New York University

Mousetrap

A Series

Elton Orbito

IMNY-UT 400: Capstone

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Abstract

Currently, there is emerging interest and drive towards modular and custom-shaped computer mice (Hrnjicevic, 2025). This project aims to make way in an unfriendly direction. It seeks to understand what makes modern designs pleasing by exploring and designing *un*comfortable variations. Utilizing supplemental research into the useless and the awkward, this project presents a series of nine mouse designs with squishy shells to spikes meant to have users think differently about how they use mice and tech. Users were invited to use a computer while freely switching between mice that have been modified from their standard configuration of a solid, free moving hump and buttons, and instead strays from the familiar. It was through this testing that I brought out not only the joy people felt for machines that are "useless" and that do nothing, but also the "evil" of those devices. Ultimately, this project not only brings commentary to the computer mouse, but spotlights ideas not often thought or talked about in a seemingly solved market.

Introduction

In the world of cutting edge gaming peripherals, there has been a demonstrable increase in appeal towards lightweight (Judd, 2019) and uniquely shaped computer mice (Hrnjicevic, 2025). The scene has exploded with options below ninety grams, with the number of mice in the sub sixty gram region also having taken off. That's less than a bar of soap, and your set of AirPods Pro (Apple, 2022), respectively. Overall, the choice that buyers are given has become incrementally more daunting as the database on the mouse comparing site, eloshapes.com (u/NAITSIRK_ELO, 2022), nears one thousand mice. Brands ranging from the biggest gaming

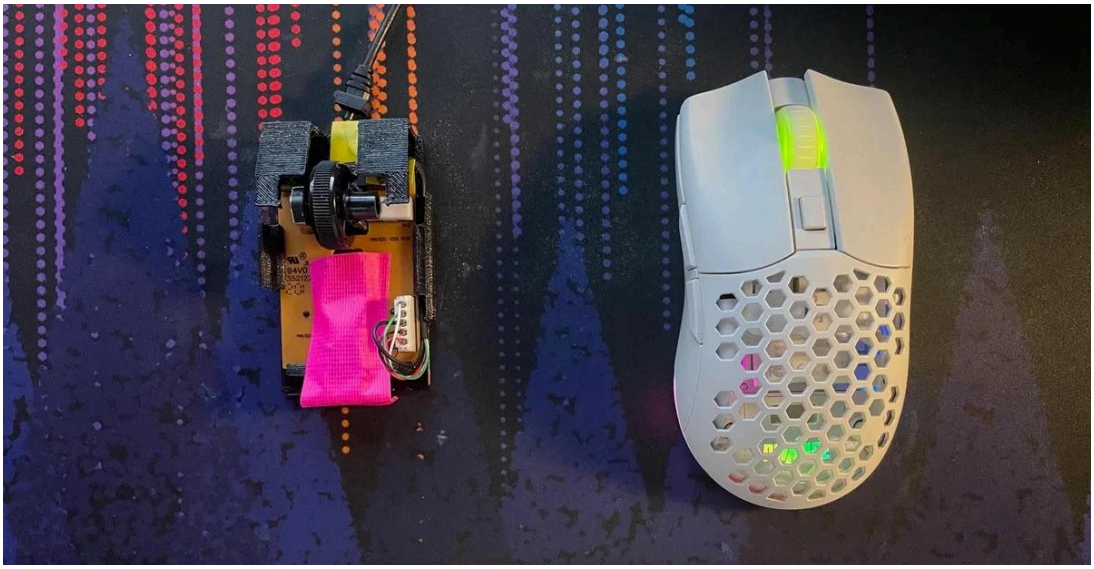
companies in the world to names imported from overseas have thrown their hat into the ring of manufacturing these new age gaming mice hoping to cash in on the hype.

Fig. 1. Glorious Model O, a honeycomb style mouse

Source: Glorious. Model O Minus Wired Mouse. *Glorious Gaming*. 2019, https://www.gloriousgaming.com/products/glorious-model-o-minus-matte-black

I personally own and have used lightweight, honeycomb-style mice in my setup since 2021. Currently living on my desk is the Pwnage Ultra Custom Wireless Symm 2 (2021), weighing in at just about seventy grams. And last year, I took to trying what many others with access to a 3D printer have done, and I created a project examining the benefits of an *ultra* lightweight mouse by 3D printing a barebones shell for a junk office mouse (Orbito, 2024). Despite its shortcomings in sensor performance, the physical hardware came in at half the weight of my main mouse, an indisputably noticeable improvement not unlike switching from driving a semi truck to a hatchback. Because of this, I was able to comprehend the purported feeling of the hardware being an extension of my arm and its movements.

Fig. 2. A mouse with 3D printed shell next to a honeycomb style mouse



Source: Orbito, Elton. “Digital Fabrication Final.” *Elton Orbito*. 28, Apr. 2024, https://orbito.net/to-build-a-better-mouse.

This Interactive Media Arts (IMA) senior capstone is a progression of that project. By creating a series of strange and unexpected mouse designs, their awkwardness juxtapose the meaning of discomfort and allure. I was inspired to expand on my previous work because I felt that in order for one to fully appreciate the satisfaction of finding and using the perfect, “endgame,” the last-I-could-ever-need mouse, one should have a reference to compare to at the opposite end of the spectrum. I think that as an enthusiast, it’s far too easy to get sucked into the rabbit hole of trying out and testing every variation of shape, size, and brand out there, hoping that one of them might unlock a hidden potential within. Ironically however, if you think about it, the face of the computer mouse has generally stayed the same: a hump with some buttons and a scroll wheel. Is that the pinnacle of design? Is there not something better... funner that we can do? I’m thinking that we’ve tunnel visioned on optimizing one particular basic shape to the point of it being banal.

As I took the course, Useless Machines (also) taught by Blair Simmons, in parallel, this project explores the nuances of use*ful*ness: The functionality, useful and uselessness of an object do not completely fall into the categories of "Yes, it works" or "No, it doesn't" rather opening itself to a spectrum of acceptability. Some *things* will be useful to us in different ways often depending on our own individual needs or values. And so, questions of who the world and the things in it are made for make their way into discussion (Hendren, 2020). According to her, and similarly, Don Norman (2013), design is something that is social beyond ticking all the laid out criteria. The issue is the problem itself. And so we must inquire about and redefine it. As has been talked about in class, much of the discourse has us pointing towards "useful" as being an attributed value on something that serves to empower a user to partake in the status quo, if not exceed it (Ahmed, 2019).

Fig. 3. The "original" "useless machine" created by Marvin Minsky

Source: Mauricio, Alejo. Useless machine against a mirror. *The New York Times Magazine*. 31, Aug. 2016, https://www.nytimes.com/2016/09/04/magazine/letter-of-recommendation-the-useless-machine.html.

