

Demo Abstract: Custom 3D-Printed Mouse: A Proof of Concept for Personalized Input Devices

Ryo Fujimura

California State University, Long Beach
Long Beach, California, USA
ryo.fujimura01@student.csulb.edu

Xin Qin

California State University, Long Beach
Long Beach, California, USA
xin.qin@csulb.edu

Abstract

Adaptive input device design holds significant potential for creating personalized solutions that cater to individual needs or integrate seamlessly with robotic systems. This project explores a custom approach to input device development by reconfiguring the internal layout of a standard mouse and designing a bespoke 3D-printed shell to house its components. Utilizing a BambuLab A1 Mini 3D printer and PLA filament, the resulting device is a lightweight, ergonomic mouse tailored precisely to the user's hand. This work not only highlights the feasibility of custom hardware adaptations but also serves as a proof of concept for broader applications in adaptive and personalized input device design.

ACM Reference Format:

Ryo Fujimura and Xin Qin. 2025. Demo Abstract: Custom 3D-Printed Mouse: A Proof of Concept for Personalized Input Devices. In *Proceedings of Make sure to enter the correct conference title from your rights confirmation email (Conference acronym 'XX)*. ACM, New York, NY, USA, 2 pages. <https://doi.org/XXXXXXX.XXXXXXX>

1 Introduction

Traditional input devices that are mass-produced like computer mice often lacks in personal customization or consumer reparability, limiting opportunities for user-specific ergonomic customization or seamless integration with robotic systems [1]. This project addresses these limitations through a demo centered on repairing a Logitech MX Master 3 mouse with a broken primary click button plastic. By developing a modular, 3D-printed shell with user-reconfigurable button layouts, we demonstrate how consumer-grade devices can be adapted to prolong their lifespan via open-source, user-repairable components while tailoring ergonomics to individual anatomical or functional needs. Furthermore, this reconfigurable framework enables robotic systems to interface with task-optimized mouse hardware, allowing dynamic adjustments to grip configurations or actuation mechanisms to enhance precision in shared human-robot control scenarios. Leveraging accessible 3D-printing workflows, our methodology aligns with Maker community efforts to democratize adaptive technology development.

The approach not only empowers users to address planned obsolescence challenges but also provides researchers with a scalable platform for prototyping specialized input devices in assistive robotics and human-machine interaction applications.



Figure 1: Overview of the original and custom mouse components

2 Design and Methodology

The project began with the disassembly of the Logitech MX Master 3 to extract its circuit boards, buttons, and sensors[2]. Care was taken to avoid damaging delicate components, such as ribbon cables. The original button layout was analyzed and a new layout was designed to better suit my hand size and grip style. Using Shapr3D, a 3D design application, a custom shell was modeled to house the components and accommodate the relocated buttons. The design process was iterative, with multiple prototypes printed to refine fit and ergonomics. The BambuLab A1 Mini 3D printer and matte PLA filament were used to create the shells. PLA was chosen for its ease of printing and biodegradability, though its durability remains a limitation. Stereo lithography Slicing software Bamboo Studio and Cura was used to prepare the 3D model for printing, optimizing parameters for strength and surface finish. Structural integrity

Unpublished working draft. Not for distribution.

Permission to make digital or hard copies of all or part of this work for personal or professional use, is granted by ACM, provided that the copies are not made for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

Conference acronym 'XX, Woodstock, NY

© 2025 Copyright held by the owner/author(s). Publication rights licensed to ACM.

ACM ISBN 978-1-4503-XXXX-X/2018/06

<https://doi.org/XXXXXXX.XXXXXXX>

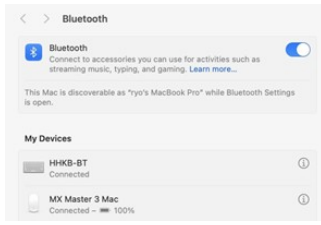


Figure 2: Bluetooth connectivity confirmation

was ensured by an infill density 15% and stress tests. The final shell weighed 15.1 grams, reducing the total weight of the original mouse from 141 grams to 77 grams, making it significantly lighter and more portable.

