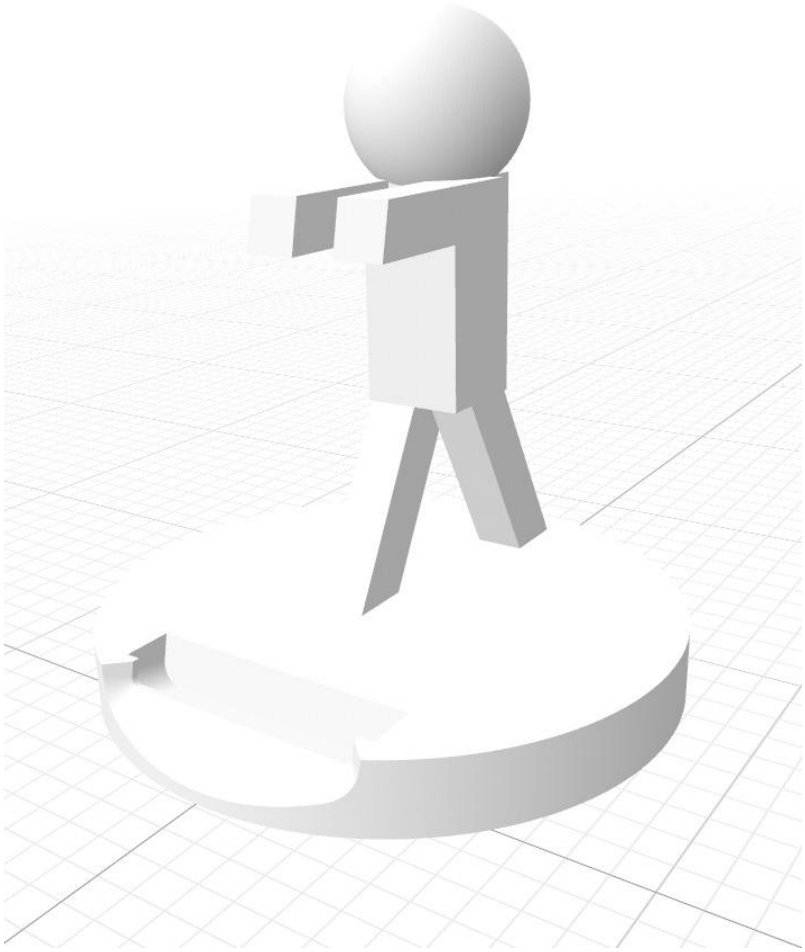
adjusted parameters and combined it with my completed cell phone stand model using “Solid Difference” so that there would be a suitable dent for my phone. Finally I connected the stand to “Scale” for the designer to adjust the stand to a suitable scale whenever the phone gets too large or small for the current design.

The Result of My Challenge

Having overcome all the hurdles I encountered along the way, I managed to create a working cell phone stand model with a Grasshopper file like this.



In this file you can manipulate the design by adjusting the phone size, tilting the phone to a certain degree and changing how much of the screen you want to see through numerical inputs. You can also adjust the thickness of each part of the little figure as well as the size of the entire stand by controlling the sliders. All the parameters in the current file are a result of meticulous calculations based on the size of my own cell phone.



Logs | Settings | Timelapse | Transactions

Zardoz
Ultimaker 3 Extended

Extruder 2	Extruder 1	Heated bed
100 °C	205 °C	59.8 °C

1662.14g - PLA - 0.6mm
737.61g - Breakaway - 0.6mm

CellPhoneStandfinal5_11937687_11937688_11940700.gcode
$6.76 14:15h 217.28g - PLA 35.88g - Breakaway

Time left: 12:07h

Pause | Cancel

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xingchen_cao@berkeley.edu
[17:57 14.09.2023] The job was started by the user: xingchen_cao@berkeley.edu
[17:57 14.09.2023] The printer status changed: from idle to downloading
[17:57 14.09.2023] 3DPrinterOS Streaming started
[17:57 14.09.2023] Software version: 6.0.14u3
[17:57 14.09.2023] Printing now...
[17:57 14.09.2023] The printer status changed: from downloading to heating
[18:02 14.09.2023] The printer status changed: from heating to printing
[18:03 14.09.2023] The printer status changed: from printing to heating
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[18:55 14.09.2023] The printer status changed: from heating to printing
[19:29 14.09.2023] Printing progress: 10%
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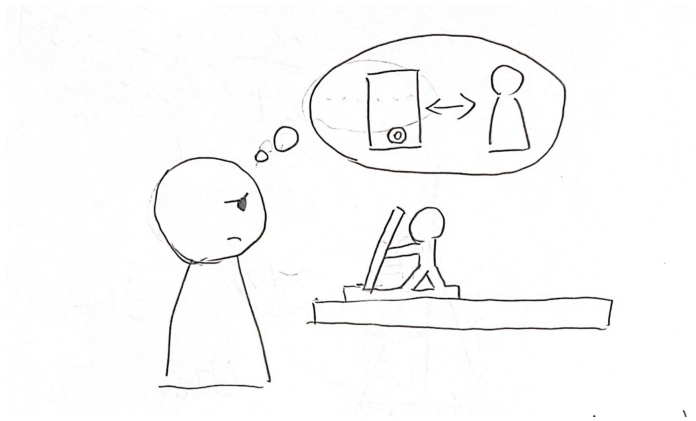
After printing it out and putting the prototype to test, I found my phone perfectly placed on it and I could easily watch Tik Tok with only one finger to swipe up and down instead of using my hand to hold it all the time.

