An Interface for Entering Data into Score Editing Software

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Abstract

Current methods of entering data into score editing software can be inefficient and unwieldy. Many of the problems associated with musical data entry could be solved with a specialized hardware device designed to allow users to simultaneously enter pitch, duration and voice information for each note without needing to keep time with a metronome.

Introduction

There are a number of commercial software packages available that allow users to enter and edit scores on computers. These tools help to overcome the difficulties associated with reproducing and editing handwritten scores and they provide additional functionality, such as automated transposition. Unfortunately, these packages do not present users with a means of entering data that is as natural or efficient as the alternative of using pen and paper.

Every note that is entered into a score-editing program must contain three dimensions of information: a pitch, a rhythmic duration and an association with a particular voice or staff on the score. It must be possible to enter notes in a way that accommodates users who write vertically as well as horizontally, which means that users must be able to change voices easily while entering pitch and duration information. This must be done in a way that feels natural and is easy to use.

Existing Solutions

There are two standard existing approaches to musical data entry. The first is to use the mouse to select a rhythmic value from a palette and then move the mouse pointer to the appropriate staff to insert a note at the desired pitch. This is inefficient because it forces users to move the mouse pointer back to the palette every time that they wish to enter a note with a different duration. An additional problem is that the spatial separation between adjacent lines on a staff is small enough compared to the granularity of control of a typical mouse user that it is easy to accidentally select the wrong pitch.

This first problem can be dealt with by assigning hot keys to different rhythmic values. The second problem can be dealt with by increasing the size of staves on the screen. Unfortunately, the first solution necessitates non-intuitive memorization and forces users to use physically awkward key combinations. The second solution decreases the number of lines that can be displayed simultaneously on the screen, with the result that users may need to scroll up and down when they wish to enter notes on different staves.

The second standard approach to musical data entry is to have users use a MIDI keyboard to enter music. The user must enter notes in time with a metronome. Although this can be an effective method for entering pre-written music, it is difficult for unskilled keyboardists. Furthermore, it does not allow users to specify which notes should appear on which staves unless they record the music one line at a time. In addition, users who wish to access functionality such as copying and pasting must move their hands away from the MIDI keyboard to the alphanumeric keyboard or mouse. Finally, this approach is inappropriate for users composing new music unless they are able to compose at the same rate as the metronome.

Proposed Solution

A specialized hardware device, designed specifically for musical data entry, could overcome the limitations inherent in MIDI keyboards and mouse/keyboard-based interfaces. Such a device must allow users to enter notes with as little conscious thought and hand movement as possible. Users should also be provided with easy access to additional functionality provided

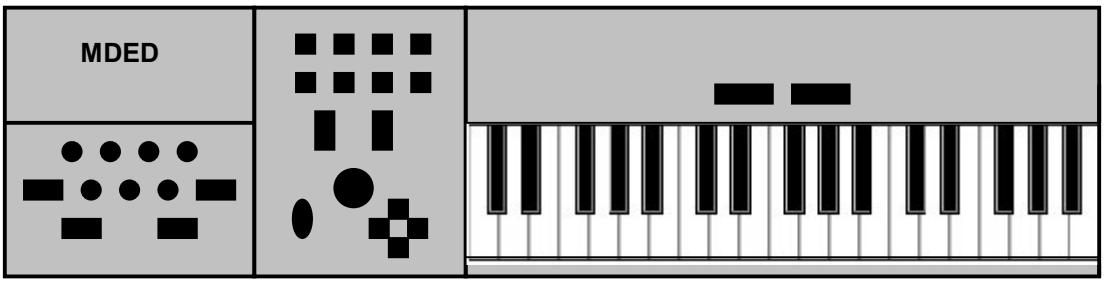

Figure 1: The MDED musical data entry device

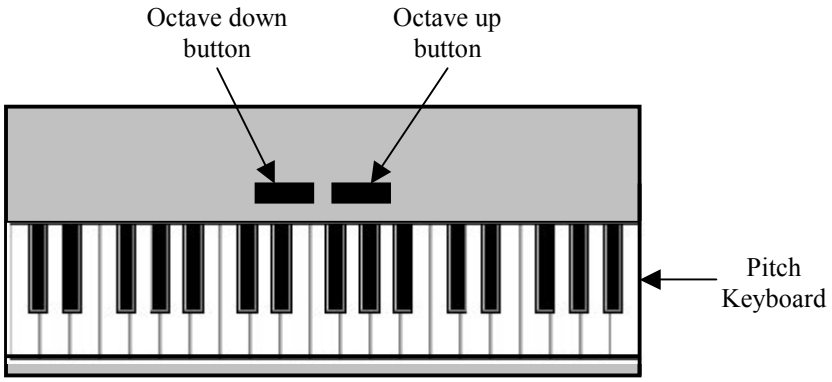

Figure 2: Pitch keyboard portion of the MDED

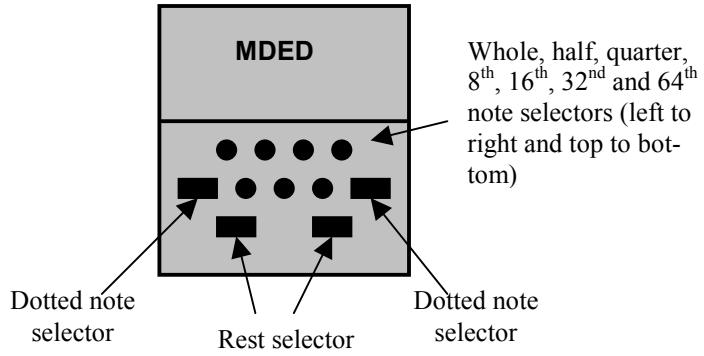

Figure 3: Rhythmic data entry portion of the MDED

by the score-editing program that the device is used with. The device proposed here is referred to as the MDED (Musical Data Entry Device) and can be seen in figure 1.

