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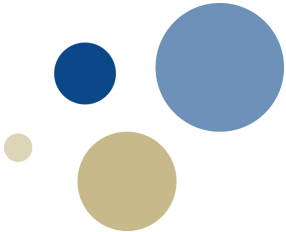

Human Computer Interaction

NIMEs (focus on evaluation and practices)

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30 October 2018

Comments on the 1st week

- HCI Individual Assignment Day 1
- HCI Group Assignment Day 1
- HCI Individual Assignment Day 2
- HCI Group Assignment Day 2 . . .

Learning Outcomes

- Get a sense of the synergies between HCI and NIME research.
- Explore a range of key practices in the NIME community from an HCI perspective (focusing on evaluation).
- Identify the NIME practices relevant to personal projects.
- Discern the format of NIME paper writing.

Preparation: Reading

— Send a summary (1 page max.) of the following article:

- Jeronimo Barbosa, Joseph Malloch, Marcelo Wanderley, and Stéphane Huot. 2015. What does 'Evaluation' mean for the NIME community? Proceedings of the International Conference on New Interfaces for Musical Expression, Louisiana State University, pp. 156–161. [1]

The summary should include: the research question, the approach used to address the research question, the main findings, and the main contribution.

Class Structure

- 10.15-10.20 Comments on the 1st week.
- 10.20-10.50 Mapping the NIME field: Evaluation at NIME.
- 10.50-11.00 Selection of papers.
- 11.00-11.30 Teamwork: Understanding NIME paper writing.
- 11.30-12.00 The teams summarize to the group their selected paper (5–7 min per group).

Evaluation @ NIME

Warm-up Activity: Evaluation @ NIME

Proceedings of the 2007 Conference on New Interfaces for Musical Expression (NIME07), New York, NY, USA

THE ACOUSTIC, THE DIGITAL AND THE BODY: A SURVEY ON MUSICAL INSTRUMENTS

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ABSTRACT

This paper reports on a survey conducted in the autumn of 2006 with the objective to understand people's relationship to their musical tools. The survey focused on the question of embodiment and its different modalities in the fields of acoustic and digital instruments. The questions of control, instrumental entropy, limitations and creativity were addressed in relation to people's activities of playing, creating or modifying their instruments. The approach used in the survey was phenomenological, i.e. we were concerned with the *experience* of playing, composing for and designing digital or acoustic instruments. At the time of analysis, we had 209 replies from musicians, composers, engineers, designers, artists and others interested in this topic. The survey was mainly aimed at instrumentalists and people who create their own instruments or compositions in flexible audio programming environments such as SuperCollider, Pure Data, ChucK, Max/MSP, CSound, etc.

Keywords

Survey, musical instruments, usability, ergonomics, embodiment, mapping, affordances, constraints, instrumental entropy, audio programming.

1. INTRODUCTION

For more than six years we at ixi software [6][7] have been creating alternative instruments for the computer, focusing on the graphical user interface and its deterministic nature. We have tried to resist the temptation of imitating the world of acoustic various universities and art institutions all over Europe. Although we have had good and instructive feedback from ixi software users, musical collaborators and workshop participants, we have been interested in developing more systematic feedback or dialog, which induced an interest to create a user survey addressing the questions that we are focusing on in our work.

In the survey we were specifically concerned with people's experience of the difference between playing an acoustic and a digital instrument. The approach was phenomenological and qualitative: we wanted to know how musicians or composers describe their practise and relationship with their musical tools, whether acoustic or digital. We deliberately did not define what we meant by "digital instrument" (such as sequencer software, graphical dataflow language, textual programming language or sensor interfaces mapped to sound)[1], as we were interested in how people *themselves* define the digital, the acoustic, and the relationship between the two. How do people rate the distinctive affordances and constraints of these instruments and is there a difference in the way they critically respond to their design? Furthermore, do people relate differently to the *makers* of these two types of instruments? We were curious to learn if musical education and practise of an acoustic instrument yields a different critical relationship to the digital instrument. How does instrumental practice change the ideas of embodiment and does it affect the view of the qualitative properties of the computer-based tool? Finally, we were interested in knowing how people relate to the chaotic or "non-deterministic" nature of their instruments (if they see it as a limitation or a creative potential) and whether they feel that such "quality" could be arbitrarily[2] designed into digital

[2]

The Acoustic, The Digital and the Body

- RQ: Understand people's relationship to their musical tools focusing on the question of embodiment and its different modalities in the fields of acoustic and digital instruments.
- Evaluation:
  - 209 replies from musicians, composers, engineers, designers, artists.
  - Quantitative and qualitative questions.
- 5 main themes:
  - Acoustic vs digital instruments.
  - Affordances and constraints.
  - The instrument maker criticised.
  - Entropy and control ininstruments.
  - Time and embodiment.
- Contribution: Informs future design and evaluation of musical tools.