One of the biggest systems that we have to participate in is getting online and accessing our lives in the digital realm. And to do that, we use touchscreens, trackpads, keyboards, and (ever decreasingly) the computer mouse (Bogost, 2024). And, our lives in the digital realm hinge so much on these mundane and homogenous devices that they've faded into the background as unremarkable, sometimes niche, utensils. So, it surprises me to hear a mouse being called foreign or secondary to the trackpad. The computer mouse for many, including me, is the first point of contact with the digital realm, thus making itself its *own* status quo. What makes it stand out from the rest is in the physicality as the mouse guides us. All that being said however, this norm can be resisted through acts of challenging those established patterns of use, when we break from and do differently. This project comes to disrupt that routine interaction, and the greater concept of a mouse as a hardware tool, not necessarily by turning another everyday object into a "Norman door" (2013), but by totally reinterpreting it. What if I WANT to do it this way? ...*My* way? Against the grain that big tech has shoveled upon us?

With that context in mind, analysis of existing mice, and a little bit of a silly mindset, this project brings a twist to the common computer mouse. With it, I wanted to see how much I could play with the fringes of its design and usefulness. I believe the space has become stagnant with lazy "ambidextrous" mice that only have *right* handed thumb buttons as well as the infinite re-release cycle plaguing names like the Logitech G Pro which is on its SEVENTH iteration (2024). And so, with that rant out of the way, this capstone is my love letter to the computer mouse, and an invitation to take a moment and think a little differently about it the next time you push one across a desk.

Related Works

I have taken a look at a few existing products ranging from those meant to be gimmicky, different, accessible, or innovative. Among my resources I've also included a dive into research papers looking at the effect of mouse shape on arm muscles, artworks challenging the ideas of usefulness and discomfort, including a reference to ITP (Interactive Telecommunications Program) alum Emma Rae Bruml Norton's "Complication of the Computer Mouse." Last, but certainly not least, much of the content learned in the class, Useless Machines, provided a solid framework to contextualize in.

Existing Products

Starting with the real life products, I discovered the Orbital Pathfinder (2024) and a YouTube review by Ali Sayed, better known by his channel name, Optimum. An Australian creator focused on reviewing the ultimate in PC hardware and peripherals, in his video, he looks at the Orbital Pathfinder prototype, a product that when launched, is set to be the first modular gaming mouse. After trying it out, Sayed doesn't fully argue in support of it possessing the "elusive endgame" shape, but rather advocates for its ability to help users find a generally preferable size, shape, or gripstyle before searching for something more appropriate for their needs.

Keeping accessibility in mind, I also found that Microsoft has an accessible mouse product, aptly called the Microsoft Adaptive Mouse (2022). Building upon 2018's Xbox Adaptive Controller, Microsoft has added to their lineup of accessibility-focused user input devices. With the Adaptive Mouse, they have boiled the computer mouse down to its core features, necessitating the addition of attachments to get the most out of it. Accessories are

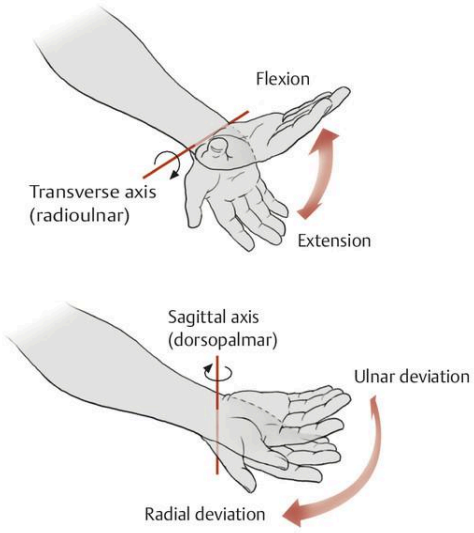
available from Microsoft's website to 3D print on your own or to have a third party shop make it for you. This is another step towards more inclusive computing, having made way for other accessibility-minded peripherals like Sony's Project Leonardo (2023) for the PS5.

Fig. 5. Microsoft Adaptive Mouse with 3D printed accessories

Products like these are aimed at making accommodations in a field where that has not been expansively done before and where designers and manufacturers assume a one size fits all approach. Sara Hendren refers to this as "aggregative fallacy" and further posits that design is a *social* practice rooted in the dimensional lives of people rather than an assignment to meet technical requirements (2020). These products employ a minimalistic frame that invites more to be added to it later in an almost less is more mentality. Where I've attempted to go against that grain, projects like these showed me what exists at the opposite end of the accessibility spectrum.

Other existing and unorthodox mice I looked at include the Ragnok Gun Mouse (2023) and the Mindshunter, now, Marsback, Zephyr (2021). In another video review from YouTube, Dawid Coleman of Dawid Does Tech Stuff, a channel that plays at the whimsical, less mainstream end of PC gaming, checked out the Gun Mouse. Preferring ergonomic, vertical mice, Coleman tried out the AliExpress find. First impressions felt right, but actually using the mouse and its intended pistol grip exposed several problems mostly in its cheap, plastic build and loose wrist rest. Coleman states that a mouse is a "tool that you shouldn't have to be thinking about," alluding to how it constantly fell apart beneath his hand, in anything more than casual use. On the topic of shape, Coleman suggests that the reason he performed worse in shooting games while using the Gun Mouse came down to the way it's held in a fully perpendicular fashion against a desk compared to the more gentle angle of a conventional vertical mouse. However, he does not give a more in depth explanation for his hypothesis.

Fig. 4. Two axes of motion in the wrist. The Gun Mouse moves around the transverse axis. Normal mice around the sagittal axis.



Source: Plastic Surgery Key. Movement axes of the wrist joint. *Plastic Surgery Key.* 18 Mar, 2017, https://plasticsurgerykey.com/anatomy-and-functional-anatomy-of-the-hand/.

David Gauthier, a regular host of mouse and controller unboxings on Linus Media Group's ShortCircuit, proposes that the reason why the Gun Mouse won't be "precise" is due to it calling for the use of different axes of motion in the arm and hand that one wouldn't be used to if they were coming from a normal mouse, describing the translation of a "gun's" handling in 3D space onto a flat screen as unintuitive.

Moving onto the Zephyr, Gauthier also presented an overview. While playing *Tom Clancy's Rainbow Six Siege* and comparing it against something he was more used to, the Logitech G403 (2016), Gauthier remarks that the core functionality of the, albeit pre-production, Zephyr is solid. When it came to its differentiating selling point, the internal fan, it tended to be loud and cause an almost unwanted vibration. Though the mouse takes *advantage* of the honeycomb trend in modern gaming mice, the fan doesn't seem to fully make *use* of it, with Gauthier suggesting that the passive airflow already afforded in honeycomb designs should be enough to cool the user's hand.

