

From toy to tutor: Note-Scroller is a game to teach music

Robert Macrae
Centre for Digital Music
Department of Electronic Engineering
Queen Mary, University of London
robert.macrae@elec.qmul.ac.uk

Simon Dixon
Centre for Digital Music
Department of Electronic Engineering
Queen Mary, University of London
simon.dixon@elec.qmul.ac.uk

ABSTRACT

The computer games industry has recently been producing titles in a new genre called ‘music’ that toys with engaging the user in musical expression. The technology used in these games has allowed for novel interfaces for representing musical instructions which has yet to be tried within musical practice and tuition. The games themselves have greatly simplified the instruments and the music created to the point where the skills learnt are not transferrable to the actual instruments that they seek to recreate.

The aim of this work is to explore the potential to move from this category of entertainment systems based on musical expression towards tutoring applications that support learning musical instruments in an entertaining and rewarding experience. Note-Scroller (Figure 1) is an interface that has been designed to bridge this gap and act as a case study for evaluating the potential of such a movement. It is hoped that Note-Scroller will be fun and intuitive to use, teaching users how to play music on a piano-style keyboard.

Keywords

Graphical Interface, Computer Game, MIDI Display

1. INTRODUCTION

In this paper, we describe an interactive system for providing the user with musical instructions using methods inspired by video games. This system also has the purpose of acting as a learning aid that can evaluate the users performance in real-time to provide visual feedback. As MIDI files often contain the full range of instruments and instructions used in a musical piece, the option of having the computer play selected instruments means Note-Scroller can also accompany the player.

Previous work in this area includes examples of computer based musical learning aids [2]. Work by Guillaume Denis and Pierre Jouvelot [3, 4] demonstrates the opportunity to create video games with the purpose of teaching music. The use of visual feedback in musical expression and its implications on mental workload was explored in François et al’s *Mimi* tool [5]. Also, games that already go some way as to use musical expression on a more simplified level are proving immensely popular. The *Guitar Hero* franchise (see Figure



Figure 1: A front and back view of the projected display

2) for example, is the first video game franchise to generate more than \$1bn in revenue and the title *Dance Dance Revolution* (with a similar instructive interface) alone sold more than 7.5 million units. Recreating the elements that make these games successful in educational platforms would be the next logical step.

The motivations for incorporating this set of features into one package are varied but ultimately stem from the hope of making music more accessible to a wider audience:

- The display methods used in these popular video games may be more intuitive to non music-literate users than standard music notation.
- Computer games incorporating modern features have been shown to increase students’ motivation [7].
- Adding visual cues to the users’ auditory feedback loop may result in an increase in performance.
- As an interface to the vast MIDI content already available on the internet, students will be able to choose musical pieces from an almost limitless source.

By making the performance of music more accessible it was intended that such a system will remove the typical barriers that deter people from learning to play instruments such as the cost of tuition, availability and the requirement of reading standard music notation. However, Note-Scroller would also ideally be used in conjunction with other learning methods.

2. DESIGN

Similar to the displays featured in video games such as *Guitar Hero*, *Frets on Fire* and *Dance Dance Revolution*, the instructions flow to the user as and when they need to be executed. As these video games show, providing users with visual cues of what is coming next allows the user to prepare more efficiently for their subsequent actions utilizing any spare attention [8]. Another benefit to the animated

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NIME08, Genova, Italy

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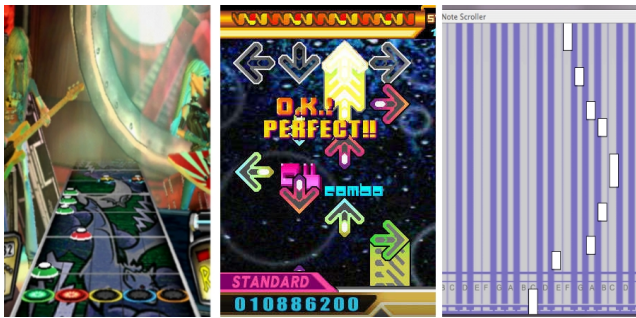


Figure 2: From left to right: The interface for *Guitar Hero*, *Dance Dance Revolution* and *Note Scroller*

display over static music sheets is that the user doesn't have to change their point of focus as the required information moves itself to where the user's gaze already is.

Using a MIDI connection to the keyboard, or a Moog *PianoBar* [9], the proposed system keeps track of which notes are being played correctly. By changing the display of the notes to green or red, (depending on whether they are being played), the system will provide the user with visual feedback. This colour code follows the familiar 'traffic light' convention that will be recognizable by users [10].

The musical instructions will be projected onto a screen above the keyboard/piano, flowing down to where the keys are. Therefore when a note needs to be played, the graphic representing that note is close to the keys. As the note graphics are vertically aligned with the keys they correspond to, there is a clear natural mapping [10] between the musical instructions and their executions.

3. IMPLEMENTATION

Note-Scroller is designed to be used in conjunction with a projector, screen, keyboard and MIDI input cable. The interface loads MIDI files by drawing all notes on a vertical piano roll that then flows down the screen. The user presses a key whenever a note graphic reaches the keys on the piano-style keyboard. The user can select which of the used MIDI instruments are shown and also the instruments played by the computer. When the notes pass by the playing line, the interface looks to see whether that particular note is being played and changes the display accordingly. The user is marked on whether or not they have played the correct notes. The user then has the option of choosing whether playing additional notes detracts from his/her score as some users may wish to intentionally improvise within a performance.

The system is designed to be simple to use in that the user opens the MIDI file and uses start, stop, tempo, zoom and position sliders to fully control the flow of information. The display is customizable so the user can configure how much information is shown to suit themselves.

A core MIDI library of basic piano pieces was assembled from freely available MIDI files on the internet. The user can then find and load more MIDI files as they see fit.

4. CONCLUSIONS & FUTURE WORK

Preliminary testing of the Note-Scroller system has so far been promising, showing that music-illiterate players could perform basic pieces and on average thought the system was better for them to learn music rather than reading scores.

Work on improving Note-Scroller is ongoing as there are many opportunities arising within digital music that may add to the functionality of Note-Scroller and similar sys-

tems. One example would be in using live audio synchronization to provide a means of controlling the playback speed of the instructions by simply playing faster or slower. There are also interesting developments in haptic interfaces [6] that could pave the way for a touch sensitive feedback loop to the system.

The main drawback with the Note-Scroller interface is in setting it up as the system requires a projector, computer and a suitable keyboard/piano screen to project the image onto. This also entails a lot of trial and error getting the virtual keys in line with the keyboard and finding space behind the instrument to position the projector. This problem could be mediated with a resizable display and with the advancement of flat screen monitors the projector will at some point be no longer necessary.

Adapting commercially successful games to suit educational needs isn't new, with an example being *Neverwinter Nights* [7] being transformed into a historical and political educational game for students. *Dance Dance Revolution* is also being used in schools in West Virginia to aid Physical Exercise lessons [1].

It is the long term goal of this work to use the popularity of video games, and their ability to reach and motivate millions of people, to teach transferable skills. Learning musical instruments using Note-Scroller has provided a clear example of how this could be done.

5. ACKNOWLEDGMENTS

With thanks to Andrew Robertson for his feedback. RM is supported by a studentship from EPSRC.

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