Proceedings of the 2008 Conference on New Interfaces for Musical Expression (NIME08), Genova, Italy

The A20: Musical Metaphors for Interface Design

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ABSTRACT

We combine two concepts, the *musical instrument* as metaphor and *technology probes*, to explore how tangible interfaces can exploit the semantic richness of sound. Using participatory design methods from Human-Computer Interaction (HCI), we designed and tested the A20, a polyhedron-shaped, multi-channel audio input/output device. The software maps sound around the edges and responds to the user's gestural input, allowing both aural and haptic modes of interaction as well as direct manipulation of media content. The software is designed to be very flexible and can be adapted to a wide range of shapes. Our tests of the A20's perceptual and interaction properties showed that users can successfully detect sound placement, movement and haptic effects on this device. Our participatory design workshops explored the possibilities of the A20 as a generative tool for the design of an extended, collaborative personal music player. The A20 helped users to enact scenarios of everyday mobile music player use and to generate new design ideas.

KEYWORDS

Generative design tools, Instrument building, Multi-faceted audio, Personal music devices, Tangible user interfaces, Technology probes

1. INTRODUCTION

We are interested in creating tangible user interfaces that exploit the semantic richness of sound. Our research draws from two disciplines: Human-Computer Interaction (HCI) and NIME to explicitly question traditional ways of thinking and open up novel design directions. Our goal was to create a technology probe that focuses on the sonic aspects of tangible interfaces, using participatory design to create and explore the possibilities of a working prototype.

We also draw on the *instrument building* approach from NIME, which offers a similar notion of generative design. Musical instruments are developed as open-ended systems that allow the creation of novel compositions and interpretations, while *idiomatic composition* recognizes that limitations are imposed by the characteristics of the system or instruments. We use this instrument building metaphor as one of the foundations for our generative design approach: the limitations of the instrument serve to both define and constrain the design space, with respect to the given research problem.

[3]

http://www.olivierbau.com/a20.php

Musical Metaphors for Interface Design

- RQ: Exploration of how tangible interfaces can exploit the semantic richness of sound.
- Evaluation:
  - Evaluation of a polyhedron-shaped, multi- channel audio input/output device with participatory design methods from HCI (16 participants).
  - Evaluation 1: Focus on the perceptual characteristics of the device.
  - : Evaluation 2: cultural probes / technology probes, participatory workshops with tasks and a design theme.
- Results: Evidence of a platform for generating and exploring new sound interaction ideas.
- Contribution: Informs futuer design and evaluation of tangible interfaces for music and new approaches to sound design.

Proceedings of the International Conference on New Interfaces for Musical Expression

Dimensionality and Appropriation in Digital Musical Instrument Design

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ABSTRACT

This paper investigates the process of appropriation in digital musical instrument performance, examining the effect of instrument complexity on the emergence of personal playing styles. Ten musicians of varying background were given a deliberately constrained musical instrument, a wooden cube containing a touch/force sensor, speaker and embedded computer. Each cube was identical in construction, but half the instruments were configured for two degrees of freedom while the other half allowed only a single degree. Each musician practiced at home and presented two performances, in which their techniques and reactions were assessed through video, sensor data logs, questionnaires and interviews. Results show that the addition of a second degree of freedom had the counterintuitive effect of reducing the exploration of the instrument's affordances; this suggested the presence of a dominant constraint in one of the two configurations which strongly differentiated the process of appropriation across the two groups of participants.

Keywords

design, appropriation, interaction, mapping, embedded hardware

1. INTRODUCTION

Musicians often use instruments in unexpected ways. The history of musical instruments is replete with examples of performance practices which challenged the designer's original intentions. Jazz saxophone playing overturned many of

This paper investigates appropriation and the emergence of personal styles amongst performers of a simple digital musical instrument (DMI). Building on the results of a study by Gurevich et al. [6], ten musicians were given an unfamiliar instrument with highly constrained sonic capabilities. Through a series of rehearsals, performances, questionnaires and interviews, we sought to achieve three goals:

1. To verify and extend the results of Gurevich et al. [6] on the influence of constraints on musical style.
2. To study the role of *dimensionality* in how performers approach musical instruments. Specifically, we ask whether an instrument with more dimensions of control produces a richer set of musical interactions.
3. To identify signs of appropriation and personalisation in performers' interactions with an instrument.