I consider both their sentiments towards these mice in my project because it shows that even a beneficial idea at first glance might be great, such as putting users' hands in a more ergonomic position, with a little practical usage and user testing, the theory might prove itself completely wrong. It means that I could also potentially stumble upon a good bad idea. Both of these products have features that might be seen as a gimmick, but personally it served as one of those ideas or inventions that come off as ingenious but in reality might end up making the overall product *more* useless. They're different from conventional mice that just have a scroll

wheel, main buttons, and sensor. They attempt something that should make sense and it's these wacky innovations that I drew from.

One more mouse that flew into my radar was the Lofree Touch (2023) which morphs a mechanical keyboard's likeness into its main buttons. Although possessing stems like those for installing keyboard keycaps, the Touch uses a proprietary shape limiting its actual customizability. A large, square-looking mouse, actually offering many *useful* features, like a built-in screen and three connectivity options, it unfortunately falls short in implementing its most distinctive feature by locking users out from using the plethora of existing keycap styles. Walled garden approaches like this end up de-incentivizing enthusiasts like myself from buying into the product.

Fig. 5. Lofree Touch swappable keycaps

Research Papers

In addition to real products, I studied the impact of ergonomic, more specifically, slanted computer mice on muscle activity in the forearm and shoulder using surface electromyography (sEMG). A 2004 paper, "A sEMG-based method for assessing the design of Computer Mice," (Agarabi, Bonatom, and De Luca) recorded data from different static "grasps." A later study, "The effect on forearm and shoulder muscle activity in using different slanted computer mice" (Chen and Leung, 2006) went more in depth, examining arm muscles in participants that performed a dynamic, standardized task with five different mouse designs. Each mouse exhibited a slightly increasing slant angle over the last. Analysis of this data revealed that increased slant angles reduced muscle strain in several arm muscles including the extensor carpi ulnaris and pronator teres in the arms, and upper trapezius muscles, while the extensor digitorum (responsible for extending the four fingers aside from the thumb) saw increased strain. These findings suggest that ergonomic mice with moderate slants can improve user comfort and potentially reduce the risk of musculoskeletal disorders. Additionally, findings from the 2004 study showed that larger hands used a small amount of muscle movement to conform to mouse shape while smaller hands tended to "sit" on top of mice and medium sized hands demonstrated the most activity in fitting the mouse. This research was relevant to my study towards *un*ergonomic design where even subtle changes will impact muscular activity, providing empirical evidence on how input device modifications go a long way in affecting user comfort.

Artworks

I was inspired by pieces from Janne Schimmel, Katerina Kamprani, Jacques Carelman, and Dewi Van de Klomp.

Schimmel's *Case Mod 3* (2023) is an interactive sculpture that reimagines the Nintendo Game Boy console. This artwork features a playable artist-original game, "Becoming," running on a custom-modded Game Boy. The alien-like piece explores the intersection of physical hardware and digital art, deconstructing the minimalistic console and remaking it into something more organic. The Dutch artist focuses on pulling out the otherworldly feeling of video games and applying it to the boxy nature of the consoles that run them. *Case Mod 3* exemplifies his approach by blending traditional craftsmanship with modern game design, challenging the evolving boundaries between art and interactive media.

Fig: 6. *Case Mod 3*

Meanwhile, works like Kamprani and Carelman's series channel an energy akin to the Japanese art of *chindōgu*, the practice of creating nifty little gadgets that actually cause more problems than they solve. Where inventions like these differ from the "original" useless machine that turns itself off (Minsky, 1952) however, is in that we can still understand what would make them practical. *The Uncomfortable* (2012-2019, 2014-2017), and *Catalogue d'objets introuvables* (1969), respectively, are series of everyday objects and tools reinterpreted to be impractical. Kamprani includes things like thick cutlery and a watering can that pours back into itself. Carelman drew up double sided bikes and a kettle with the handle and spout on the same side. Collections like these explore themes of usability, expectation, and perception, as well as humor in design. These artists use these projects to encourage us to rethink and to challenge assumptions about common objects' functionality and purpose.

Dewi van de Klomp's *Soft Cabinets* is a furniture series made from foam rubber, a material otherwise unnoticed in the house. This project aims to bring more attention to its overlooked value. When encumbered with objects, the shelves take on new forms, sagging and deforming, depending on the contents. It begs us the question of how we view strength and resistance. Critics argued that the shelves are not functional enough, with Klomp positing that these are "showpieces" meant to push the "boundaries of design."

Each playing at different angles regarding my research, *Case Mod 3* shows the fusion of an organic shape to interact with a digital medium. It helps to demonstrate that technology does not have to be sterile and impersonal where artists have the opportunity to be expressive with it and inject it with life. Kamprani, Carelman, and Van de Klomp's collections demonstrate how aesthetics and unconventional approaches factor into the "normal" thinking towards design. It gives inspiration on how to alter something that "works" by, for example, simply widening

dimensions or angling a handle in the wrong way. Changes don't necessarily have to be huge to be groundbreaking. They would probably still "function" at the end of the day, albeit not as one that is the most intuitive, straightforward, or sensible.

Lasty, in her NYU Interactive Telecommunications Program thesis titled, "Complication of the Computer Mouse," Emma Rae Bruml Norton discusses the history and convolution of the computer mouse. Her introduction asserts that its design is to be assumed as intuitive, yet, gradually has become less the case with the advent of touchscreens for direct interfacing. First, it was the ditching of the trackball and therefore the mousepad: the mouse became less dependent on the *environment* it was in to work. And as a device to hold your hand into accessing the world through a computer, it actually "assumes a lot about your body:" It assumes that we are able to make "disciplined" arm movements and "follow" that movement along on the screen with our eyes. This made the computer "simultaneously [...] easy to use and incredibly inaccessible." Coming down to a less macro scale, Norton in her conclusion posits the interaction with a mouse as a "handshake" or "entanglement" between body and computer, moving through our world so we can move through its world. And so, we can see that the mouse is more than just a tool or a peripheral. It's a way for us to understand the relationship between us and computers.

Book

And from relationship, we get companionship, or a "*forness*," that is capable of affecting us. In other words, as Sara Ahmed puts in *What's the Use?: On the Uses of Use* (2019), "To be for something is to endow it with positive value." Ahmed gets this point across by exemplifying the daily water pot in George Eliot's Silas Marner (1861). Both of these things, the mouse and the pot, are little, everyday objects that we leave an impression on while simultaneously giving

us an *ex*pression. It's not that we just have a relationship with *the* or *our* own computer. We have one with the devices we use to use it as well. That makes the mouse a masterclass in industrial and interaction design.

Methodology

My capstone presents nine designs, altogether exploring the meaning of usability and comfort. Each modification puts forth a unique challenge meant to give users pause. They are not supposed to be completely intuitive or easy to use. They should be somewhat ambiguous and confusing.

