HCI, Music and Audiences: Enabling New Performance Contexts by Understanding Experience

Sam Ferguson
Creativity and Cognition Studios
School of Software
University of Technology Sydney
samuel.ferguson@uts.edu.au

Oliver Bown
UNSW Art and Design
UNSW
o.bown@unsw.edu.au

Abstract
In this position paper we consider the relationship between interactive music research and research in HCI. We consider some examples of research into interactive art and develop some possible research directions for ways in which HCI may contribute to interactive music research.

Author Keywords
HCI; Music; Interaction Design; Experience Design; Interactive Art.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction
This position paper outlines the type of contribution that we see Human-Computer Interaction (HCI) making to the field of music and musical performance. One of the most influential recent developments in modern musical practice has been the growing dominance that computers have within musical practice. We discuss the way that computer technology has changed musical performance contexts and the associated audience experience. We consider the possibilites for HCI research methods to investigate the new performance modes that modern computer systems now make possible, and to better match the intentions of the

performer and the experience of the audience.

Computing and Musical Practice

Computers have had a profound effect on musical performance, through new methods for composition (MIDI and computer based scoring), instruments (eg. samplers, digital synthesis), interfaces (eg. drum machines, interfaces for musical expression), recording systems (eg. non-linear recording), and musical performance contexts (eg. surround reproduction). Many of these changes have their basis within cheaper emulations of pre-existing methods and approaches for musical practise (eg. digital synthesis of brass instruments vs. hiring a brass section). However, one of the most *transformative* effects of computers in music is that they are enabling the creative re-conception of the relationship between performer and audience. Nevertheless, while these new possibilities are rapidly expanding, methodologies and practises for understanding or evaluating these new performance practises are in their infancy. Some discussion of a selection of new performance modes will help to contextualise the research discussion that follows.

Live coding, a practice in which a musician-coder writes code that expresses both generative and audio synthesis algorithms that are executed in real-time, is one example of new musical context made possible by advances in computer technology. The development of the code (an expression of musical form) is made transparent to the audience – it is usually projected behind the performer and is written 'from scratch', which can mean some time elapses before musical results can be heard. The initially simple music is progressively developed, becoming a complex musical and computational structure as the performance progresses. Online collaboration and performance is another new performance context. Mills and Beilharz have investigated telematic musical performance, whereby geographically

disparate performers collaborate by means of a low-latency audio stream [10]. Bryan-Kinn's work evaluating the *daisyphone* system (a collaborative iPhone application) has used the data transmitted between participants to investigate the process of collaboration and meme-generation [6].

Bio-musical or gestural performance is another context that has developed due to capabilities made possible by computers. This type of performance usually involves a set of sensors being attached to the body. The performance style is often a solo improvisation made possible by real-time synthesis algorithms driven by the signals obtained from the sensors, and it usually eschews (for obvious reasons) any physical instrument as musical embodiment of the performance. The audio result is strongly determined by the design of algorithms that transform movements to sound.

Another newer musical performance context made possible by changes in technology is 'multiplicitous media', whereby small battery powered, interactive, networked, audio producing devices are distributed to the audience, thereby involving the audience in the performance in a direct manner, while still allowing the composer/performer to exert control over the musical result [4, 5]. The delineation between the performers and the audience is somewhat broken down in this performance mode. Giving the audience members the devices in order to both participate in the performance and learn how the devices respond to interaction.

Research and Evaluation

Attempts to investigate these diverse musical contexts are forced to adopt particular methodological approaches. Obviously, the 'purpose' of music has been a contentious issue for theorists for some time, and therefore traditional performance-based metrics may be ill-suited to questions about audience experience. As HCI has matured in recent

years there has been a general trend away from reductive performance metrics (although these obviously have their uses), and towards a diversification of research methodologies, including qualitative methods.

Research into music and art creation is often concerned with one of two modes of inquiry: much music research focuses on studies of musical composition, music history or music psychology, often treating music quite broadly as a general human endeavour. Other communities, however, have broadly focused on practical technical descriptions of the design of new composition methods, interfaces, instruments or systems (for instance the NIME community and predecessors/others). The former often treats music with the associated rigour and detachment that can be expected for a research context. The latter is often primarily engaged in the expansion of musical possibilities for musicians and composers, with limited *continued* investigation of the success or efficacy of each new interface or system – this is left to the artist who chooses to employ this new system.

There is little research in between these extremes that attempts to study the way in which audiences experience interactive music so as to describe and carefully investigate audience experience within a *specific* context, for the practical purposes of an artist-practitioner improving or better understanding their own work. Instead, music evaluation and refinement is undertaken by the composer or musician themselves and is based mainly on tacit knowledge and (hard-won) musical training. But it may be that newer research methods from HCI are starting to mature to a point that they have the capability to contribute to music and also to particular musical composition processes.

