Reflection On Action in NIME Research: Two Complementary Perspectives

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ABSTRACT

This paper discusses practice-based research in the context of live performance with interactive systems. Practice-based research is outlined in depth, with key concepts and approaches contextualised with respect to research in the NIME field. We focus on two approaches, both of which are concerned with documenting, examining and reflecting on the real-world behaviours and experiences of people and artefacts involved in the creation of new works. The first approach is primarily based on reflections by an individual performer/developer (auto-ethnography) and the second on interviews and observations. The rationales for both approaches are presented along with findings from research which applied them in order to illustrate and explore the characteristics of both. Challenges, including the difficulty of balancing rigour and relevance and the risks of negatively impacting on creative practices are articulated, as are the potential benefits.

Author Keywords

Practice-based research, interaction design, live performance, methods

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

Practitioner-researchers in new musical instrument/interface design often set themselves multiple challenges: they seek to design and implement new technologies, create and perform new works, examine and evaluate what they have done and, finally, articulate what has been learned in the process. To do this effectively requires careful consideration of the links between creative work and research. Failing to do so can lead to technical research which lacks relevance to creative practice or, conversely, creative work where the broader contribution is unclear.

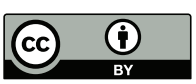
In this paper we present two approaches to examining the design and use of new interactive systems for live performance. The first approach is self-reflective and auto-ethnographic, in which an individual performer-developer reflects upon the design of new systems and the associated creative practices as they co-evolve. The second is, in contrast, primarily based on examining the co-evolution of creative practice and interactive system design from a broader perspective and involves observations of, and interviews with a range of performers and designer/developers.

These approaches are first contextualised with respect to the literature on practice-based research, as well as recent discussions on the relationship between practice and research in the NIME field. We argue that both approaches are valuable and can contribute new perspectives on the creative and technical work involved in designing new interfaces for live performance. We present two practice-based research projects in order to show how these methods are applied in practice, and highlight the strengths and pitfalls of each. The aim is to provide members of the NIME community, particularly those who see themselves as creative practitioners, with concrete examples of ways to apply practice-based methods.

2. PRACTICE-BASED RESEARCH

According to Candy [3], a research project is 'practice-based' if its contribution to new knowledge is demonstrated partly through practice and the outcomes of that practice. Practice-based research projects provide original contributions to new knowledge through both the presentation of artefacts and creative works developed through practice, and substantial textual contextualisations of these outcomes in the form of doctoral theses or other published materials. Although the significance of the creative outcomes of the research project must be described in writing, "a full understanding can only be obtained with reference to the artefact" [3].

Central to the notion of practice-based research is the role of the 'practitioner-researcher' in carrying out the research project. As defined by Robson, a practitioner-researcher is someone who works as a practitioner in a professional setting whilst simultaneously undertaking a 'systematic inquiry' that is of direct relevance to their work [20]. In art and design contexts, practitioner-researchers hail from a variety of professions including the visual arts, interaction design, music, dance, creative writing and other backgrounds. Gray [9] has noted that the practitioner-researcher identifies 'researchable problems raised in practice, and responds through practice,' and often plays a multi-dimensional role including: creator of research materials (art/design works), observer of self and others and, when involved in group projects, collaborator [9].



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2.1 Practice-Based Research and NIME

Practice-based research approaches have a long and varied history in the context of NIME research.[1] As a field concerned with the development and use of new creative artefacts, the opportunities for practice-based research are wide-ranging. Many seminal NIME and 'proto-NIME' [11] papers present design criteria based on experiences creating and performing with new instruments (eg. [25, 6, 5]). Of particular note, because of the depth and breadth of the theoretical and musicological contributions are the performances and writings of George Lewis [16].

As Gurevich has recently noted, whilst the community is strongly interdisciplinary and contains a variety of methodological approaches, 'NIME is a discipline fundamentally rooted in practice and practice-based writing' [11]. Surveying the diversity of approaches to research in the NIME community, he notes that early writing in the field by artists such as Gordon Mumma, Daphne Oram, David Rosenboom and Michel Waisvisz represented a style of writing which presents 'critical, theoretical, and historical underpinnings for their practice, as well as reflective accounts of their experiments intended to catalyse future creative endeavours.' [11].

Green argues that NIME research and practice are part of assemblages, where our outputs are directed to differing audiences depending on the particular content of these outputs (*technical reports* for those interested in design, *musical performances* for general audiences, discussion of *aesthetics* for musicological audiences, etc). Musical sharing and co-practice are areas Green suggests have been under exploited as 'methods' of research [10].