The MDED consists of three sections: a standard three-octave keyboard that is used to enter pitch information (see figure 2), a panel of buttons corresponding to the rhythmic durations of notes and rests (see figure 3) and a panel of controls that is used to navigate the score-editing software (see figure 4). This last section will always be at the center of the device. The other two sections can be disconnected from the center and switched with each other in order to accommodate the preferences of both left and right-handed people.

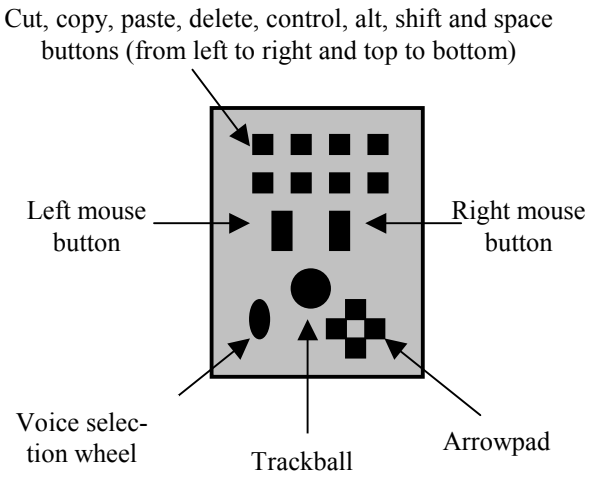

Figure 4: Central portion of the MDED

The pitch keyboard section of the MDED is limited to three octaves in order to minimize the cost and footprint of the device. Buttons to lower and raise the range of the keyboard by octave increments are included in order to allow the MDED to accommodate scores with notes in arbitrary registers.

The rhythmic section of the MDED has a button each for whole notes, half notes, quarter notes, eighth notes, sixteenth notes, thirty-secondth notes and sixty-forth notes. These buttons fit within one hand-span and are organized into two rows in order to match up with the four fingers. Pressing one of these buttons causes any note played on the pitch keyboard to have a rhythmic duration that corresponds to the duration of the button that was pressed. There are also dotted note and rest buttons on both sides of these two rows. These buttons can be pressed with one's thumb while another finger selects the rhythmic duration that is to be dotted or interpreted as a rest.

The central portion of the MDED allows users to access additional software functionality without having to move their hands from the MDED to the mouse or alphanumeric keyboard. The most important of these controls is the voice selection wheel, which allows users to move the insertion point between different voices. This wheel is close enough to the left section of the MDED that it can be accessed by one's thumb without having to move one's left hand out of position on the left portion of the MDED.

The central portion of the MDED also includes a four-directional arrow pad that moves the insertion cursor around the score. There is also a trackball and right and left mouse buttons. This prevents users from having to move their hands from the MDED if they wish to make a selection from a menu or perform some other mouse-related task. There are also buttons for the control, alt, shift, space and delete keys. These buttons can be used in conjunction with the trackball to access expert shortcuts, if desired. There are also copy, cut and paste buttons, since these functions are very useful when writing music with sequences or thematic repetitions.

Discussion

The advantage of the standard alphanumeric keyboard and mouse method is that it is useful when editing sections of a score that have already been entered. The advantage of the MIDI keyboard method is that it allows the user to enter pitch values in a way that is intuitive to musicians. The MDED combines the benefits of both of these approaches.

The primary advantage of the MDED is that it allows the user to simultaneously enter pitch and rhythmic information, with easy access to the voice selection wheel. This is done without needing to worry about keeping time with a metronome. Furthermore, the MDED allows users to navigate and edit scores using the controls on its central portion. They can do this without having to memorize arbitrary alphanumeric keyboard

combinations or move their hands between different devices.

The chief weakness of the MDED is the time that must be invested in learning how to use it. Fortunately, the idea of using a musical keyboard is familiar to all Western musicians, so this gives users some instant familiarity with the device. In addition, the central part of the MDED contains controls that are used in virtually all PC applications, so even users with a bare minimum of computer literacy should be able to use them.

The rhythmic section of the MDED is more difficult to learn, but its simplicity necessitates only minimal learning time. There are only a few buttons to learn and the similarity between them makes them fairly easy to grow accustomed to, especially since this part of the device relies on mechanics of data entry that are somewhat similar to those of alphanumeric keyboards. This is especially true for musicians, who have exceptional manual dexterity, and should be able to quickly learn how to use this device in a way that is automatic and requires little conscious thought.

Conclusion

The MDED provides a means of entering musical data with greater ease and speed than is possible with a MIDI keyboard or a mouse and alphanumeric keyboard. Users can simultaneously enter the pitch and rhythmic duration of each note without needing to stay in time with a metronome, and can move between voices without needing to move their hands from the pitch and rhythmic duration sections of the MDED. They also have easy access to the controls on the central portion of the MDED, which enables them to navigate a score and access additional functionality of the score-editing program that they are using. The MDED would be of great utility to users such as composers, music librarians and arrangers, who frequently need to enter and edit scores, and for whom the added productivity would more than compensate for the learning time and money that they would need to invest in the MDED.