Frameworks for similar types of investigation have been explored extensively within the a closely-related discipline of interactive art. Edmonds has described several key ques-

tions within this domain [8], such as: 'When is experiencing interaction engaging? How can we evaluate the experience of interaction? How do familiarity and engagement interrelate? Where is the art - in the object or in the experience? Whose experience- audience or performer? What makes interactive art engaging?'. There have also been a number of attempts to codify audience experience in terms of a framework. For instance, Bilda's engament framework [3] describes the process by which an audience member engages with a work, while Costello's pleasure framework [7] describes various motivations for play with a work. Alarcón-Diaz et al. drew on these frameworks and methods to evaluate a public exhibition of Edmonds work [1], resulting in an evaluation process being undertaken with audience members within a working gallery space. Rather than this process being removed and clinical, the artist and curatorial team were directly involved in the development and design of the questions used in the structured interviews.

Within musical interaction research there have been a few examples of similar research approaches, but these have tended to prioritise the effect of the interface or synthesis methods on the music making experience. Bengler and Bryan-Kinns used a mixed method approach to evaluate the *Polymetros* system for collaborative music making, with an audience that used the system in a museum setting [2]. Results showed that the impression of being able to control the system was associated with enjoyment and a feeling of being part of the musical process. Fencott and Bryan-Kinns used a similar approach – triangulating collaborative musical experience through the use of questionnaires and log data created from musical interfaces in use [9]. Finally, Mills and Beilharz used video-cued recall, interviews and video coding techniques to investigate telematic music-making [11].

HCI for Music Practice

The research discussed in the preceding section has shown the potential for HCI methods to contribute to music. Through passive and active observational approaches (eg. video-cued recall) and structured interviews, partnered with data logging and other quantitative interventions, it is possible to gain multiple perspectives on the audience experience of audience interacting with and experiencing a musical performance or musical work. By its nature, audience experience is not a singular cohesive phenomena, so it stands to reason that multiple approaches are well-suited to unearthing diverse responses. This triangulation approach also has the benefit of resulting in more perspectives for a given evaluation, meaning that it is more likely that it will be possible to find relationships and understandings about experience, and to provide tools for design and musical practice. With this in mind, several music performance practice questions (drawing on Edmonds previously noted questions) that HCI might inform include:

- What is the difference between music listening and music interaction?
- What is engaging - the musical composition, the medium, or the experience itself?
- How do we investigate the experience of an audience participating in the performance and an audience witnessing the performance?
- How can we evaluate the experience of music listening?

References

[1] Ximena Alarcón-Díaz, Kira Askaroff, Linda Candy, Ernest A. Edmonds, Jane Faram, and Gillian Hobson. 2014. Evaluation in public art: the light logic exhibition. In *Interactive Experience in the Digital Age*, Linda Candy and Sam Ferguson (Eds.). Springer, 187–208.

[2] Ben Bengler and Nick Bryan-Kinns. 2014. In the wild: evaluating collaborative interactive musical experiences in public settings. In *Interactive Experience in the Digital Age*, Linda Candy and Sam Ferguson (Eds.). Springer, 169–186.

[3] Zafer Bilda, Linda Candy, and Ernest Edmonds. 2008. Designing for creative engagement. *Design Studies* 29, 6 (2008), 525–540.

[4] Oliver Bown, Lian Loke, Sam Ferguson, and Dagmar Reinhardt. 2015. Distributed Interactive Audio Devices: Creative strategies and audience responses to novel musical interaction scenarios. (August 14-19 2015).

[5] Oliver Bown, Dagmar Reinhardt, Sam Ferguson, and Lian Loke. 2014. Contact: A Concert for Interactive Sounds in the Hands of the Audience. In *xCoAx 2014: Second conference on Computation, Communication, Aesthetics and X:*. Universidade do Porto.

[6] Nick Bryan-Kinns and Patrick G. T. Healey. 2007. Exploring Mutual Engagement in Creative Collaborations. In *ACM Creativity and Cognition*. ACM, 223–232.

[7] Brigid Costello. 2007. A Pleasure Framework. *Leonardo Journal* 40, 4 (2007), 370–371.

[8] Ernest A. Edmonds. 2014. Human Computer Interaction, Art and Experience. In *Interactive Experience in the Digital Age*, Linda Candy and Sam Ferguson (Eds.). London: Springer, 11–24.

[9] Robin Fencott and Nick Bryan-Kinns. 2013. Computer Musicking: HCI, CSCW and Collaborative Digital Musical Interaction. In *Music and Human-Computer Interaction*, S Holland, K Wilkie, P Mulholland, and A Seago (Eds.). Springer, 189–205.

[10] Roger Mills and Kirsty Beilharz. 2012. Listening Through the Firewall: Semiotics of sound in networked improvisation. *Organised Sound* 17, 1 (2012), 16–27.

[11] Roger Mills and Kirsty Beilharz. 2014. The Network Unveiled: Evaluating Tele-musical Interaction. In *Interactive Experience in the Digital Age*, Linda Candy and Sam Ferguson (Eds.). Springer, 109–122.