The second author has previously observed that framing examinations of new instruments/interfaces in terms of 'evaluation' is problematic. He argues that doing so tends to lead to the tacit assumption that 'musical expression' is an unchanging activity with stable requirements and goes on to propose that:

> "'New Interfaces for Musical Expression' should, in our minds if not in actuality, be re-named 'New Interfaces *and* Musical Expression', in order to promote a more symmetrical view which fully acknowledges the complexity of a situation where creative practices are provoked, challenged and disrupted by new instruments/interfaces and therefore bring about new approaches to musical expression." [13]

Finally, Elblaus et al. argue for a more sustained engagement with the intersections between interface design and practice in the NIME community [7]. Their central argument is that *evaluation* is often a process researchers undertake in order to prove that our proofs-of-concept work, though they are not necessarily tested 'in the wild'. They suggest that as researchers and designers, NIME researchers should engage more fully with musical practice and how these interfaces stack up through prolonged use in performance.

3. THE ROLE OF THE 'ARTEFACT'

In this paper we refer to the creative 'artefact' in practice-based research projects. In the context of New Interfaces for Musical Expression, this term may refer to physical objects (instruments, controllers, physical interfaces etc.), and/or real-time software systems used for the performance of live, interactive music. In practice-based research, such technological artefacts are a focal point of the research project. The 'practice' in practice-based research, therefore, refers to the development of the artefacts (software/hardware design) and their use during testing, iterative development and live performance.

A central concern in practice-based research projects is how this artefact is positioned in the generation of new knowledge. In the context of art and design, practice-based research projects are common, and the artefacts are considered both an outcome of the research, and also an integral part of the research method. Common to many practice-based projects is an acknowledgement that practice itself can serve as the primary tool for knowledge generation, and as such it maintains a central place within the chosen methodology. Practitioner-researchers may use their practice to examine latent research themes, explore developing ideas about practice itself or undertake experiments related to a central topic of interest [22]. Such explorations are carried out in the plane of practice directed towards the generation of artefacts. Although artefacts developed through practice-based research may embody knowledge generated throughout the research process, they must be analysed and evaluated in light of the unique practical context in which they were developed.

Practice-based research projects may therefore use practice to generate research questions as well as significant creative outcomes addressing these questions. Throughout the research process research questions and themes may only reveal themselves as a consequence of moves within practice, making the practical domain a space for both generating and responding to research questions. The role of practice as method in practice-based research highlights some fundamental issues of research method and the communication of knowledge within creative arts research.

Stephen Scrivener has suggested that although practice-based research centres upon the creation of artefacts, there exist fundamental differences between those artefacts that are developed as a response to justified and well-defined research problems, and those projects focused upon creative production that use practice as a vehicle for exploring complex research themes [22]. For Scrivener, this distinction is essential to understanding what kind of knowledge claims can be made by practice-based research projects in art and design. He advocates that in such contexts, due to the focus upon process and the entanglement between artefact development and emergent research interests, self-reflexive practice provides the most suitable means by which researchers in this area might make their research contributions.

Discussing research methodology in doctoral projects in art and design, Scrivener has outlined the differences between traditionally understood *problem-solving* research projects and what he terms *creative-production* projects typical of practice-based research in artistic contexts. According to Scrivener, artefacts developed in *problem-solving* research projects are presented as either novel artefacts posited to solve well-defined problems, or as improvements upon already existing artefacts [22]. By contrast, *creative-production* research projects are concerned with the generation of artefacts as a means to investigate, explore and define research problems as well as to solve them. Problems arise through the practice of artefact creation, and research themes are developed and explored through subsequent moves in practice. The artefacts themselves, along with written documentation and explication of the process of design and development, together comprise the project's contribution to new knowledge [22].

[1] See, for example, the Practice-Based Research Workshop at NIME 2014 NIME: `http://www.creativityandcognition.com/NIMEWorkshop/`.

As Scrivener has outlined, where practice is used as a core method for knowledge-generation, self-reflection both in and on practice becomes an indispensable tool for both improving practice and communicating the insights gained from these reflections to wider audiences. What separates 'practitioners' from 'practitioner-researchers' is the rigour and depth with which such self-reflection is undertaken. To the practitioner-researcher, self-reflection may become a core research method that enables the reader to enter into the complex cycles of action present during practice that have culminated in the developed artefact. Practice-based researchers can therefore make implicit or tacit knowledge communicable through self-reflection, and in doing so provide insights into creative processes and point towards larger research themes beyond the immediate creative work.

4. PROJECTS

Having provided a broad overview of practice-based research, we now provide two specific examples based on our own recent work. Project 1 was primarily an individual creative project which involved self-reflective approaches. Project 2, in contrast, was a larger-scale creative production involving a range of stakeholders.