The following mods were made before user testing: (1) Swapped the stock glide feet of a mouse with grippy rubberized feet, such as those used for furniture and appliances. (2) Much like a bowling ball and ironically mimicking honeycomb mice, holes were cut into the housing of a mouse over where the microswitches are. (3) Rerouted a mouse's cable to exit through the top of the mouse in a similar but opposing fashion to the Apple Magic Mouse (2015). (4) A normally shaped mouse with grip tape stickers featuring stone textures. Inside, weights were inserted and the bottom side gained a sheet of sandpaper to further the impression of a rock. (5) One mouse's hard, rigid shell was exchanged. Internal components were encased in a putty or slime that adapts every time it is touched or used. Extra explanation is made at the end of each section if that modification was expanded upon post user testing (see below).

Modifications (6), (7), and (8) were designed after critique. (9) is a last minute addition coming in after the presentation. Respectively, they incorporate a large cone into the back panel, encase a gaming mouse into a mini, fish tank-like enclosure, embed a mouse's internals into a silicone hand, and shortens the cable.

1) Locked In

Fig. 7. Locked In bottom view

Changing stock feet was a simple task. For this design I chose the large, button rich, CyberPowerPC mouse (release date unknown) donated by a friend, Nicole. Its feet were already heavily worn out and scratchy against a mousepad, a perfect reason to go ahead with the mod. I pried off the factory feet with a spudger, being sure to clean off residual adhesive with isopropyl alcohol. I wiped and dried the surface of the remaining liquid. Given the option as the screws were exposed, I disassembled the mouse further to clean the internals of any dust that may have accumulated throughout its previous life. I screwed the two halves of the housing back together and applied aftermarket, rubberized feet. I attempted to fill every space left by the original feet to maximize the surface area and effect the rubber would have. This modification turned out to have an unexpected additional feature that further rendered the mouse less operable: because the

rubber feet were thicker than the original glide skates, the mouse became considerably raised, leaving the sensor unable to track surfaces beneath it.

User testing (see below) deemed that the modification this mouse received was not enough. Bringing in an idea about brass knuckles, I 3D printed a set of five rings approximately one inch in diameter, and hot glued them to the top of this mouse. I staggered and aligned each where a finger might lay. They are positioned in a way that in order to achieve that grip, the mouse must almost be put on like a set of rings or a glove.

2) New Fear Unlocked

This design was about cutting holes big enough for a finger to fit through at the main buttons, the one spot on mice definitively NOT given the honeycomb treatment. Taking the holes trend on too hard, this mod exposed the actual microswitches on the mainboard. To start, I bought a honeycomb mouse that I wouldn't feel too badly about emaciating: the Dierya M1SE (2022). Upon initial disassembly, the housing proved to be much more intricate than I expected. The mouse was constructed using a bottom plate, a mid-frame, and two separate top pieces. The mid-frame on its own was especially overbuilt, requiring extra material deletion with a Dremel towards the front end of the frame. Luckily, though, the plastics used were either thin or of low quality, and easily succumbed to the power tools. This extra modification ensured that there would be enough clearance for fingers to rest near the microswitches.

Moving onto the main mod, it was a matter of positioning the holes in the correct spots. The square pillars beneath the shell that press the microswitches, other than being in the way of the Dremel, were very structurally sound. Going in from the top wouldn't produce a perfectly round circle either; a quick tracing of lines returned something akin to an octagon. I employed a

new strategy: I manually held down the “abnormal” geometry of the button shell against a sacrificial piece of wood rather than putting it in a vice or clamp and swapped to using a drill. With my method, I was able to drill into the opposing side of the pillar, removing it from the shell and creating a small hole that I could enlarge. To enlarge it, I swapped the bit to a ⅝ inch spade bit. I repeated these steps for the other side. The holes turned out asymmetrical when it was done, but importantly they fit my fingers at the very least. Any jagged edges were refined using a sanding bit on the Dremel and universal dot feet from Pwnage (2024) were installed on the bottom.

Fig. 8. New Fear Unlocked

After feedback (see below), this mouse received an extra modification to help it stand out. I positioned toothpicks in the holes of the MS1E’s honeycomb structure. So that they

wouldn't stick out too far, I split in half about a dozen wooden toothpicks and hot glued them among the holes at varying angles such that it would look like a porcupine. I also took the extra step of covering up the RGB lighting with black electrical tape since I felt the lighting pulled from the intention behind this mouse.

3) Black Magic Mouse

Rerouting the cable was also relatively straightforward. To implement this, I picked up a CoolerMaster MM710 (2019) from eBay because the logo on the hump made for a good line to trace with a Dremel and when cut out would be a good size to route a full size USB cable through. It took me about twelve minutes altogether to make the hole using a ~one inch saw blade and sand the edges down of any jagged edges that might scratch the cable or users' palm. Mouse now cut, disassembly and access to the internal USB connection was achieved again by removing the stock feet and screws from the bottom. This cable, like in most mice, was routed off to the side of the PCB and fitted to the front with a slotted strain relief. I undid the cable from the front and fed it out of the newly cut hole. Because the hole is wider than the actual cable and is *above* the internals now, the cable hangs rather loose in and around the mouse now. Finally, universal dot feet were again used to replace the original full sized feet.

Following user testing (see below), further modification was made to this mouse. To enhance the protrusion of the cable, I acquired a small metal pipe and cut it down to a few inches using a Dremel. Another cut was made along the side so that the cable could be pushed through along its length; the connectors at each end of the cable made it too big to feed through the sides of the pipe. The pipe was the perfect size however to fit into the previously cut hole in the hump of the mouse. It was hot glued in place there and the strain relief hot glued at the other end of the

pipe. There is now a rigid structure that protects and projects the cable a considerable distance above and away from the mouse itself.

