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NIMEcraft Workshop: Exploring the Subtleties of Digital Lutherie

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NIMEcraft Workshop: Exploring the Subtleties of Digital Lutherie

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ABSTRACT

This half-day workshop will explore the craft of digital musical instrument design. Craft practice is central to the working process of both acoustic and digital instrument builders. Unlike the higher-level NIME design frameworks and taxonomies that appear in the literature, craft knowledge is often personal, subjective, and occasionally difficult to describe in writing. This workshop will call attention to this important aspect of instrument design through a combination of discussion and a hands-on instrument design activity focused on sculpting the subtle behavioural details of an instrument. The workshop will also reflect on how craft knowledge can be better disseminated and shared in the NIME community.

Author Keywords

Craft, design, digital lutherie, tacit knowledge, evaluation

ACM Classification

H.5.5 [Information Interfaces and Presentation] Sound and Music Computing, H.5.2 [Information Interfaces and Presentation] User Interfaces – Evaluation/methodology

1. INTRODUCTION

Throughout its 16-year history, NIME has drawn on both the scientific method and a rich history of artistic experimentation. Building a New Interface for Musical Expression has never been a solely scientific exercise. As Perry Cook put it at NIME 2001 [5]: "Musical interface construction proceeds as more art than science, and possibly this is the only way that it can be done."

Sergi Jordà coined the term *digital lutherie* to describe the creation of digital musical instruments (DMIs) [10], writing in 2004:

> Digital lutherie is in many respects very similar to music creation. It involves a great deal of different know-how and many technical and technological issues. However, like in music, there are no inviolable laws. That is to say that digital lutherie should not be considered as a science, but as a sort of craftsmanship that sometimes may produce a work of art, no less than music.

In recent years, within the NIME paper track (known in some years' conferences as the "scientific" program), there has been increasing emphasis on rigorous design processes and reflective, sometimes formal evaluation [1]. This evolution is perhaps tied to increasing links between NIME and the broader domain of human-computer interaction (HCI) [7]. Jensenius and Lyons, reflecting on their *NIME Reader* anthology, write in 2016:

> While a healthy respect for adhoc, improvised approaches persists, we also see individuals and groups engage in more long-term and structured development work. This work is often focused on development as process, with an acknowledgment of both formal and informal evaluation of the interfaces as an important part of this process.

Many NIME frameworks have been proposed for design [9, 13], taxonomy [2, 16] and evaluation [15, 17]. Partly due to the brevity of the NIME paper format, it is unclear the extent to which these frameworks are being actively used in the creation of new DMIs.

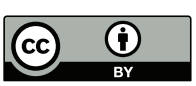
What is clear is that the published literature is not, and probably can never be, a comprehensive template for how to create a completely new DMI. This workshop intends to pick up where the literature leaves off, highlighting and querying the skills and decision-making processes in digital lutherie which go unremarked in scientific papers. In short, we seek to explore *NIMEcraft*: the craft of digital lutherie as distinct from its science and engineering.

2. CONSIDERING CRAFT

We deliberately avoid providing a comprehensive working definition of *craft* in this workshop, though it has been studied in contexts outside of NIME [11, 4]. Instead, we use the term as a stand-in for the personal, sometimes subtle, often subjective decisions which contribute to the identity of an instrument, but would not be captured in a high-level taxonomy of the instrument's form or function. We also use *craft* to encompass the process and actions by which an instrument comes into being, as distinct from its final form, i.e. the *how* rather than the *what*.

2.1 Craft in Traditional Instrument Making

Craft is a culturally celebrated yet understudied aspect of instrument making. In acoustic instrumental traditions such as string instrument *lutherie*, a luthier's craft (however it may be defined) is recognised as a critical aspect of their ability to produce high-quality instruments for professional



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players. A typical luthier spends years in training, acquiring skills in hand tool conditioning and usage, and learning to see and hear instrument quality in fine detail. It is rare for a luthier to start their own workshop upon leaving school; it is instead more likely that they will work in instrument repair and maintenance as part of a team for up to ten years before they are ready to consider becoming an independent maker. The process of learning and improvement will be ongoing throughout a career, just as the perfect instrument is a culturally-dependent ideal which is aspired to, but never realised.

Beyond the adherence to basic templates, acoustic principles and cultural traditions, it is craft which distinguishes playability among the most highly regarded (and thus played) instruments. Despite considerable study [3], many of these details still elude scientific quantification and systematic decomposition. String instruments in particular have tightly coupled, interdependent structure-behaviour relationships, which makes inference between making decisions and playability essentially impossible with current methods. Since craft can not be measured, it can not be communicated easily, and so this important part of instrument making does not receive the attention and prestige it deserves.