1.1 Constraints and Personal Style

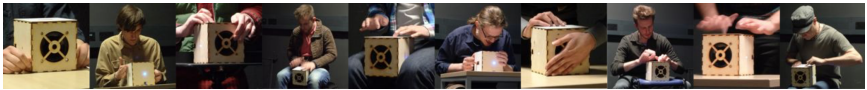
Constraints can be a powerful motivator for musical creativity. Magnusson [10] observes that musicians encountering a new instrument tend to explore its constraints rather than engaging only with the designer's intended affordances, a result which holds even for more complex augmented instruments which are partially familiar [11].

Gurevich et al. [6] conducted a study in which nine performers were given a one-button instrument; the button produced a tone of fixed frequency and loudness. This two-state device (tone or no tone) represents perhaps the simplest possible electronic musical instrument, yet the performers developed a broad array of playing styles. In addition to rhythmic variations, many performers discovered

[4]

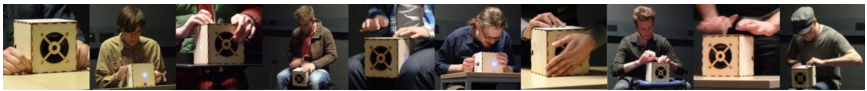
http://instrumentslab.org/research/hackable-instruments.html

Dimensionality and Appropriation (1/2)



— RQ: Investigation of the process of appropriation in digital musical instrument performance, examining the effect of instrument complexity on the emergence of personal playing styles.
— Evaluation:
  - Ten musicians were given a constrained musical instrument, a wooden cube containing a touch/force sensor, speaker and embedded computer.
  - Half the instruments were configured for two degrees of freedom while the other half allowed only a single degree.
  - Home practice and delivery of 2 performances. Techniques and reactions were assessed through video, sensor data logs, questionnaires and interviews (mixed methods).

Dimensionality and Appropriation (2/2)



— Results: the addition of a second degree of freedom had the counterintuitive effect of reducing the exploration of the instrument's affordances.

— Contribution: In alignment with the the one-button instrument study [5]. Informs the design of DMIs.

Proceedings of the International Conference on New Interfaces for Musical Expression

SoundXY4: Supporting Tabletop Collaboration and Awareness with Ambisonics Spatialisation

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ABSTRACT

Co-located tabletop tangible user interfaces (TUIs) for music performance are known for promoting multi-player collaboration with a shared interface, yet it is still unclear how to best support the awareness of the workspace in terms of understanding individual actions and the other group members actions, in parallel. In this paper, we investigate the effects of providing auditory feedback using ambisonics spatialisation, aimed at informing users about the location of the tangibles on the tabletop surface, with groups of mixed musical backgrounds. Participants were asked to improvise music on "SoundXY4: The Art of Noise", a tabletop system that includes sound samples inspired by Russolo's taxonomy of noises. We compared spatialisation vs. no-spatialisation conditions, and findings suggest that, when using spatialisation, there was a clearer workspace awareness, and a greater engagement in the musical activity as an immersive experience.

Keywords

ambisonics, spatialisation, auditory feedback, interactive tabletops, tangible user interfaces, *The Art of Noise*, musical improvisation

1. INTRODUCTION

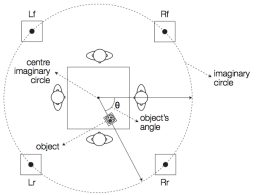

Figure 1: Imaginary circle representing ambisonics on a tabletop system. The sound source is dependent on the angular position and distance of the object on the sphere in relation to the position of the loudspeakers.

on tabletops, it becomes difficult to identify simultaneously

[6]

https://vimeo.com/70693984

Supporting Tabletop Collaboration and Awareness

- RQ: How to best support the awareness of the workspace in co-located tabletop tangible user interfaces (TUIs) for music performance. Investigation of the effects of providing auditory feedback using ambisonics spatialisation.
- Evaluation:
  - Task: Music improvisation in groups of four participants: 8 groups, 32 participants in total.
  - Qualitative analysis (thematic analysis) of video recordings.
  - Themes: Space territoriality; Sounds, categories, and filters; Realistic scenes; Musical immersion.
  - Spatialisation vs. no-spatialisation conditions.
- Findings: Spatialization promoted a clearer workspace awareness, and a greater engagement in the musical activity as an immersive experience.
- Contribution: Informs DMIs design using an ecological approach and the area of computer-supported collaborative work.

