NIMEhub: Toward a Repository for Sharing and Archiving Instrument Designs

Andrew P. McPherson
Centre for Digital Music
Queen Mary U. of London
London, UK
a.mcpherson@qmul.ac.uk

Edgar Berdahl
Music / Ctr Comp. & Tech
Louisiana State University
Baton Rouge, LA, USA
edgarberdahl@lsu.edu

Michael J. Lyons
Ritsumeikan University
Kyoto, Japan
michael.lyons@gmail.com

Alexander Refsum Jensenius
Dept. of Musicology
University of Oslo
Oslo, Norway
a.r.jensenius@imv.uio.no

Ivica Ico Bukvic
SOPA, DISIS, ICAT
Virginia Tech
Blacksburg, VA, USA
ico@vt.edu

Arve Knudsen
Independent software developer
Berlin, Germany
arve.knudsen@gmail.com

ABSTRACT

This workshop will explore the potential creation of a community database of digital musical instrument (DMI) designs. In other research communities, reproducible research practices are common, including open-source software, open datasets, established evaluation methods and community standards for research practice. NIME could benefit from similar practices, both to share ideas amongst geographically distant researchers and to maintain instrument designs after their first performances. However, the needs of NIME are different from other communities on account of NIME's reliance on custom hardware designs and the interdependence of technology and arts practice. This half-day workshop will promote a community discussion of the potential benefits and challenges of a DMI repository and plan concrete steps toward its implementation.

Author Keywords

NIME, database, repository, archive, community standards, historical preservation

ACM Classification

H.5.5 [Information Interfaces and Presentation] Sound and Music Computing, C.3 [Special-purpose and Application-based systems] Real-time and embedded systems, D.2.3 [Coding Tools and Techniques] Standards

1. INTRODUCTION

In prior decades and centuries, musical instruments have been designed on relatively local scales. However, in modern Internet-connected design communities, it is becoming much easier to exchange and manufacture components, share ideas, distribute documentation and learning materials, and evaluate by consensus using social media such as YouTube. Yet these resources are not optimized, standardized, or vetted specifically for NIME. The NIMEhub

project aspires to create a NIME-centered design ecosystem in which instrument components can be more easily shared across the world, potentially enabling instrument components to be more rapidly designed, manufactured, and evaluated.

Many new digital musical instrument (DMI) designs are presented at NIME and similar conferences each year, and many others are developed by makers and artists unaffiliated with any academic community. Of these instruments, very few are described in sufficient detail for other researchers and artists to recreate them.

This situation creates two problems. First, scarcity of practical design information leads to duplication of effort. Many designers face similar problems, solving them independently and sometimes at great length. Second, many DMIs are not maintained in the long term. Hardware failures and software version changes will render many instruments inoperable after the first few years absent an active maintainer. In many cases, this also makes it impossible to perform pieces composed for specific instruments.

We suggest that a repository of DMI designs could be a starting point to addressing these issues. This could complement the nime.org proceedings database, which is focused on archiving the papers published on various instruments, but often with inadequate resources to reproduce the actual designs. Our proposed NIMEhub differs in its focus on hardware and software designs, though links between the two would be a future possibility. This workshop will investigate the benefits and feasibility of the NIMEhub concept, gathering suggestions from the community, and planning the next practical steps for its creation. One central topic of discussion will be the extent to which designs in the repository should use standardised tools and platforms, versus taking an open approach.

1.1 Potential NIMEhub Benefits

A NIME repository with hardware and software standards could benefit the NIME community in several ways such as:

1. Providing a landscape of design ideas/considerations for beginning NIME designers to learn from and be inspired by.

2. Enabling designs to be made more modular on many different levels.

3. Facilitating collaboration between geographically separated institutions in areas including instrument (co)design,

composition and performance.

4. Encouraging older successful designs to be revisited in a new technological framework, potentially enabling these instruments to be used by new generations of musicians and designers.

5. Reducing duplication of effort by sharing practical construction information in addition to the research concepts currently presented in NIME papers.

6. Promoting easier fabrication and mass-production of NIMEs through standardised platforms and production processes, just as the usage of interchangeable parts was vital to the development of the industrial revolution.