Fig. 9. Black Magic Mouse

4) Rocky Rock

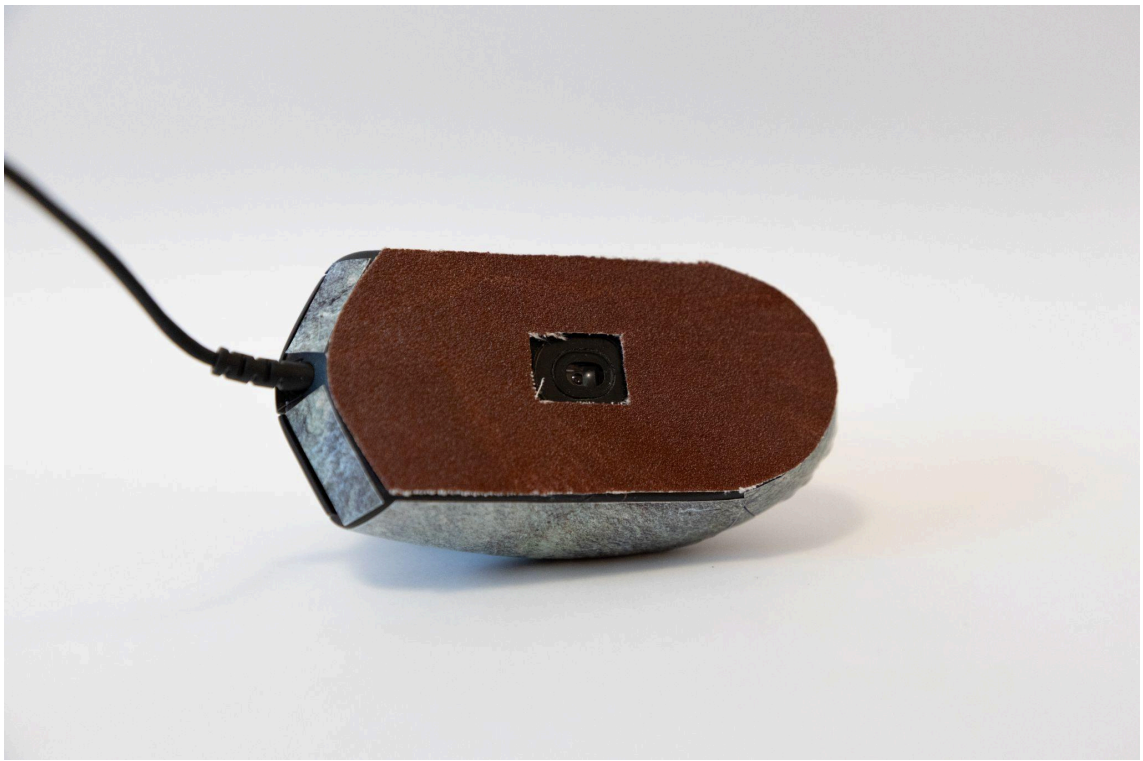
For turning a mouse into a stone, I started by selecting a few rock textures from Adobe Stock. Chosen assets were enlarged, and placed into an appropriately sized artboard at ~50X6 inches for the IMA department's UV printer. The file was printed on matte sticker paper without any cuts. Cuts were made manually by once again disassembling the selected mouse, a Logitech G203 (2017), and tracing the top and button shells onto the sticker with a pen. Even with this tracing, I cut the stickers for the mouse buttons a little larger before shaving their edges down. Meanwhile, I cut the rounded sticker of the rear hump far too small, necessitating a second

attempt. It turned out, mapping a flat plane onto a rounded surface was a challenge. With the second attempt, I cut a piece much larger than necessary and tried to stick it down. The reason why flat stickers don't adhere well to rounded surfaces is due to the way the sticker will want to fold over itself near the edges to compensate for the differences in surface area. Thus the solution I used was to add a small cut where these folds were and to divide the rear hump sticker into multiple parts: a piece down the center, two on each side of it, and a half crescent shape near the end. With this knowledge, a similar process was used for cutting and applying the stickers to the rounded edges around the sides of the mouse. None of it is a professional job like those in purpose made, pre-cut griptapes. It instead is more evocative of the DIY method of cutting from a universal sheet at home.

Adding weights called for an examination of any free space inside the mouse's housing, necessitating another teardown. The G203 is an 85 gram, midsize mouse with a round, egg-like shape, so it had some space to play around inside. Although, there was a section at the rear, with three LEDs for the RGB effect as well as a plastic bracket to keep them in place. Desoldering and removing those parts freed up some more space to put in weights. For weights, the CyberPowerPC mouse from earlier came with five metal cylindrical weights coming in at five grams each. I also had two rectangular ten gram weights salvaged from a Satechi C1 (2021) (Sometimes manufacturers themselves add weights to mice to make them feel more "premium"). I also picked up a small rectangle of aluminum (2g) and a metal nut from the IMA junk shelf that fit one of the cylinders from the CyberPower. Tungsten (a dense, safe, and readily available material) tape was also purchased from Amazon. Electrical tape was then used to wrap the weights and cover the bottom side of the PCB. I started by applying a layer of the tungsten tape on the bottom and inner sides of the mouse before reinserting the PCB. The weights from the C1

were put together over the sensor, the aluminum under the side buttons, and the nut and cylinders near the rear. The electrical tape not only protected from a possible short circuit that could fry the board but also helped to friction fit all the weights and prevent them from shifting around. Putting the top back on for a test fit, it seemed like the fit was too tight; Some of the tungsten tape near the main buttons prevented the top from going back on completely flush, requiring a small amount of tape to be removed. But, when finally put back together, the mouse comes in at a whopping 164 grams. Nearly double the original weight and certainly one of the heaviest mice out there.

Fig. 10. Rocky Rock bottom view



Sandpaper, 120 grit, a middle ground between smooth and rougher varieties was sourced from a local store, Union Square Supply. Along with superglue, I traced the bottom profile of the

mouse onto the reverse side of the sandpaper. Ordinary scissors were used to cut it out before eyeballing the position of where the sensor hole should go. A box was drawn with pen before using a hobby knife to cut it out. Roughly cut to shape, the glue was applied to the free areas on the bottom of the G203 before letting its own weight hold itself down for the curing process.