A Physical Intelligent Instrument using Recurrent Neural Networks

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ABSTRACT

This paper describes a new intelligent interactive instrument, based on an embedded computing platform, where deep neural networks are applied to interactive music generation. Even though using neural networks for music composition is not uncommon, a lot of these models tend to not support any form of user interaction. We introduce a self-contained intelligent instrument using generative models, with support for real-time interaction where the user can adjust high-level parameters to modify the music generated by the instrument. We describe the technical details of our generative model and discuss the experience of using the system as part of musical performance.

Author Keywords

Embedded instruments, recurrent neural networks, generative models, interaction.

CCS Concepts

•**Applied computing** → **Sound and music computing**; •**Computing methodologies** → **Neural networks**; •**Human-centered computing** → *Interaction paradigms;*

Figure 1: A user interacting with our physical intelligent instrument: a device that continually generates and performs music using a recurrent neural network. The system is self-contained with controls for volume and sampling "temperature" as well as a built-in speaker for sonifying generated notes.

1. INTRODUCTION

The use of machine learning algorithms to create musical compositions is a growing field of study. A lot of recent

on a self-contained embedded platform, and explores manipulation of the continuous note sampling process as the main interactive function. This small device could be applied

[7]

https://github.com/edrukar/intelligent_instrument

A Physical Intelligent Instrument using Recurrent Neural Networks

Torgrim Rudland Næss

Thesis submitted for the degree of
Master in Robotics and Intelligent Systems
60 credits

Department of Informatics
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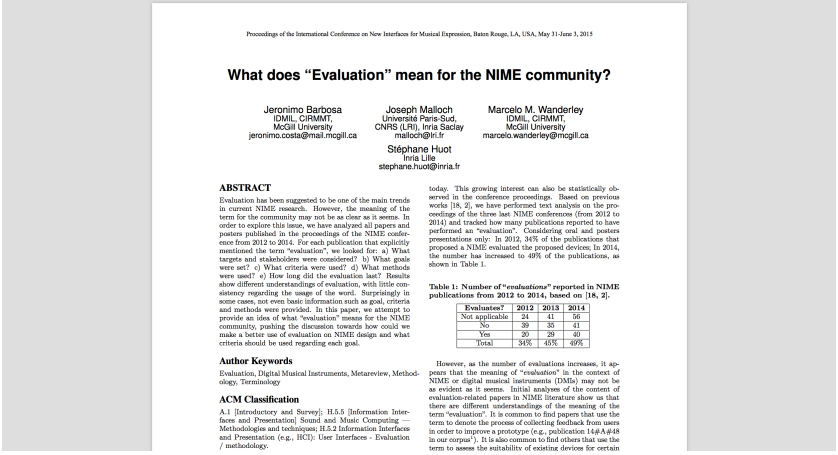
Autumn 2019

A Physical Intelligent Instrument

- RQ: Exploration of whether intelligent musical systems can provide an easier introduction into music creation for novice users focusing on a self-contained intelligent instrument using generative models.
- Evaluation:
  - User study with 12 participants.
  - (1) impact the different high-level parameter controls on participant's perception of musical instrument's control and (2) Evaluation of the generative models trained on different datasets in terms of musical quality.
  - Collected numerical ratings and open-ended answers (mixed methods).
- Results: Perceived feeling of control over the music was quite high and the high-level parameter controls allowed participants to creatively engage with the instrument in the music-making process.
- Contribution: Informs DMIs design & evaluation using machine learning and embedded computing.



Proceedings of the International Conference on New Interfaces for Musical Expression, Baton Rouge, LA, USA, May 31-June 3, 2015

What does "Evaluation" mean for the NIME community?

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ABSTRACT

Evaluation has been suggested to be one of the main trends in current NIME research. However, the meaning of the term for the community may not be as clear as it seems. In order to explore this issue, we have analyzed all papers and posters published in the proceedings of the NIME conference from 2012 to 2014. For each publication that explicitly mentioned the term "evaluation", we looked for: a) What targets and stakeholders were considered? b) What goals were set? c) What criteria were used? d) What methods were used? e) How long did the evaluation last? Results show different understandings of evaluation, with little consistency regarding the usage of the word. Surprisingly in some cases, not even basic information such as goal, criteria and methods were provided. In this paper, we attempt to provide an idea of what "evaluation" means for the NIME community, pushing the discussion towards how could we make a better use of evaluation on NIME design and what criteria should be used regarding each goal.