7. Encouraging more detailed documentation of NIMEs.

8. Promoting reproducibility of studies published at NIME.

1.2 Context and Related Work

The aim of NIMEhub is to provide a solution, but one that is seen as a resource and not yet another repository that takes time to update and maintain. An important question, then, is how we balance our needs in connection to everything else being shared online these days, including:

- code repositories (e.g. github.com, sourceforge.net and the academically-oriented soundsoftware.ac.uk [4])

- sound and music repositories (e.g. freesound.org and soundcloud.com)

- video repositories (e.g. youtube.com and vimeo.com)

- music research repositories (e.g. repovizz)

- open research datasets [5]

- do it yourself repositories (e.g. instructables.com)

- open tools for designing D-I-Y components (e.g. fritzing.com)

- data-sharing and discussing academic channels (e.g. PLoS One)

- multimedia-oriented artistic research channels (e.g. Journal of Artistic Research)

There are already some attempts within NIME to address some of the needs we are facing. One is that of the repositories created for various laptop orchestras. Linux Laptop Orchestra (L2Ork) [3] approaches this challenge by integrating local git repository into a homogeneous environment, supported by a collection of visual tools that allow for real-time monitoring and near-instant synchronization of data among multiple clients. The ensuing git repository is also integrated into the newly released L2Ork add-on to the Ubuntu Linux distribution, offering a transportable means of storing, updating, and cataloguing a growing library of works. The system utilizes full potential of the underlying infrastructure, differentiating between critical and user-centric files (e.g. piece preferences, such as handedness or preferred performance output levels). In its current state, the library is Pd-L2Ork-centric, primarily due to ensemble's focus on the said platform, with a growing number of works for other real-time digital signal processing tools and languages, such as Supercollider.

In terms of hardware standards for creating NIMEs, many platforms have been created in the past decade. Recent examples include Satellite CCRMA [2] and Bela [7], both based on embedded ARM Linux computers. Other relevant initiatives include the results of the EU-funded Integra project [9], which aimed at creating a software solution for preserving the technologies used in electro-acoustic pieces. On the musical side, Miller Puckette's Pd Repertory project[1] aims to archive the patches needed to run selected pieces of live electronic music.

A more recent non-academic initiative is that of Muzhack[2] by Arve Knudsen, focusing on preserving music technology projects.

1.3 Questions and Challenges

A number of important questions remain to be resolved about the NIMEhub concept, ranging from the philosophical to the mundane. The following topics will be discussed during the workshop.

1.3.1 Scope

What information should be contained in NIMEhub? Starting from the premise that the repository holds design information, questions remain about what types of information are needed to document a design. Relevant information may include schematics, CAD drawings, custom software, references to particular versions of OSes or standard software, and detailed instructions for building an instrument.

An open question is whether the structure of the documentation is left to the discretion of each designer or whether it should be structured into standard categories.

Another important question is to what extent the repository should also include (links to) everything from underlying research results to artistic uses of the instruments.

1.3.2 Standardisation

Perhaps the biggest decision is whether to encourage or enforce particular hardware and software standards on NIMEhub designs. There are several possible platforms which could become standards, including embedded Linux systems like Satellite CCRMA [2] and Bela [7] or the newly introduced Ubuntu L2Ork add-on (publication pending), microcontroller boards like Arduino [1, 8] and PC software like Supercollider, Pd, and Pd-L2Ork.

Standardisation within NIMEhub could have major benefits for the community through easy design exchange and shared solutions to common problems. On the other hand, enforced standards risk limiting the creativity of NIME designers or reducing participation in the repository. Choosing a standard platform also requires a community commitment to maintain and update that platform.

1.3.3 Modernisation vs. Archiving

As software and OS versions change, many older designs become inoperable. On one hand, there may be value in freezing DMI designs and all supporting materials (hardware and OS) at a particular point in technology history. On the other hand, updating older designs to run on the latest hardware may be a better way to keep instruments in active use.

