Printing the Muses: Reimaging digital musical instruments through 2.5D printing

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Abstract

The objective is to explore cross-disciplinary methods of converting musical terms for tactile interfaces, thus enabling people unfamiliar in creating music to be explorative through the development of novel musical interfaces. The project involves working with designers, coders, engineers and musicians to translate musical terms for musical composition into a taxonomy that can be then converted into a physical interface or new musical instrument, e.g. zones of patterns, textured slider bars, different heights that contain different resistance. The approach tests different print technologies incorporating 3D and 2.5D printing, and a range of materials, smells and textures. Surfaces need to quickly recognised in different conditions (eg. humidity, darkness), and tests a range of materials for haptic and sensory comfort.

Introduction

Music notation is a system to graphically represent the sound of music that is either sung or played on a musical instrument. Musical notation has evolved over centuries and is represented in a variety of ways across cultures. There are many different methods to represent and interpret music, for example. avant-garde composers John Cage, Leon Shidlowsky, Helmut Lachenmann, Steve Roden, Bogusław Schaeffer. [1] These scores are highly graphic and dynamic, including colours, shapes and graphics.

Recent developments in new materials, open source technologies in electronics, coding and digital media are providing opportunities for new forms of expression and creativity between musicians, computer scientists and designers that move beyond a musical score, or a laptop and coding, towards an interface that reflects the creative, conceptual and performative aspects of music. [2] Emergent touch sensitive technologies enable an evolution from screens and pads to pressure sensitive and multi-touch interfaces, presenting new opportunities for human interaction and creativity. Music is beneficial for all ages, recent study has shown that music has benefits for all ages, and can the improve quality of life in numerous ways, by reducing stress and anxiety. [3] Parallel research, in collaboration with Bristol City Council and Bristol Legible City, is an exploration and development of tactile maps and products for visually impaired.

Motivation: How can we re-imagine musical interfaces for a connected digital world as: 1) a new form of interface design, which acknowledges the user's part in both design and performance; 2) as an open resource and digital playground, though which digital instrument interaction and the Internet of Musical Things (IoMT), including distributed connected musical experiments. This project builds on new interfaces for musical expression (NIME) and scientific research exploring the role of new technologies in relation to musical expression, conceptualisation and artistic performance. In order to better understand the requirements and workflows for NIME, what interface, interaction, and haptic feedback would an artist design, if through the democratisation of technology?

Methods: using cross disciplinary methods for new tactile musical interfaces, we are exploring the combination of applied computer science and fine printing methodologies, alongside artistic and curatorial practices, new media approaches and Do-It-Yourself maker manufacturing. For our design and build of tactile interfaces for new musical expression, we have tested a range of printing and fabrication methods, for example, thermal swell paper, 2.5D UV curing hard and flexible inks, laser cutting, cast materials, and including low-cost touch sensor arrays.

We have undertaken collaborative workshops with musicians and artists, with particular focus on mapping of gesture to action, translating musical terms for musical composition, and towards developing a taxonomy that can then be converted into physical interfaces for new musical instruments. Workshops, quantitative and qualitative assessments comprise: **1)** Translation of musical composition into a taxonomy for a physical interface or new musical instruments e.g. zones of patterns, textured slider bars, different heights that contain different resistance. **2)** Assessment of surfaces/textures for sensitivity and recognition. **3)** Assessment of materials subject to different lighting conditions, eg. low-lighting, coloured lights. **4)** Exploration of different printing processes onto a range of substrates. **5)** Testing longevity of surfaces, eg. abrasion, wear and tear, sweat, de-lamination of ink from substrate.

References

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[3] Yingshi Zhang, et al., "Does music therapy enhance behavioral and cognitive function in elderly dementia patients? A systematic review and meta-analysis," Ageing Research Reviews, 35 (2017) pg.1-11

Author Biography

Carinna Parraman is Director of the CFPR and Professor of Design, Colour and Print. She is on 2 programme committees for Electronic Imaging IS&T, Chair of the Colour Group GB (2015-17), has recently written "2.5D Printing: Bridging the Gap Between 2D and 3D Applications", (Wiley, 2018, with Maria Ortiz Segovia), and is part of Appearance Printing - European Advanced Research School (ApPEARS).

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