3 Results and Discussion

The custom mouse successfully resolved the discomfort caused by the broken original. One of the key improvements was the customized button layout, where the buttons were repositioned to better fit my hand, improving both comfort and usability. Additionally, total weight was significantly reduced, as the 3D-printed shell weighed 15.1 grams compared to the original shell of 79 grams, bringing the total weight down to 77 grams and making it more portable. This project demonstrates the feasibility of creating personalized input devices. By adapting the design process, similar devices could be developed for individuals with physical limitations or for special interface robotic systems.

4 Demo Description

The demo will showcase the custom 3D-printed mouse alongside a live demonstration of its use. Attendees will observe the ergonomic benefits of the design and the lightweight nature of the device. Physical setup will include a laptop connected to the mouse, allowing users to experience the improved comfort and responsiveness firsthand.

5 User Experience

Participants will be encouraged to interact with the mouse, exploring its custom button layout and ergonomic design. They can compare custom mouse's click accuracy, speed, and comfort with the original Logitech MX Master 3.

6 Demo Requirements

The demo requires a standard table, power outlet, and basic wireless connectivity. The setup includes a laptop, the custom mouse, and a small display stand. No special space or arrangements are needed.

7 Future Work

A promising direction is to further customize our input device, a modified computer mouse, to enhance the robot arm's ability to mimic human motion. Although a traditional mouse is primarily a pointing device, our approach extends its functionality to capture nuanced user interactions, enabling greater precision and adaptivity.

In this framework, the behaviors C (robot-generated) and C' (human-generated) are governed by a Signal Temporal Logic (STL) specification ϕ , which enforces constraints such as safe velocity limits and task deadlines. For example, if a human operator moves the mouse slowly and smoothly, the system enables the robot to replicate this motion, thereby enhancing human-robot synergy.

Consider a customized computer mouse that interfaces with:

- A *robot arm*, which manipulates the device to produce behavior C , and
- A *human arm*, operating a nominal counterpart to produce behavior C' .

With ϕ specifying the necessary constraints, our system guarantees:

$C \models \phi$ (robot behavior satisfies ϕ)

$C' \models \phi$ (human behavior satisfies ϕ)

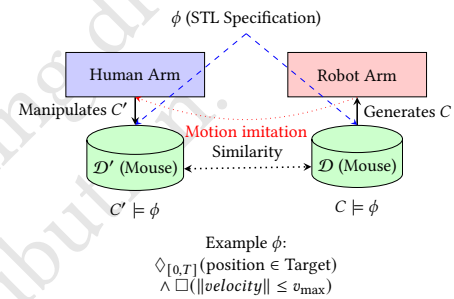


Figure 3: Schematic of Human-Robot Interaction via STL-Constrained Haptic Devices. Illustrates a human arm operating a nominal device \mathcal{D}' to generate behavior C' , while a robot arm manipulates its corresponding device \mathcal{D} to produce behavior C . Both behaviors are constrained by the Signal Temporal Logic specification ϕ , ensuring that the robot replicates the human motions, with a feedback loop reinforcing motion imitation.

8 Conclusion

This project successfully transformed a Logitech MX Master 3 into a custom, ergonomic, and lightweight mouse. By leveraging 3D printing and iterative design, the project highlights the potential for personalized input devices. It serves as a proof of concept for adaptive designs that cater to individual needs or integrate with robotic systems, paving the way for future innovations in human-computer interaction.

References

- [1] Patrick Baudisch and Stefanie Mueller. 2017. Personal Fabrication. *Foundations and Trends in Human-Computer Interaction* 10, 3–4 (2017), 165–293. <https://doi.org/10.1561/11000000055>
- [2] C. Frauenheim et al. 2019. Logitech MX Master 3 Repair. Retrieved February 5, 2025, from https://www.ifixit.com/Device/Logitech_MX_Master_3.
- [3] Microsoft. 2025. Microsoft Inclusive Design. Retrieved February 5, 2025, from <https://inclusive.microsoft.design/>.
- [4] E. Weinoffer. 2019. Logitech MX Master 3 vs 2S Teardown: Our favorite mouse got even better. Retrieved February 5, 2025, from <https://blog.bolt.io/logitech-mx-master-3-vs-2s/>.