Speculations

1. Impact on Human Experiences

The design of my cell phone stand holds potential for several interesting impacts on human experiences. First and foremost, it introduces an element of playfulness and whimsy to the act of using a smartphone. The stand, inspired by The Myth of Sisyphus, adds a layer of metaphorical depth to our interaction with technology. As users place their phones on the stand, they are reminded of the cyclical and sometimes futile nature of their digital habits. This visual cue may prompt moments of self-reflection, encouraging individuals to use their devices more intentionally.



The user reflecting the relationship between them and the object the use (their phone) through another object (the cell phone stand) as the medium

Moreover, the stand's customizable features, such as adjusting the phone size and viewing angle, enhance user convenience and comfort. By tailoring the stand to their preferences, users can create a personalized viewing experience that aligns with their unique needs and habits. This level of customization can contribute to increased user satisfaction and overall well-being.

2. Impact on Engineering

From an engineering perspective, my project highlights the adaptability and versatility of computational design tools like Rhino and Grasshopper. Through experimentation and problem-solving, I was able to overcome initial challenges related to geometric shape creation, angle control, and solid union operations. These challenges pushed me to develop a deeper understanding of these tools and their applications.

My project also underscores the importance of considering both form and function in design. Initially envisioning a cute and rounded design, I had to pivot towards a more angular and functional approach to ensure the stand effectively supported the phone. This shift demonstrates

and informs the interplay between aesthetics and engineering in product design, emphasizing the need for a balanced approach that prioritizes usability.

Finally, I find significant the fundamental difference between constructing 3D models through computational methods, such as by adjusting numeric parameters and relationships of objects in Grasshopper, and direct manipulation in a graphical user interface which I'm more familiar with. While computational methods work better in precision and suitability for real-world applications, GUI-based approaches thrive in artistic expression and the creation of visually captivating scenes like games or website banners, serving different design intents.

3. Intersection with AI

I anticipate that the tools we use for computational design, like Rhino and Grasshopper, will continue to evolve rapidly. One prominent trend is the integration of AI and machine learning into these platforms. We're already seeing AI-assisted design suggestions, generative algorithms, and even AI-driven fabrication processes. I believe this integration will become more seamless, making it easier for designers to harness the power of AI in their projects. Additionally, the cloud will play a significant role in the future of computational design. Cloud computing enables collaborative design processes, real-time simulations, and data-driven insights. We'll likely see more plugins and extensions that leverage cloud resources for complex calculations and simulations, further expanding the capabilities of these tools.

Conclusion

In conclusion, my journey through the Computational Design program has been both challenging and rewarding. I embraced the opportunity to delve into the world of computational design and explore its potential.

Throughout the development of my cell phone stand project, I received valuable feedback during the video presentation session, which greatly influenced the evolution of my design. Based on this constructive input, I took following actions to enhance my project:

I touched more on the design process within Grasshopper in this brief, as suggested by my peers. Understanding the importance of transparency in the design process, I have elaborated on the challenges encountered while building geometric shapes, controlling angles, and achieving the final solid union. This added detail aims to provide a clearer view of my journey, allowing others to learn from my experiences and challenges.

Moreover, the feedback highlighted the importance of user customization and interactivity. In response, I modified the Grasshopper file to enable users to tilt their phones to a preferred viewing angle. This enhancement not only showcases the flexibility of computational design but

also addresses the practical needs of users who may want to adjust their phone's position for comfort and usability.

Finally, I have taken the feedback to heart regarding the consideration of actual use cases. By incorporating suggestions and insights gained from the presentation session, I now understand the significance of achieving a balance between general user needs and personal aesthetics. While my initial design was inspired by personal experiences and metaphors, I am eager to further refine my project to accommodate a wider range of user preferences and practical applications. This includes exploring additional use cases, such as video conferencing, reading, or cooking with instructional videos, to ensure that my design resonates with a broader audience.

In essence, my project represents not only a testament to my growth as a computational designer but also a commitment to continuous improvement based on constructive feedback. As I continue my academic journey, I look forward to exploring further opportunities in the field of computational design, going beyond a simple cell phone stand and a self-centered metaphor.

Links:

Video Presentation: https://youtu.be/yEydlOI9Exo
Github: https://github.com/Berkeley-MDes/tdf-fa23-XingchenIsHere/tree/main/Project1