Any decision on this topic must include musical considerations. Gurevich [6] presents a case study of performing several Cage pieces using modern technology, prioritising fidelity to the composer's musical intentions over resurrection of vintage analog tape and other original materials. Perhaps providing a continuing performance life for NIME music is more important than maintaining the technology. On the other hand, as continuing interest in vinyl, vacuum

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[1] http://msp.ucsd.edu/pdrp/latest/files/doc/
[2] https://muzhack.com

tubes and analog modular synths demonstrate, the artistic value of a technology often lies in its subtle idiosyncrasies and limitations rather than in its theoretical capabilities.

1.3.4 Peer Review and Moderation

The NIME proceedings database contains work that has been peer reviewed. Peer review may also hold value for NIMEhub, ensuring a minimum quality for instruments and the quality of their documentation. For example, peer review could verify whether a design could be recreated from the available materials (a problem that also faces software repositories). Both the review process, and the requirements it would impose on the designer, are open questions.

Any review process might lead to disagreements, e.g. between reviewers or between author and reviewer. Some moderation process would be needed to resolve these, with a moderator given final authority on whether a design is included in the repository or not.

More informal peer commenting may be another (or additional) method for the community to engage with each others' designs, as is often also used in other online repositories.

1.3.5 Maintenance

Maintaining the repository will require dedicated volunteer effort and technical infrastructure. Practical questions include where the repository would be hosted, who would maintain it (and how), and to what extent its future direction should be planned by a steering committee versus allowed to evolve in an ad hoc fashion.

This point is particularly critical when it comes to asking people to use the database in the first place. It may be difficult to get people to use a database if they are not ensured that their time and effort will be maintained. Here NIME has an advantage in that it is possible to enforce the use of the database as part of the regular submission procedure, albeit with the risk of obtaining fewer submissions to the conference.

The question is also whether the database should be restricted to only NIME conference material or be open for anyone in the community. It may also be possible to consider teaming up with related conferences/festivals to ensure enough momentum to get the project off the ground.

2. PRACTICAL INFORMATION
2.1 Participants

The workshop will be free and open to any interested participant (subject to the usual NIME registration policies). We are particularly interested to include the perspective of artists and makers who are not academically affiliated.

To gather input before the workshop, we will circulate an open call for participation in the spring. Participants who would like to present an idea at the workshop will be asked for a *short* description (max 1 page) application one or more of the following:

- Motivation for attending the workshop;

- A short position statement on the topic of sharing or archiving musical instrument designs or on common standards for instrument creation;

- An idea of what NIMEhub should be or what features it should have;

- An example of an instrument design they would like to include in the archive.

Statements of interest will be reviewed by the organisers for suitability and feedback sent by no later than the end of May. Statements will be used to allocate short speaking slots for selected participants (maximum 5 minutes, depending on number of submissions), but attendance at the workshop will be open whether or not the attendee submits an application.

2.2 Workshop Schedule

The workshop will take place over 3 hours, organised into the following sections:

2.2.1 Organisers' Introduction (40 minutes)

The workshop organisers will present the NIMEhub idea. Topics covered will include those described earlier in this workshop proposal. Following a general overview (10 minutes), each organiser will have a 5-minute speaking slot which they can use to present their ideas for NIMEhub and any projects of theirs which relate to it.

2.2.2 Initial Q&A (20 minutes)

Following the first presentation, there will be a short opportunity for questions and discussion amongst all participants. More discussion follows later in the workshop, but this provides an opportunity to capture initial reactions from participants.

2.2.3 Participant Presentations (45 minutes)

Each participant who submitted an application to the open call will be given a short speaking slot (2-5 minutes depending on number of presentations) with 15 minutes reserved at the end for questions and reactions to these presentations.

2.2.4 Design Breakout Sessions (45 minutes)

The workshop will split into small groups to conduct practical brainstorming exercises about what NIMEhub should contain and how it should be implemented. Topics for breakout groups could include: example instrument designs which could be included (with a focus on what kind of documentation would be needed); structure of the repository; possible standard formats/platforms for repository submissions; web interface considerations and how to best engage the broader community. Groups will be encouraged to take written notes which can be considered in detail later.

2.2.5 Final Discussion and Planning (30 minutes)

Each group will report back a brief summary of its discussion. Areas of general consensus about NIMEhub design and implementation will be identified, and the workshop organisers will coordinate plans for future activities.

