Designing an Accessible MIDI Controller: Enhancing Usability and Reducing the Educational Barriers in Music Production for Beginners

The Role of Educational Inequality and Technological Access in Shaping Opportunities in Music Production

A Thesis Prospectus in STS 4500

Submitted to

The Faculty of the School of Engineering and Applied Science

University of Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science in Computer Engineering

By

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Nov 9, 2024

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Moving into the 21st century, technology has revolutionized music production. With the help of computer software and codified music notation, producers no longer need professionalism, a fancy studio room, and expensive equipment to make a good piece of artwork. Yet, while some of the barriers to music production have been lowered, they reveal other issues such as music education. Many beginners lack early education in instrumental training, theory, or even exposure to music in general. This significantly hinders their ability to succeed in music production. Moreover, the tools that help make music, including Digital Audio Workstations, which are the software used to make music, and tools such as MIDI controllers, all have noticeable learning curves. To understand and make use of the devices, people need to know many things, ranging from computer skills, and musical skills, to the understanding of physics and sound in order to operate them. These factors further raise the bar, countering the benefits technologies provide to music production, which are potential reasons why many are steered away from attempting to participate in music production and enjoy the numerous benefits that music production provides to people.

The sociotechnical challenge lies in creating tools that make production more accessible and equal. In the technical project, an improved, user-friendly design of an existing device, with special features that simplify chord progression creation and lower the learning curve, is proposed to solve the challenge. The technical project is accompanied by a parallel STS project, which examines the educational and technological inequalities that impact music access and explores cases and ideas that aim to lower barriers to music production and extend them to a broader environment. Together, both projects take on the technical and social aspects, ultimately promoting inclusivity and diversity in the music production industry.

Technical Project

Positionality

With more people starting to produce their music, many lack adequate music education and find it extremely hard to create a chord progression, which is the basis of a song (Stevens, 2016; Brunner, 2017). In an Apple-exclusive software called Logic Remote, there is a "Smart Chord" mode that presets chords according to a given musical key. This ensures the user only uses chords within the selected key, making music theory unnecessary. Users can use this feature to experiment with different combinations of chords to create a chord progression that they prefer without worrying about making them out of tune. However, to access these features and professional tools, you must sacrifice your freedom of choice, spend a fortune, and commit to Apple's system. Consequently, not everyone can enjoy this feature. Moreover, the complexity of these software tools generates a steep learning curve, which only tech-savvy people can navigate.

Many other tools that a typical music producer uses, such as MIDI keyboards and MIDI controllers, also have steep learning curves. Without education in piano or other keyboard instruments, new producers might find it nearly impossible to use them effectively. (Airy & Parr, 2001; Bierylo, 2022). Additionally, without any instructions, people might find MIDI controllers—which are simply blank rows of buttons—very confusing to use.

However, many improvements can be made by redesigning something already widely accepted—such as the MIDI controller. The technical project aims to focus on a more user-friendly interface and to include built-in functions that eliminate the need for music theory when constructing a song.

Physical Design

To design a user-friendly control interface, I used the case study method to research how existing products make getting started easier. Due to the high customizability of my project, I analyzed the design of two similar products: one is the Stream Deck, and the other is a game cabinet called Jubeat. These designs incorporate transparent buttons layered over a screen, allowing each button to actively display information and alter them according to different functions.

Following this idea, we adapted the key design elements for use in MIDI controllers. With the help of the screen, the user can see the action associated with each button press. Additionally, part of the screen serves as a navigation page with intuitive operating logic. A separate navigation button allows the user to navigate menus and select different functions. These designs greatly enhance the usability of the device for unaccustomed users, and new producers benefit from a smaller learning curve.

Unique functionalities

To determine which new features might benefit producers, we conducted a structured questionnaire with a group of producers. In this questionnaire, I asked them what their view on current MIDI controllers is, what they value in the design, and if our proposed features are worth highlighting. In their response, many indicated that they prioritize function over form and confirmed that a feature to assist with chord progression construction would be highly beneficial.

In addition to the standard functions of a traditional MIDI controller, we added two unique modes to the device. The first mode is the smart chord mode. In this mode, the user is prompted to select a key for the song. Then, recommended chords for this key populate the twelve buttons. With this feature, the user does not need knowledge of music theory to compose a catchy chord

progression, as the screen provides guidance. This ensures users can focus more on creating a chord progression they enjoy rather than searching through various online tutorials. Another unique mode we introduce is the guitar strum mode. In this mode, each button in the row is assigned to one of four notes in a chord, which the user can select. Swiping across the buttons allows the user to simulate a guitar strumming effect. This allows those who don't know how to play guitar to experience a close-to-real simulation.