2.2 Craft in Digital Instrument Design

Any DMI designer, faced with the task of creating a specific instrument, must make myriad practical decisions which are not the subject of scientific study and are not covered by published NIME frameworks. Some of these are engineering questions: the choice of microcontrollers or sensors; details of schematic design; choice of programming language; architecture of the code. Others concern physical aspects: what materials to use; form and size; how to sculpt the materials into precisely the right form. Still other decisions are aesthetic, including appearance, feel and sound design.

These practical decisions are typically not scientific: they do not contain testable hypotheses, nor can there be a generally agreed optimum solution. The decision-making process is often personal. Where these aspects appear in NIME papers, it is usually by way of giving context rather than providing transferrable knowledge; a detailed discussion of *how* an instrument was built would be judged by many reviewers to be beyond the scope of what should appear in publication.

Some exceptions to this state of affairs can be found in published reflections from longtime practitioners, such as Perry Cook's design principles [5, 6]. Still, Jensenius and Lyons [8] suggest that a space for future expansion in the NIME community would be "Nurturing ideas: many NIME papers are fairly terse and have only room to present one (or a few) core ideas of a larger picture. It would be useful to create a space in which ideas can be expanded, generating new insights, suggesting new research directions, and supporting community-building."

The purpose of this workshop is to call further attention to these factors which underlie the creation of every DMI, yet fall outside the scope of most published papers.

3. WORKSHOP INFORMATION

3.1 Goals

The goal of this workshop is to explore and develop the idea of *NIMEcraft*, the craft of digital lutherie as distinct from its science and engineering. In particular, we seek to identify aspects of the DMI creation and refinement process that go beyond what is published in a typical conference or journal paper. We will offer an opportunity to participants to compare experiences, reflect on the role of craft in their own work, and discuss ways for craft knowledge to be shared and disseminated.

3.2 Participants

The workshop will be free and open to any interested parties (subject to the usual NIME registration policies). We expect that most or all participants will have experience creating digital musical instruments of some form (whether hardware or software), though no specific technical expertise is required. We would also welcome participants with experience in traditional or acoustic instrument making or non-musical crafts such as sculpture.

No submission or pre-registration beyond the usual NIME registration will be required to attend. Nonetheless, we will publish information on the workshop online in the months before the conference and circulate a call for participation, where interested participants will be encouraged to consider a particular craft-related issue they might like to discuss at the workshop.

Participants should bring to the workshop a laptop with the Chrome browser installed, which will be used during the hands-on activity to modify the software of a digital musical instrument.

3.3 Workshop Schedule

This is a half-day workshop that will divide into three parts of approximately 1 hour each. The central activity of the workshop will be a hands-on instrument development exercise, framed on either side by discussion and evaluation.

3.3.1 Introduction and Discussion

In the first 20 minutes, the organisers will briefly introduce the concept of NIMEcraft, situating it within historical context and examples from the literature and their own work. This presentation will conclude with a series of open questions about the role of craft within NIME and how this knowledge is communicated amongst practitioners.

The next 40 minutes will feature open discussion of these questions, inviting personal perspectives from the participants. To facilitate this, the workshop organisers will follow the methods set out in [TODO: ref open space tech guide]. In this short time, we do not expect to reach firm conclusions, but we will record notes for later review and exploration.

3.3.2 NIMEcraft Activity

To call attention to the fine details of NIMEcraft as distinct from the higher-level taxonomies and frameworks for DMI design, participants will engage in a hands-on DMI crafting activity. It will begin with a 10-minute technical introduction, followed by an hour for the activity itself.

Figure 1: MOAI, a percussion digital musical instrument, will be used in the hands-on workshop activity.

The organisers will bring several copies of a digital musical insturment with a deliberately constrained set of affordances and mappings. The instrument (Figure 1) is based on Bela [12]. It is percussive in nature, consisting of one or more wooden boxes containing accelerometers and piezo sensors. The boxes are mounted on flexible steel bars such that the boxes oscillate up and down when struck. The piezos are used as velocity-sensitive triggers, and the accelerometer is used to measure the oscillation of the box, selecting between different sound sets when moving or stopped.

The task will be to modify and fine-tune the sensors and mappings of the instrument to produce the best subjective experience of playability. Participants will be given a core constraint that the overall mapping strategy (dimensions of control, large-scale relationships between action and sound) must remain the same, focusing the activity on subtle details. Possible modifications include changing sensor placement, response curves, thresholds that distinguish between different behaviour patterns, or adding materials to the playing surface to change the tactile response.

This activity might be analogous to a luthier repairing and restoring a violin, rather than attempting to transform the violin into a fundamentally different instrument.