2.3 After the Workshop

Following the workshop, the organisers will prepare a written summary of the discussion along with some recommendations for next steps (assuming the consensus is that the NIMEhub concept is worth pursuing). This will be posted freely online and circulated to the NIME mailing list for further comment.

Subject to the agreement of the NIME general chairs and scheduling availability, we also propose a short panel (max 20 minute) discussion during the main conference relaying the findings of the workshop and gathering further community input.

3. EXPERIENCE

The organisers collectively have substantial organisation experience at recent NIME conferences. Jensenius is chairman of the NIME Steering Committee and maintains the NIME

proceedings database; Lyons has co-organised the NIME Primer workshop since 2010 and co-organised similar workshops at CHI, SIGGRAPH and ACM MM; Berdahl has run workshops on Satellite CCRMA (2013-2015), Haptics (2013-2015) and others; Berdahl and McPherson together with two others ran an Actuated Acoustic Instruments workshop (2012); McPherson has run workshops on keyboard interaction (2014) and Bela (2015) and was a co-organiser of the CHI 2016 Music-HCI workshop; Bukvic has run an interactive art workshop on Cloud (2015) and brings experience in creating the L2Ork repository. Knudsen is the creator of the MuzHack instrument design archive.

3.1 Biographies

Andrew McPherson is Senior Lecturer (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 Master's 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 multi-touch keyboard was featured in a successful Kickstarter campaign in 2013.

Edgar Berdahl is an Assistant Professor in Experimental Music and Digital Media at Louisiana State University. In collaboration with the Cultural Computing Group at the Center for Computation and Technology, he studies how new technology is influencing new music and vice versa. He is accelerating the coevolution of new music and new technology by developing open-source tools for designing electronic musical instruments and making these tools available to the community. He has led the development of the tools such as Satellite CCRMA (a platform for making low-cost embedded musical instruments using components such as the Raspberry Pi 2), Synth-A-Modeler (a modular physical modeling environment that integrates the digital waveguide, mass interaction, and modal synthesis paradigms), and the Open Source Haptics for Musicians and Artists repository.

Michael Lyons is Professor of Image Arts and Sciences at Ritsumeikan University. He studied Physics at McGill University (B.Sc.) and the University of British Columbia (M.Sc., Ph.D.) and has worked in computational neuroscience, pattern recognition, human-computer interaction, and media arts, as a Research Fellow at the California Institute of Technology, Assistant Professor at the University of Southern California, and Senior Research Scientist at the ATR Research Labs. Michael proposed and co-organized the CHI 2001 workshop on New Interfaces for the Musical Expression, and has served as a member of the NIME steering committee and advisory board.

Alexander Refsum Jensenius is a music researcher and research musician working in the fields of embodied music cognition and new interfaces for musical expression (NIME). He is currently the Head of Department of Musicology at the University of Oslo, where he also holds an associate professorship in music technology. Alexander studied infor-

matics, mathematics, musicology, piano performance and music technology at the University of Oslo, Chalmers University of Technology, UC Berkeley and McGill University. He organized the NIME 2011 conference and is currently chairing the NIME steering committee.

Ivica Ico Bukvic is a researcher and an artist working in the area of ubiquitous interactivity. His most recent work focuses on communal interaction, audio spatialization, exploring connections among the arts and human health, and recontextualizing STEM K-12 education through innovative approaches to creativity and technology. Dr. Bukvic is currently an associate professor of music technology in Virginia Tech's School of Performing Arts, where he serves as the founder and director of the Digital Interactive Sound and Intermedia Studio (DISIS) and the Linux Laptop Orchestra (L2Ork), Institute for Creativity, Arts, and Technology's Senior Fellow, and a member of the Center for Human-Computer Interaction with a courtesy appointment in Computer Science. He has co-organized four conferences to date, and continues to serve as the director of the international Linuxaudio.org consortium.

Arve Knudsen is an independent software developer, residing in Berlin, Germany. He has a long background in software engineering, with a specialization in the creation of Web applications, and is the creator of MuzHack, an online application for the publishing of music hardware designs. Arve holds a Master of Computer Science from the University of Oslo.

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