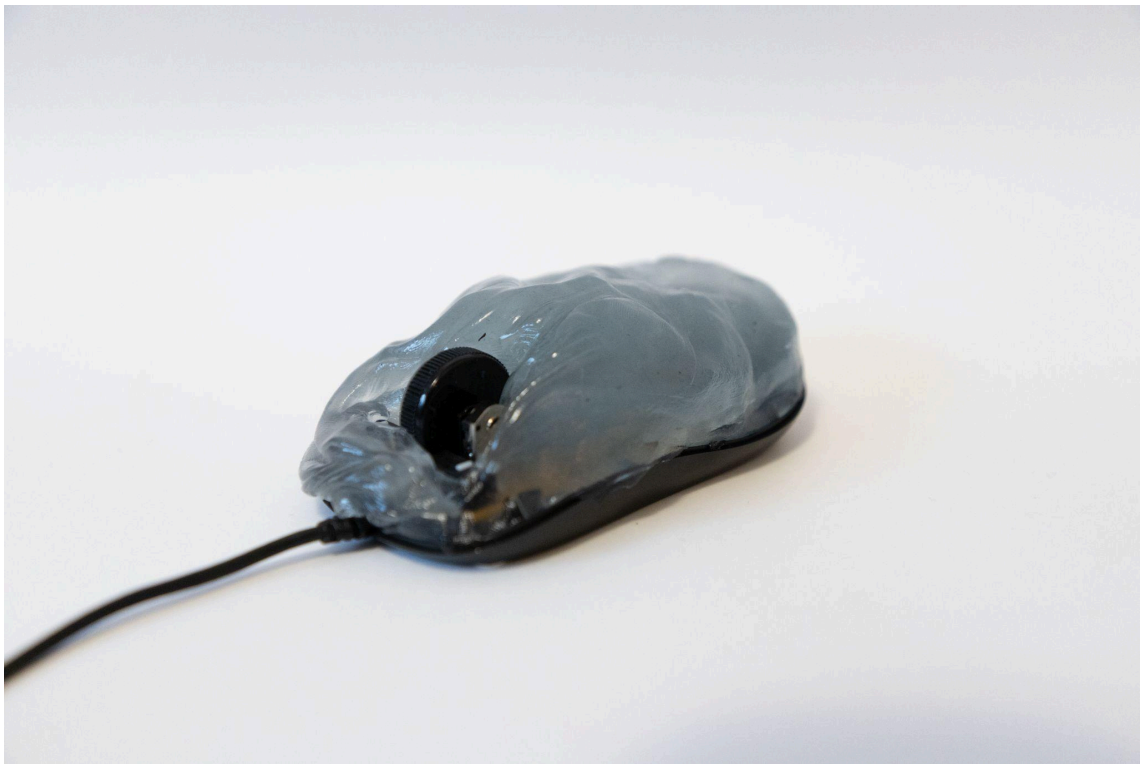
Post-user testing (see below), the sticker application on the hump was revised to be a single rather than multi-piece design by image tracing a skin from MightySkins (2024) in Adobe Illustrator, printing and cutting it out to use as a stencil, and finally tracing it onto a leftover portion of the stickers I had. Some bunching still occurred even with the proper cuts. However, it should complement the other improvement I made: a rough texture for the stickers was achieved by applying a dollop of superglue on the faces of each sticker before spreading it around with a brush and paper towel. The mouse was then set aside to dry as the glue settled. Not only does the mouse *feel* a little rougher now, it looks rougher as the dried glue scatters light compared to the smooth matte decals.

5) A Goo[d] Idea

Idea five disregarded a shell entirely. For this one, the internals were harvested and left intact. I used a combination of the leftover PCB from my last project and a newly junked Kensington mouse (2015) for the foundation. I tore apart the “new” mouse and transplanted the “old” PCB onto that bottom shell. The internal cable, free from any enclosure, was hot glued down. Again, universal feet were put in place of the original. For putty, I ordered some premade stuff from Amazon and generously put in over the hardware. With some preliminary testing, the substance did not appear electrically conductive as the mouse still fully functioned, however, covering the exposed circuit board with electrical tape or other protective coating should be

considered. When not in use, the putty is put back into its container to prevent it from drying or settling.

Fig. 11. A Goo[d] Idea



6) Party Trick

The first of the second set of mice affords a giant spike that looks like a party hat. I replaced the top battery panel of a G304 (Logitech, 2018) with a modified 3D print of the same thing. The basic file for the panel was acquired from inornate on Thingiverse before being taken into Fusion360 for editing where I learned that the program has two types of bodies that are incompatible with each other without extra reworking: mesh and solid bodies. I switched to using Blender for processing, as it didn't seem to care: a circle was placed onto the hump and a vertex well above the body. These points were connected and faces inserted before I manually

and meticulously fused the points of the main body to the newly sculpted cone. Printing took about four and a half hours. It came out not exactly a flush fit. I pried off the clips it copied from the original panel and hot glued it down into place, revoking access to the AA battery slot and wireless dongle storage.

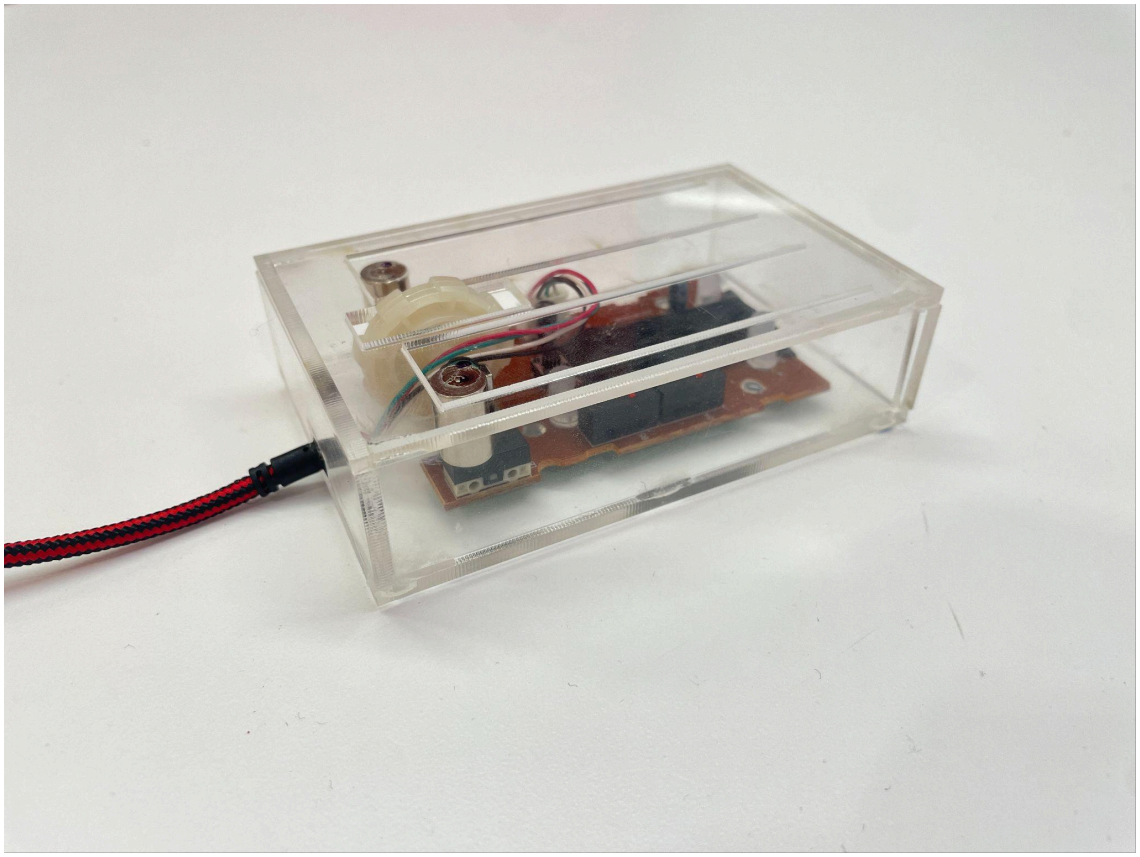
Fig. 12. Party Trick

7) Gaming Mouse

An idea that came about during user testing and feedback, this design aims to mimic the fishtank style cases in computer building that have glass panels on multiple sides to show off internal components. I went to Micro Center and bought a white label gaming mouse, the GM63 (release date unknown), that had RGB lighting and opened it up to measure the board, scroll

wheel, and other components with calipers. I used these measurements to draw rectangular panels in Adobe Illustrator. These sketches were laser cut into a large piece of found, scrap one eighths inch clear acrylic.