3.3.3 Evaluation and Review

In the final section of the workshop, participants will play each of the modified instruments in rotation. Depending on the number of participants and instruments, each participant may spend between 2 and 4 minutes per instrument. Participants will keep a sheet of paper on which they take notes about their experience with each one, focusing on the subtle details of its response.

After trying all instruments, a general discussion will compare the qualities of each instrument. From this, we will seek to clarify the definition and scope of NIMEcraft and draw distinctions between it and higher-level decisions of instrument structure that are more often found in DMI design frameworks. We will also consider how the kinds of design decisions made during the hands-on activity might be disseminated for future instruments: for example, whether it should be part of a paper, as companion material, or indeed whether it can be fully represented in a textual description at all.

4. FURTHER INFORMATION

4.1 Materials Brought by Organisers

We will bring the following to the workshop:

- Instruments for the hands-on activity (at least 5 copies). If registration is large, participants may work together in pairs or groups.
- Pairs of headphones for each instrument. We will bring these so identical headphones can be used for each one.
- Materials to change the playing surface of the instrument, including sheets of wood, plastic and metal.
- Tools and materials for modifying the instrument: adhesive tapes and putties, hot glue.
- Extra piezo sensors, accelerometers, wire and basic soldering equipment (mainly for repairs).

4.2 Requirements of the Space

The workshop should ideally be held in a room large enough to accommodate at least 5 teams of 3 people each. We ask for the following from the NIME workshop venue:

- One table (ca. 1x2 meters) for each team. Power should be available at or near each table.
- A pair of high-quality powered monitor speakers for demonstrating the instruments at the end.
- A video projector for the beginning presentation. (We can run the workshop without this if needed.)

4.3 Biographies

Andrew McPherson is Reader (Associate Professor) in the Centre for Digital Music at Queen Mary University of London. With a background in electrical engineering and music, his research focuses on augmented acoustic instruments, new performance interfaces, and study of performer-instrument interaction. He did his undergraduate and masters work at MIT, completing his M.Eng. thesis in Barry Vercoe's group at the MIT Media Lab. He completed his PhD in music composition in 2009 at the University of Pennsylvania. Before joining Queen Mary in 2011, he spent two years as a post-doctoral researcher in the Music Entertainment Technology Laboratory (MET-lab) at Drexel University. He is the creator of the magnetic resonator piano, an augmented acoustic piano which has been used in pieces by over a dozen composers, including a collaboration with the London Chamber Orchestra, and his TouchKeys multitouch keyboard was featured in a successful Kickstarter campaign in 2013. In 2016, his lab launched Bela, an open-source embedded platform for ultra-low-latency audio and sensor processing. Following a successful Kickstarter campaign, Bela is now available to the public with a growing community of makers, artists and engineers.

Jack Armitage is a PhD student at the Augmented Instruments Lab. He has a BSc in Music, Multimedia and Electronics, and previously was a research engineer at ROLI Ltd. working on the Seaboard GRAND, Seaboard RISE, BLOCKS and other projects. He is currently investigating craft in digital musical instrument design.

Astrid Bin is an artist, designer and technologist, with a particular interest in tangible music interfaces. She is a PhD researcher within the Augmented Instruments Lab at Queen Mary University of London, where she is developing a design framework for including the opportunity for human error in the design of electronic musical instruments.

Fabio Morreale is a Postdoctoral Research Associate in the Augmented Instruments Lab. He has a PhD in Music and HCI with a thesis focused on the design of new experiences of music making. His current research activities concern musical instrument design and evaluation.

Robert Jack is a doctoral candidate in the Augmented Instruments Lab. He has a MA(Hons) in Applied Mathematics and Music and an MMus in Composition. His current research investigates tactility in digital musical instrument design.

4.4 Experience

Andrew McPherson has previously (co-)organised several NIME workshops, including 2016 (NIMEhub: Toward a Repository for Sharing and Archiving Instrument Designs); 2015 (BeagleRT Embedded Audio Workshop); 2014 (Keyboard Salon); and 2012 (Actuated Instruments). Outside of NIME, he has (co-)organised workshops at ICLI 2016 (Making Embedded Instruments with Bela and Pure Data) and CMMR 2012 (Expressive Performance). He was also one of several co-organisers of the CHI 2016 Music and HCI workshop (principal organiser Simon Holland).

More generally, the organiser team from the Augmented Instruments Laboratory has been involved in organising and delivering several workshops and hack days related to the

Bela platform [12], including an intensive 3-day workshop at STEIM in Amsterdam in August 2016 [14].

5. ACKNOWLEDGMENTS

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