The Chordinator: An Interactive Music Learning Device

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ABSTRACT

The Chordinator is an interactive and educational music device consisting of a physical board housing a "chord stacking" grid. There is an 8x4 grid on the board which steps through each of the eight columns from left to right at a specified tempo, playing the chords you have built in each column. To build a chord, you place blocks on the board which represent major or minor thirds above blocks that designate a root (or bass) note represented as a scale degree. In the bottom row, the user specifies a bass (root) note, and any third blocks placed above it will add that interval above the bass note. Any third blocks placed above other third blocks add an additional interval above the prior one, creating a chord. There are three rows above each root allowing either triads or seventh chords to be built. This interface combined with the board design is intended to create a simple representation of chord structure. Using the blocks, the user can physically "build" a chord using the most fundamental skills, in this case "stacking your thirds." One also learns which chords work the best in a sequence. It provides quick satisfaction and a fun, interactive way to learn about the structure of chords and can even spark creativity as people build interesting progressions or try to recreate progressions they love from their favorite music.

1. MOTIVATION

The goal of this project was to create an interactive and educational tool to help people understand foundational harmonic structures in Western music. We wanted to create a product that had a physical dimension (as opposed to a purely digital product or application) with interchangeable pieces that made the design fun and engaging while remaining as simple and intuitive as possible.

The target user for this product is someone without formal musical training but who may be interested in the building blocks of music theory, or curious about the chords and chord progressions in their favorite songs. In our research for this project we were unable to find any interactive, physical products like this.

There several standalone and online software application systems for understanding the fundamentals of music theory (i.e., notes, intervals, and chords). The drawbacks to these systems is that they tend to be expensive (e.g., EarMaster [1]), or highly task-oriented and geared towards aiding novice music students (e.g., www.musictheory.net [2]), or designed for academic use within a structured program (e.g., Musitian [3], SmartMusic [4]). Our product was designed to be more akin to software products such as Captain Chords [5] (a plugin compatible with many DAWs that allows a user to build chord progressions), but with a physical component. We believe this helps with the learning process by combining a tactile response with a visual (color representation of the intervals and orientation of the third blocks) response, and an auditory response.

Another motivation for this project was the potential for our product to contribute to research in music perception and cognition. With this platform of creating chord progressions, we wanted to see if a user's choice of timbre affects the type of chord progression they make. In other words, does creating chord progressions with a rock guitar sound tend to "pull" the user into creating a more pop-rock chord progression? To test this, our product is designed to allow a user to choose a timbre, and collects data regarding the final settings (all roots, thirds, tempo, and timbre) when a user is finished using the board. We chose five timbres that we thought best represented five common genres of music: strings for classical, electric guitar for rock, autoharp for folk, synthesizer for electronic, and a rhodes organ for jazz, as well as a more neutral or cross-genre sound, the piano.

2. DESIGN

Since the crux of our project relies on "stacking" or "building" chords, we needed a compartmental, sectional design. As such, a design similar to that of a fishing "tackle box" was chosen as the basic architecture for the board itself. We limited ourselves to eight columns (one per chord) and four rows (one root "box" and three third "boxes") for practical reasons; namely, the addition of more columns would have made the board too large or the blocks too small. Since the average phrase of a popular song is typically four measures with one to two chords per measure, eight columns was an appropriate length to capture a single musical phrase.

In the inside, we wanted the spaces for root blocks to be visually different from the third blocks as to make a visual representation of their importance and also to make the distinction between the block types more intuitive. This was achieved in the form of the root note blocks being larger than the third blocks, meaning the spaces for the root note had to be larger than the third notes. As our box was to be an eight-column by four-row grid, we had to create one row larger than the others while keeping the other three the same. Ultimately we created our grid by creating an interlocking, modular "lattice" of MDF wood strips. Finally, we placed this lattice inside the box to achieve the "tackle box" look we were aiming for (see Figure 1).

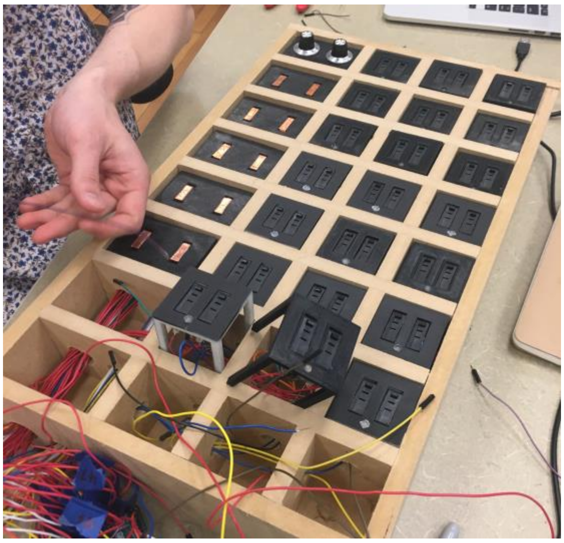

Figure 1: The chordinator board design

For sound generation and switch onset detection we used an Arduino Mega that sends data over serial port to a MaxMSP patch which converts the data to MIDI and plays the chords in real time as they are sequenced. There are two potentiometers, one which controls tempo, and one which controls timbre. As the user creates their chord sequence, they can change instruments and tempo in real time. When they are finished, they press a button and the state of the board is saved.

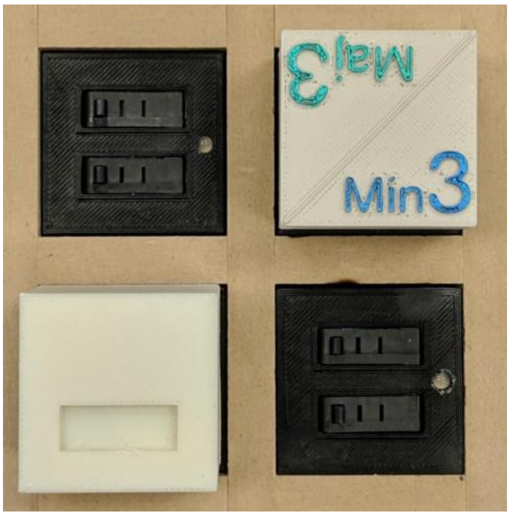

Figure 2: The switch detection method for the thirds.

We decided to use two different systems of communication for our two types of blocks; the third blocks communicate a signal to the Arduino by a simple binary switch depression system, and the root blocks communicate by resistor.

Two switches per block were required to detect three different states: no block, major third, and minor third. Both switches were aligned on the grid space so that, according to the location of the cavity when placed, it will either trigger one switch or the other (see Figure 2). One orientation corresponding to a minor third interval and the other corresponding to a major third interval.

Figure 3: Resistor detection method for bass notes.

To select the bass note for each chord, the larger (root) blocks are placed on the bottom row of each column. Instead of using switches to detect the different bass blocks, we used different values of resistors and assigned different notes to their corresponding values. Copper tape and a unique resistor was secured on the bottom of each bass block as well as the spaces where the bass blocks are placed (see Figure 3). When the connection is made, the block is identified based on the resistor that was used. From the user's perspective, they are placing a block with a number corresponding to the scale degree. So, in the key of C Major, the number three would correspond to the note E.

3. CONCLUSIONS

The Chordinator could be a useful product as a fun, standalone "toy" or game, and has the potential to be modified as a board or game for music education. Its ability to collect data makes it valuable for music perception and cognition research—something we hope to contribute to via this project in the future. We hope to collect user feedback at this stage of the prototype in order to make improvements to any aspect of the design, sounds, or user experience for the purposes of future development.

4. REFERENCES

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