Fig. 12. Gaming Mouse



When I put everything together for the first time using super glue, the dried residue left a jarring frosted finish on all the panels. There were traces of my fingerprints from previous handling and the transparent look was lost. Further, I had not given much thought to the design of the click functionality in the top panel. Originally, a square cut out right above the

microswitches, I redrew the cuts to be more like an actual mouse with a diving board style mechanism: a three sided rectangle extending towards the rear without a cut there.

Getting this second version to cut however, was a trial. The not-broken laser had a tendency to shake the material that was placed in it, adding more anxiety to the fact that in order to get a clean cut, the job would have to be run twice. After much troubleshooting and error, the solution was to align any inserted material to the right (the direction material was drifting in) rather than to the standard left.

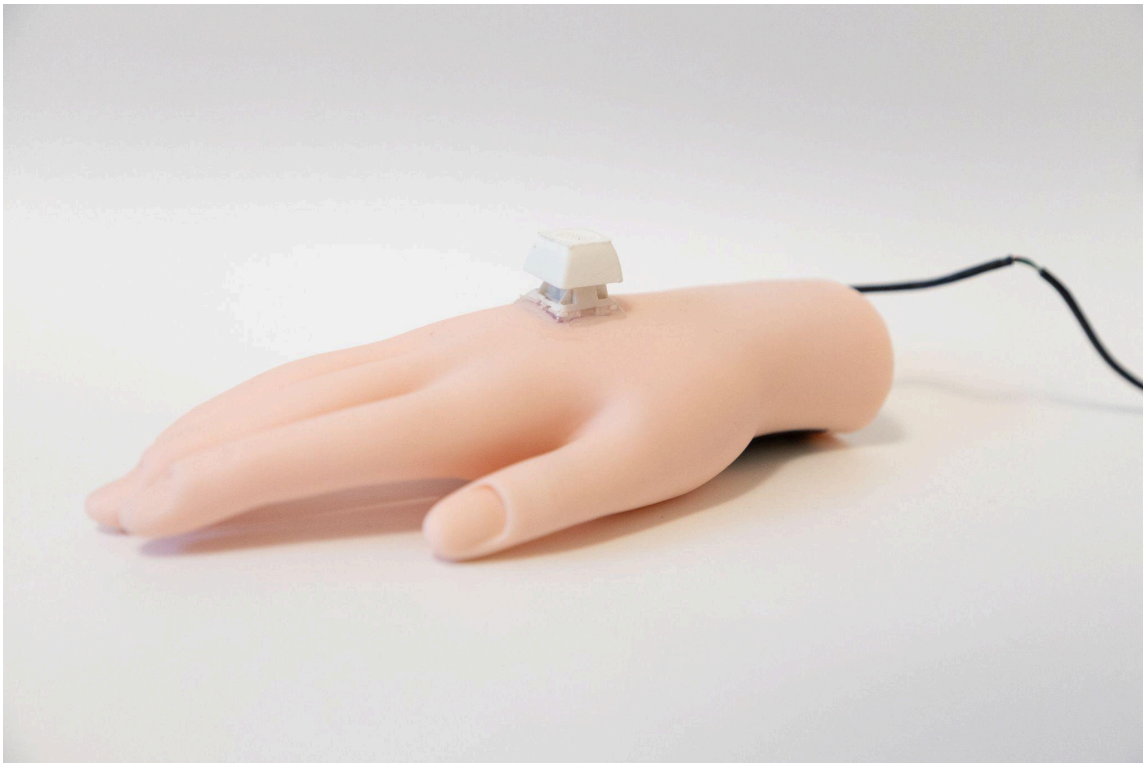
Putting everything together this time, I handled my materials, especially the acrylic, with greater care and used only small drops of glue rather than completely along the edges like before. Because the top panel lay well above the switches, a solid spacer attached to the underside of the bottom of the "diving board" was needed to reach them. For this, I got two more metal cylinders that happened to be the perfect length to reach, while still providing a clicky enough haptic feedback.

8) Thing

Stemming from Norton's idea about a mouse as a handshake, I bought a silicone hand meant for practicing applying nails on Amazon. Using a hobby knife, I cut off the plastic base and removed the stuffing. The mouse I put inside of it is another Kensington mouse, the same one as in Goo[d] Idea. To fit the sensor, I traced the profile of the mirror onto the underside of the wrist before cutting it out with a hobby knife. Because the board was going to be far from where one's fingers lie during a handshake, I determined that I'd need a cable run and a new switch type: I cut a hole for a full sized mechanical *keyboard* switch in the top of the hand.

The microswitches from this copy of the PCB were desoldered. In this instance of soldering, I managed to rip off a solder pad used for the left click. Not having another readily usable board, I continued on, opting to have the single key switch I had delegated to the *right* click. I soldered the male ends of a pair of male to female jumper wires to the right click and hot glued the mirror to the bottom of the board.

Fig. 13. Thing



I made a cut along the side of the wrist as a strain relief for the material and so the internals could have some wiggle room when being fitted. I fed the click wires up the wrist to the hole for the switch and hot glued the board in place along the cut mentioned earlier and at the sensor hole. The female ends of the jumper wire were plugged into a key switch before it was hot glued into place in the top of the hand. A blank 3D printed keycap from whoneyc on Thingiverse

was used to top it off. Black electrical tape was used to cover up the extraneous surface area of the mirror on the bottom. The internals remain exposed when viewing from the end of the wrist area.

9) Wireless Technology

Left with extra materials, this was a quick addition to the series. Unlike with every other mouse in the series, the internal end of the USB cable of the extra white label mouse (release date unknown) I bought from Micro Center is soldered straight into the board. This meant that if I wanted to modify cable length, I could cut it wherever I wanted, strip, and solder directly to the board rather than splicing two cables together and applying shrink wrap. So that's what I did.

I cut the cable just long enough that the USB plug would effectively be a part of the shell. With the strain relief on the plug being thicker than that on the mouse side, I took a Dremel with a burr bit to enlarge the hole where the cable would normally come out of. I shaved out enough to leave the fit tight enough not to require glue.

Next was desoldering the length of cable that was still attached to the board and stripping the shortened USB side. Upon stripping it I noticed that this end used copper strands rather than a solid core like what was originally soldered down. The material wasn't a dealbreaker, it just meant I had to handle the strands delicately, or else if they broke and I kept exposing more innards, the cable would become *too* short and I would have to source another USB cable. But that was the beauty of it. This mouse, and USB in general, uses just four pins: power, ground, and two data pins; red, black, white, and green. I just had to resolder the (now shortened) wires in that same order and manage any extra slack left inside so that the USB connector would sit flush with the rest of the body.

