Toward Accessible Technology for Music Composers and Producers with Motor Disabilities

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ABSTRACT

In an initial user study, three motor-impaired musicians—a composer with a degenerative motor neuron disease, a guitarist who suffered a stroke, and a first-year college student with impaired finger movement—identified prospective areas of research in assistive technology. Participants in the study made use of a range of technologies to adapt conventional software to their needs, and identified practical limitations and challenges in those adaptations, including suggestions for novel and intuitive interfaces, optimized control-surface layouts, and repurposing opportunities in text-input techniques.

Categories and Subject Descriptors

H.5.2 [Information interfaces and presentation]: User Interfaces – Input devices and strategies

General Terms

Design, Economics, Human Factors, Theory.

Keywords

Music, notation, production, disabilities, UI, user study.

1. INTRODUCTION

Modern software tools for music score-writing (Sibelius, Encore, Finale, etc.) and music production (Ableton Live, FL Studio, Reaper, etc.) support a wide gamut of stages in music production (including improvisation, pre-compositional planning, composition, mixing and mastering, and many types of performance); they also manifest software instances of music's most common hardware technologies (physical and virtual MIDI-controllers, sound synthesis, and sound processing).

These tools rely heavily on the use of complex user interfaces in order to provide access to all parameters that need to be specified. Separate user interfaces exist for definition of the sequences of notes in individual phrases, for controlling the parameters of the synthesis, for mixing the individual voices, etc.

The motor-impaired people that lack sufficient dexterity in their hands may be capable of receiving the visual stimuli from these tools but their ability to control them is limited.

Various techniques were developed that enabled persons with motor-impairment to control the computer via emulation of the keyboard and the mouse, such as one-switch input [2], voice input [3], or eye tracking [1]. These methods are however tailored to the most common applications and interactions.

Recently, the notion of *adaptive instruments* emerged. They are instruments that are capable of adapting to the specific needs of musicians with particular disabilities. One example of a commercially successful project is Skoog, see [4]. They do however target a standard consumer market, rather than professional users.

2. USER STUDY

This poster reports on an initial user study aimed at identification of specific challenges that the motor impaired people are facing when using professional music authoring tools. The study was organized in the form of a semi-structured interview.

Three participants at various levels of physical disability were interviewed. They were asked about their daily routine of using the computing equipment, their previous or current music practice (instruments, tools, genre, their role in the industry), and their specific problems related to their music practice, induced by their disabilities.

The names of the participants have been changed to protect their privacy. Their participation was voluntary. The purpose of this study was fully disclosed to them and we received their consent to publicly report on the findings.

2.1 Peter (P1)

Peter is an acclaimed music composer with Amyotropic Lateral Sclerosis, a progressive and terminal degenerative disorder more commonly known as *Lou Gehrig's Disease*. In his own words, he is *"no longer capable of any real-time music input"*.

Peter writes instrumental and vocal concert music that requires detailed and complex notated scores.

Peter is an advanced user of the Sibelius and Finale notation tools on a MacBook Pro. He wishes to keep using the software, with which he is familiar, but due to the progression of his illness, his assistive technology needs change continuously; he describes his condition in its various phases as *"a moving target"*. For a while

he was slowly typing on the keyboard. Later he adopted a combination of keyboard and speech recognition.

Currently he uses head-tracking software and a one-switch interface emulating the mouse. He uses an on-screen keyboard for text and music input. He prefers a single-screen over multi-screen setup. He operates the software through customizable keystrokes, triggered by the on-screen keyboard. He is able to enter and edit whole compositions.

He prefers not to use voice input when editing music as it interferes with the audio output from his system. Using headphones is not an option for him for reasons of safety. He is unable to remove them should for any reason the volume of the sound exceed a safe level.

Before the onset of his illness, Peter would use pencil and paper to sketch harmonic plans for whole compositions. Visualizing such plans as abstractions (particularly without note-to-note rhythmic information) allowed him to explore innovative musical structures. Instantiating the composition into a more detailed music score occurred at later stages of work. He reported that switching to a method more dependent on notation software had an impact on his workflow. *"On paper you can write chord progressions and for a while not even think about the rhythm. Most computer programs force you into making choices."*

Some authors compose music by capturing their improvisation on a keyboard. He never relied on real-time improvisation. *"Once figured in my head, I am pretty capable of using a non-real-time input because the improvisation is accomplished mentally."*

Peter reported successful attempts at using Dasher [5] (an interaction method originally developed for assistive input of text) with Sibelius, which allows note entry with sequences of letters that Dasher can manage. Dasher is appealing to him as it does not require mouse clicking and will be therefore still available for him as his condition deteriorates. He suggested a modification of Dasher to be better suited for music-character entry. He also reported that he had problems with the need to pause Dasher to prevent it from *"getting ahead of [him]"*.

Peter also reported struggling to use Virtual Studio Technology (VST) plug-ins because they often require actions that are difficult to perform with his adaptive tools, such as clicking very small graphical targets and using keyboard-mouse combinations (e.g. command-click, shift-drag).

He requires that any new user interface must be intuitive and easy to use. *"No time to think about music when I need to think about the interface."*

2.2 Stan (P2)

Stan was a guitar player in a rock-and-roll band. He suffered a stroke, after which he lost the ability to control his right (dominant) hand. He still uses a computer and cell phone every day. Before the stroke he watched on-line music lessons. He was writing music for his band but for that he did not use any music authoring technology.

He assumes that a computer can be used as a convenient storage of his work. At present time he uses computer to access Facebook and for music-related online research.

2.3 Martin (P3)

Martin is a first-year college student interested in poetry and songwriting. He has a quadriparesis caused by cerebral palsy. He has a limited dexterity of fingers and needs crutches to walk.

He uses computer and mobile telephone daily. He does not use any assistive technology hardware. He has a mild dyslexia and dysgraphia. He prefers hearing texts to reading them. He uses a text magnification tool when browsing the web.

Martin has experience with Steinberg Cubase and FL Studio music production software tools. He reported that despite his extended training he found their user interfaces confusing. He calls for a notable simplification.

Martin tried playing drums and intended to take lessons from a professional musician. His condition however prevented him from a continued effort. He only tried a standard drum set. He did not consider using an adapted set.

3. DISCUSSION AND CONCLUSION

Although generic assistive technologies replace keyboards and mice easily for some users, their performance for Peter, Stan, and Martin, is still below that of the conventional input devices.

The complexity of most of the current user interfaces for music authoring and production is notable. Without the assistive technology designed specifically for music authoring most of the current electronic music technology remains practically inaccessible also for this group of users.

A number of user requirements were identified during the interviews with our participants:

- User interfaces for music composition, allowing the users to write music in top-down manner, i.e. to sketch out the structure of a composition before committing to specific decisions, inspired by the "composing on paper" paradigm.
- Optimization of the layout of the on-screen keyboards for entering musical symbols.
- Repurposing the existing text input techniques for entering music (such as Dasher, as used by Peter).
- Increasing the accessibility of the VST plug-ins.
- Helping the traditional "paper composers" to begin with computer-aided music composition.

This poster is our first step in building tools that will increase the accessibility of existing music authoring tools.

4. ACKNOWLEDGMENTS

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