Author Keywords

Evaluation, Digital Musical Instruments, Metareview, Methodology, Terminology

ACM Classification

A.1 [Introductory and Survey]; H.5.5 [Information Interfaces and Presentation] Sound and Music Computing — Methodologies and techniques; H.5.2 Information Interfaces and Presentation (e.g., HCI): User Interfaces - Evaluation / methodology.

today. This growing interest can also be statistically observed in the conference proceedings. Based on previous works [18, 2], we have performed text analysis on the proceedings of the three last NIME conferences (from 2012 to 2014) and tracked how many publications reported to have performed an "evaluation". Considering oral and posters presentations only: In 2012, 34% of the publications that proposed a NIME evaluated the proposed devices; In 2014, the number has increased to 49% of the publications, as shown in Table 1.

Table 1: Number of "*evaluations*" reported in NIME publications from 2012 to 2014, based on [18, 2].

Evalutes?	2012	2013	2014
Not applicable	24	41	56
No	39	35	41
Yes	20	29	40
Total	34%	45%	49%

However, as the number of evaluations increases, it appears that the meaning of "*evaluation*" in the context of NIME or digital musical instruments (DMIs) may not be as evident as it seems. Initial analyses of the content of evaluation-related papers in NIME literature show us that there are different understandings of the meaning of the term "evaluation". It is common to find papers that use the term to denote the process of collecting feedback from users in order to improve a prototype (e.g., publication 144Â#48 in our corpus"). It is also common to find others that use the term to assess the suitability of existing devices for certain

There is no one-size-fits-all solution to evaluating DMIs and more precisely the choice of evaluation methodology – if any – must arise from and be appropriate for the actual problem or research question under consideration. [1, p.161]

NIME Paper Writing

Teamwork: Understanding NIME paper writing

— Selection of a paper from the NIME Reader (`https://www.springer.com/gp/book/9783319472133`), PDFs can be found in NIME Proceedings (`http://www.nime.org/archives/`). Discussion about what is ...

- the research question (RQ)
- the approach used to address the RQ / research methods
- the main findings
- the main contribution

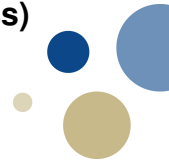
A high-level summary comparison between the format of NIME and CHI papers is acknowledged.

Teamwork: Summaries

— The teams summarize to the group their selected paper (10 min per group).
  - research question (RQ)
  - approach to address the RQ / research methods
  - main findings
  - main contribution

— Comparison with CHI papers: what are the similarities and differences?

Human-Computer Interaction Day 3 - Group Assignment (post-class)



— Create an intuitive mindmap based on a brainstorming session with your team about the topics from NIME and HCI that you think are related to the prototype that you built during the physical computing workshop. This assignment (a digital version of the mindmap) should be submitted before Thursday 31 October 2019 9:00 and the team should be ready to briefly summarize it in class.

`https://uio.instructure.com/courses/22318/assignments/28317`

References

[1] Jeronimo Barbosa et al. “What Does “Evaluation” Mean for the NIME Community?” In: *Proceedings of the International Conference on New Interfaces for Musical Expression*. 2015.

[2] Thor Magnusson and Enrike H. Mendieta. “The Acoustic, the Digital and the Body: A Survey on Musical Instruments”. In: *Proceedings of the International Conference on New Interfaces for Musical Expression*. New York City, NY, United States, 2007, pp. 94–99.

[3] Olivier Bau, Atau Tanaka, and Wendy E. Mackay. “The A20: Musical Metaphors for Interface Design”. In: *Proceedings of the International Conference on New Interfaces for Musical Expression*. Genoa, Italy, 2008, pp. 91–96.

[4] Victor Zappi and Andrew McPherson. “Dimensionality and Appropriation in Digital Musical Instrument Design”. In: *Proceedings of the International Conference on New Interfaces for Musical Expression*. London, United Kingdom: Goldsmiths, University of London, 2014, pp. 455–460.

[5] Michael Gurevich, Paul Stapleton, and Adnan Marquez-Borbon. “Style and Constraint in Electronic Musical Instruments”. In: *Proceedings of the International Conference on New Interfaces for Musical Expression*. Sydney, Australia, 2010, pp. 106–111.

[6] Anna Xambó et al. “SoundXY4: Supporting Tabletop Collaboration and Awareness with Ambisonics Spatialisation”. In: *Proceedings of the International Conference on New Interfaces for Musical Expression*. London, United Kingdom: Goldsmiths, University of London, June 2014, pp. 40–45.

[7] Torgrim Rudland Næss and Charles Patrick Martin. “A Physical Intelligent Instrument using Recurrent Neural Networks”. In: *Proceedings of the International Conference on New Interfaces for Musical Expression*. Ed. by Marcelo Queiroz and Anna Xambó Sedó. Porto Alegre, Brazil: UFRGS, 2019, pp. 79–82.