Importance

By providing users with such a device, the goal is to bridge the gap between users who lack technical, theoretical expertise, and experience, which the existing tools originally designed for experienced producers cannot satisfy. Moreover, the adaptation of more diverse features on existing MIDI controller designs will make these devices not just tools of music production, but also good education and therapy devices by letting more people enjoy the benefits of music making through these devices.

STS Project

This technical project has a strong intention of positively impacting the social landscape through technology, making it a valuable STS project. The goal is to address issues in music production caused by unequal access to technology, the imbalanced distribution of educational resources, and the general decline of music education (Aróstegui, 2016), thereby enabling more people to enjoy the benefits of music production. Consequently, the STS project will focus on how disparities in education and technology access create barriers for aspiring producers.

In my experience with music production, I worked alongside friends who were also exploring this field. During this time, I observed that many peers, while interested in music, lacked the early professional training that would have developed critical musical intuition and theoretical skills to compose harmoniously. What's more, theory cannot be taught easily to make them catch up. This led me to an essential question: how can we address this gap with our limited resources?

To analyze potential solutions, a closer examination of the root causes of inequality is needed. I will use the Intersecting Structures of Power framework, which examines how systems like politics, technology access, and education create systemic inequalities, affecting people's ability to engage in music. In many communities, formal music education is unavailable (Wiggins & Wiggins, 2008), leaving residents reliant on costly institutions or online resources. However, those without access to technology or wealth also struggle to acquire this knowledge. Artistic creation, which values creativity, should not be constrained by economic barriers or restrictive systems of knowledge.

Considering this social problem, several potential directions could improve accessibility. One important case study is Apple's music production ecosystem, which aims to enhance efficiency and provide assistance in music creation. Although not everyone has access to these tools, valuable lessons can be drawn from them to help engineer devices that bring similar benefits to a broader audience. Additionally, research has demonstrated that musical technology, particularly MIDI (Musical Instrument Digital Interface), is versatile across areas such as music creation and therapy (Saide, 2024). MIDI's universal protocol in the music industry contrasts with proprietary technologies that restrict features to specific products, offering more inclusive opportunities for users who might otherwise be limited by technocratic barriers.

Another case study that highlights inclusivity is the University of Virginia's open-access music studio, equipped with professional equipment and available by reservation. To know how well the model has been performing at UVA, I plan to use an unstructured interview to gather more, detailed feedback on how the faculty members think about the performance. To gather insights on expanding the model outside of our school, I will interview not only faculty members overseeing the studio but also educators from underfunded schools and representatives of community arts organizations. This broader range of perspectives will provide a more comprehensive understanding of how similar models can be adapted to different contexts, such as universities, schools, and community centers, and identify barriers unique to each setting.

Previous research on MIDI technologies also highlights their therapeutic benefits, pointing to the additional advantages of interactive MIDI devices and music production in general. Numerous studies reveal that music composition offers benefits such as mental health support, social capital, and cultural promotion (Henley et al., 2012; Hallam et al., 2012; Kokotsaki & Hallam, 2011). A literature review on the benefits of music-making can further demonstrate the positive impacts of promoting this technical work.

By conducting case studies, reviewing scholarly works in sociology and music technology, and examining engineering advancements, I aim to deepen the understanding of how social inequalities, such as disparities in educational resources, technological access, and economic opportunities, shape access to music production. This research will not only inform the technical project's role in mitigating these barriers but also propose additional strategies for fostering a more inclusive music production landscape.

Conclusion

In summary, the technical project is going to deliver a user-friendly MIDI controller designed to reduce educational barriers in music production with the introduction of innovative features such as Smart Chord and Guitar Strumming Mode. These enable beginners to create song structures without the need for music theory. The STS project aims to address inequality issues caused by disparities in education, limited access to affordable technology, and economic constraints that prevent many aspiring producers from engaging in music production. In the meantime, the research also explores the benefits of promoting music production equality. The insights from the STS project will provide a better understanding of how the technical project can be designed to enhance inclusivity and accessibility, making it more impactful and effective. Together, these two projects address the sociotechnical challenge of promoting equality in making music production. By providing a shortcut that reduces reliance on music-theoretical knowledge, these projects empower individuals with diverse backgrounds to participate in creating music with their creativity and enjoy the benefits of the music-making process.

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