Fig. 14. Wireless Technology

User Testing

To test the effectiveness of my new designs, I invited and allowed friends, classmates, and colleagues to use the mice as an alternative to the input device they may already use with their computer. In doing so, I was sure to consider the preexisting relationship individuals have with computer mice by asking them to state how they generally encountered one. I was also interested to see the reaction from those who identify as gamers or power users - those who are acutely aware of the importance of having a reliable mouse.

The core of my critique came from my peers at IMA: Enhe, who described herself as someone who bought the first result on dell.com when she needed a mouse. Lachlan, a developer

who prefers a trackpad. And Anshula, who doesn't often use a mouse either. Further significant input came from close classmates Sarah and Ava. My last tester was a gamer, John. All users except for John tested the mice in the location guessing game *GeoGuessr*. John tested in the shooter, *Valorant*'s, firing range. He normally uses the Logitech G Pro X Superlight (2020).

Feedback

Enhe said the rubber-footed CyberPowerPC (Locked In) mouse was "evil." John, attempting to heavily push the mouse into the table in order to close the sensor distance, made the analogy that this mouse was modified to be an aim trainer with its artificially reduced sensitivity. The found, optimal way, to use the mouse was to bring the other hand up to the bottom to manipulate the sensor. Lachlan had the same thing to say about tracking with this mouse and that it was one that didn't seem to do enough. Sarah, separately in her own words put it: "too economical." I think what was actually meant was that, unless one turned it over to see the furniture-like feet, it came off as too ordinary among the series.

Enhe used the finger-holes mouse (New Fear Unlocked) with both hands, dedicating a finger for each of the main clicks. Considering her long nails, Enhe had to adjust the grip she used to click the buttons. Those holes brought Scrub Daddy sponges to mind for her. John's attribution was towards Chinese finger traps. Anshula: as if she was "fingering" someone. Because the M1SE is another honeycomb style mouse, the addition of two extra holes at the front, despite their size, were not enough to stand out in Lachlan's observations either.

Sentiment for the modified MM710 (Black Magic Mouse) was that it could become too easy to get used to as the floppiness of its cable could conform to the shape of the mouse beneath

one's palm. In other words, the cable at the hump didn't protrude enough nor was it annoying or intrusive enough to fit the theme of unusability and challenge.

Enhe described the G203 (Rocky Rock) as feeling like a weighted blanket for a hand and potentially fatiguing after prolonged use. Lachlan and Anshula were confused in regards to the thick sandpaper bottom fully negating its ability to track. Sarah and Ava speculated on improving the rough feeling of a rock along all its sides, like it needed *more* sandpaper.

The slime mouse (A Goo[d] Idea), despite its gross-ish outwards appearance was reflected on as being toy-like. It was Sarah and Ava's favorite out of the lineup. The slime seeps around and locks up the scroll wheel and even just *finding* the switches proved to be a challenge for many, although John noted that when he did find them, the resistance of the putty made it function like a finger strengthening exercise.

Evaluation

There were smiles of both excitement and enthusiasm for more in the creations I was handing to the testers. There was an endearment or love in the things I was making as they reminded testers of memories involving childhood toys or other everyday objects. The series caught the eyes of students I've never met before as they passed by on the floor. Like why *was* I brazenly drilling holes into perfectly fine, working electronics and cutting open a fake hand? I had to really lean into all of that.

Ultimately, my users wanted *more* out of the series: bigger, additional ideas. Extra holes and grippier feet were too subtle. It had to be sold on a larger scale, physically and conceptually. It didn't *do* enough to be useless. Sarah speculated around the scroll wheel being an area of growth because it seemed ignored. There were questions about the intentionality of making core

functions such as gliding or clicking harder on some and unchanged on others. Anshula put it: “A mouse does A, B, C. Some of your mice do A and B, but not C.” Parts of the series did not seem to be cohesive or connected with the ideas in this paper. Lachlan’s idea was to find the intersection of everyday objects and mice and put them together.

At the end of the day, I was overloaded with feedback, and a need to make more - to really find that meaning of useless to me. Expansions were made where noted above in the methodology section.

Conclusion

Doing this capstone was the ultimate experience in my time at IMA. A combination of all the little things I’ve learned - it’s the biggest project I’ve ever undertaken, full stop. It feels weird to think that all of my studies, research, time, and connections up until this point have led up to... this. This, that I am proud to showcase as a piece of interactive media.

Mousetrap has come to be a manifestation of my passion for hardware. First it was getting into computers, and then mechanical keyboards, and headphones for me. These are the things that we get to physically engage with. They’re *ours*. In our physical possession. The things we get to see and hold whenever we want. This is the stuff *no one* can take from us. In any way possible. When that thing is ours, we should be able to decorate or rip it apart however we see fit without any repercussions. *That* is our impression - when we sink our hands into the keys or around the contours and leave a unique patina, when we slap on a sticker or change the wallpaper to be of our cats. No one can recreate it. And then when someone sitting next to you asks for the names of those cats, these personal touches show. These mice are mine, my creations. There’s nothing else like them out there. And now, you have taken the time to learn

about them, and though you may not have actually touched them, I'm sure they've still left an expression.

And that's why it was quite the surprise when I saw that *Razer* made a stride in releasing an innovative design. *Just* at the end of last month, as I was finishing work on this project, the gaming company announced a refresh to their productivity focused Pro Click line of mice, including a brand new vertical option. The first of its kind, this ergonomically minded mouse packs a high end gaming-grade sensor along with all the other gaming mouse goodies like RGB lighting, PTFE feet, and macro customizability. They even went as far as to implement a unique side button layout, going from tiny buttons side-by-side to large vertically stacked buttons, a conceptually sound idea. With this being out, I don't think it'd be beyond me to try out vertical mice for the first time.

Fig. 14. Razer Pro Click V2 Vertical

But yes, this is the cool kind of innovation I like to see. And I didn't even have to put out my project (yet) to see it happen. Still, that doesn't mean the work isn't over. We, as consumers, should demand new ideas and the things we want from companies. I'm disappointed to see that things like LG's last phone, the Wing (2020), came as just soon as the division died (2021). Now the only phones that aren't black slates one hundred percent of the time are foldables.

We should be able to take things into our own hands, literally, physically... That's what *Mousetrap* is about: making things yours in a stand against capitalism. It's not just my love letter *to* mice, but a *letter* letter to you for you to think about what you really want from and in your tech. To go out and make it happen. Learn how to replace the battery in your laptop. Bypass Microsoft's absurd requirements for installing Windows 11 on your PC. These are the little things that we have control over now. But just imagine what else we could have.

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