Research Project Summary and Follow-On Impact Report

Project Overview This report outlines the key findings and outcomes of the UROP summer project, focusing on the development of novel digital musical instruments and the exploration of haptic feedback mechanisms for musical performance. The project, which ran over the course of four months, involved rigorous experimentation with various actuator configurations, software-hardware integrations, and feedback systems to create interactive musical interactions.

Key Project Developments

- **Exploration of Chaos and Stability in Musical Instruments**: This part of the project investigated how controlled chaos could be incorporated into instrument design, inspired by Tom Mudd's work on nonlinear dynamical processes. The study revealed that certain actuator configurations led to feedback loops that could be both predictable and unpredictable, creating an interesting interaction with the instrument. The concept of a 'chaos bell' was developed, where users could interact with the instrument to influence unpredictable yet intriguing sonic behaviours.
- **Haptic Feedback and Interaction Models**: Extensive testing was conducted on actuators of varying sizes, leading to insights into how weight and force application affect vibration response.
- **Prototyping and Fabrication**: Various bell designs were 3D-printed and tested, integrating different actuators to evaluate their musical potential. Modifications were made culminating in a functioning demo setup.

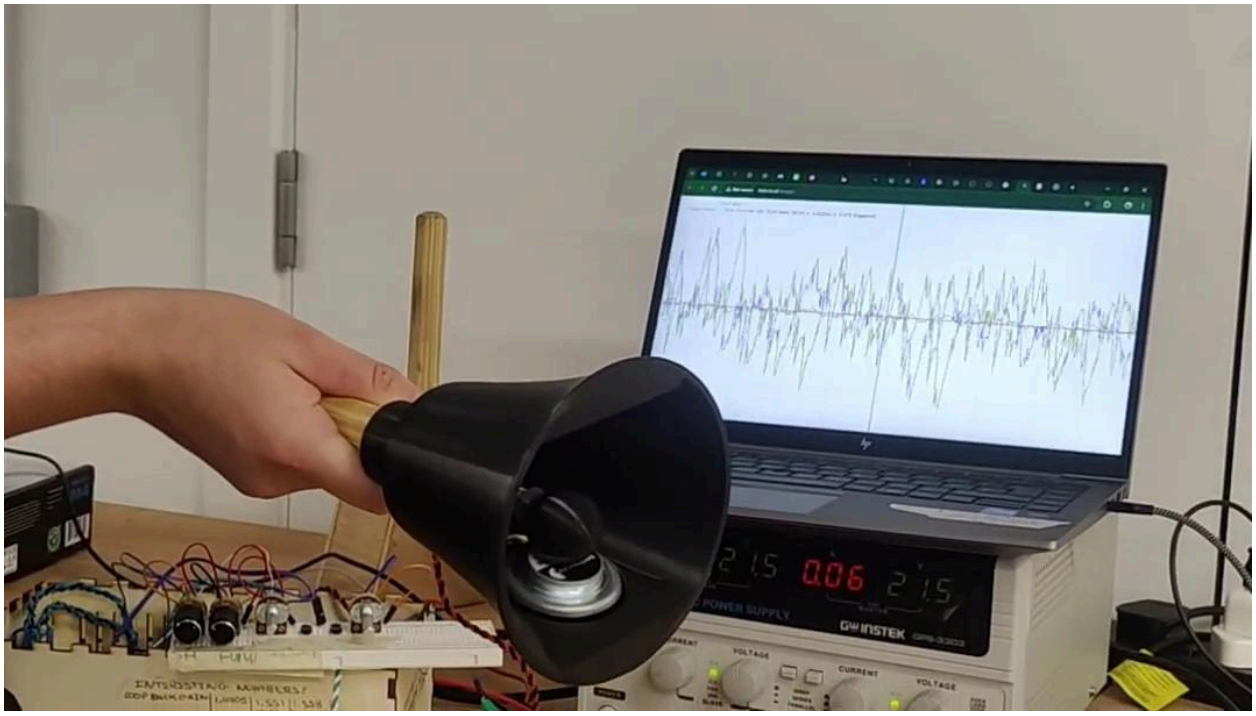
Presentation at CHIME Annual Conference 2024

After the research opportunity concluded I had the opportunity to share the findings and prototype developed at the CHIME Annual Conference 2024.

During this conference, I was able to go to attend many insightful talks as well as gain contacts within the field of Digital musical instrument design and discuss my work and
findings with many different people.

OHMI/Drake Sustain-a-thon Participation

Following the new contacts met through the conference in December, I had the opportunity to attend an OHMI/Drake Sustain-a-thon event, focusing on disability-inclusive musical instrument design with a focus on sustainability and repairability (linking back to current work being explored through my degree courses). The project's insights into haptic feedback and non-traditional interaction models were particularly relevant for accessible music technology and gave me a good base knowledge to contribute constructively to the event.



Concluding Remarks

The research project has had a significant impact beyond its initial scope, contributing to academic conferences and real-world applications in accessible music-making. The research into haptic feedback in digital instruments has opened pathways for future studies and applications in both experimental performance and assistive music technology.

Ongoing collaborations are planned to broaden the impact of the bell. Including a collaborative concert with Trinity Laban in February.

Acknowledgements

I am grateful to the Old Centralian Trust for providing me with part of the funding to take on this opportunity, which has both contributed to my continued studies as well as my

future plans. I also extend my appreciation to the EPSRC for also part funding, as well as Professor Andrew McPherson for providing valuable guidance throughout this experience.