4.1 Project 1: Individual reflection

The first author's practice-based doctoral research was concerned with the development and use of a performance system designed for improvised, human-machine performance [4]. The central creative outcome of this research was the author's *_derivations* system, an interactive performance system that uses live sampling, real-time audio analysis and timbral matching techniques to develop generative contributions to a performance with a human improviser. This system was developed to explore notions of machine agency and autonomy, as well as human-computer interaction in the context of improvised human-machine performance. For a full technical description of the software, see [4].[2]

With a musical background as a saxophonist and computer musician, the first author's research was undertaken from the perspective of a *performer-developer*. The author's *_derivations* system is the culmination of an iterative development process that formed a large part of the author's personal creative practice. The system has since been distributed freely online, and has taken part in performance with other musical collaborators.[3] However, given the idiosyncratic nature of the software artefact, the focus of the research project was neither to develop a generalisable musical tool, nor to understand the way in which this tool is used by third parties. Instead, the aim of the research project was to understand the emergent creative practice of interactive system design and use from the perspective of a performer-developer. The research sought to open up the process of design, development and use of such systems to reveal emergent theoretical considerations pertaining to human-machine performance practice. The research is therefore positioned as a *creative-production* project [22], in which the process of artefact development is foregrounded to reveal significant research themes that could later be explored through detailed and critical reflection.

One of these themes was the entangled nature of human and technological agencies in such a mediated practice. Through considered reflection-on-action [21], the twists and turns of the creative process of artefact development, testing and use were articulated in the form of a *narrative of development*, explicating the development trajectory of the *_derivations* system. Throughout this narrative, the author used self-reflective methods to highlight salient themes that emerged throughout the development of this artefact, themes that were then addressed through sustained critical analysis and reflection.

Central to this research approach is an acknowledgement of the emergent nature of both creative practice and research trajectory. As with much creative practice, the author's development process did not proceed in a linear fashion, nor was the creative artefact developed to solve a well-defined research problem. In contrast to a traditional software engineering approach, the creative artefacts developed in this research were developed using a *bricolage* approach to programming [17]. That is, the *_derivations* system gradually evolved through a process of developing algorithmically controlled sound generation modules, exploring and reflecting upon their behaviour and subsequently refining their design and the associated creative practices. This cyclical process of action, evaluation and reflection helped inform subsequent steps in the development trajectory, eventually culminating in a mature and usable software artefact.

4.1.1 Connecting to themes beyond the self

Following Schön's notion of reflective practice, this process of self-reflexivity in professional practice had great benefits for the generation a significant creative artefact. However, as a form of research, we argue that reflexivity in itself is not likely to lead to contributions to the broader field. Instead, a sustained form of self-reflexivity is required in order to provide significant contributions to academic discourse in the field at large. The chronological self-reflexivity of the *narrative of development* fed into the final chapter in the doctoral thesis, a chapter structured into three sustained reflections upon broad theoretical considerations that emerged from the narrative of development.

The first of these considered the relationship between human and material agency in the development and use of interactive musical systems. Here the inherently messy process of artefact development described above became an object of interest in the research process. Engaging with the writings of sociologists Bruno Latour, Madeline Akrich and Andrew Pickering, the unique context of the performer-developer was examined, situating the outcomes of this creative practice within a *dance of agency* between the human (performer-developer) and the material (software/code) [19]. Akrich's notion of an artefact's *script* and the concept of *black boxing* were used to explain the way in which interactive software artefacts are engaged with in development and performance [1, 2, 15]. In her work, Akrich considers how designers encode ideal or 'virtual' users into their artefacts through design. The first author has outlined how these artefact 'scripts' affect the use of the artefacts by end users. Through a period of sustained reflection, it is argued that performer-developers - acting both as designer and user - engage in both scripting and de-scripting their own artefacts. In this process, the performer-developer defines an emergent user, one that is discovered through the back and forth between development and use. It is argued that by *black boxing* the artefact in performance, the performer-developer engages with the scripts as imbedded in the artefact. Following this analysis, Hamman's conception of an artefact's *episteme* was used to describe the means by which developing artefacts provoke surprise and unpredictability, enabling the performer-developer to *suspend disbelief* during performance in spite of their proximity

[2]Video documentation of the system can be viewed at the following URLs: `https://www.youtube.com/watch?v=GHxHumlCZOQ` and `https://www.youtube.com/watch?v=odAp7rgU2yg`.

[3]see `http://derivations.net` for more information.

to their developing artefacts [12].

The second reflection engaged with the concept of musical *interpretation* in the context of human-machine improvisation. Whilst this practice naturally revolves around freely improvised performance, the development of software to be used in this context posed fundamental questions about authorship, agency and the notion of musical interpretation in this performance practice. This reflection argued that any understanding of improvised human-machine performance must contend with its mediated nature. Implicit in such an understanding is the context in which the interaction takes place, the non-human agency exhibited by the machine in performance and the role of the developer as author. By outlining how various forms of musical text embody direct and/or indirect *constraints* upon a performer, it is argued that such software artefacts place the performer within an interpretive framework. With reference to commonly understood notions of musical interpretation, the development of interactive software is positioned as akin to the creation of a musical text.

Finally, *symbiosis* is proposed as a metaphor for interactivity and reciprocity in the design and use of interactive musical systems. Sitting outside of the purely technological, symbiosis describes the mutually dependent and reciprocal relationship that exists between performer and system, as contrasted with approaches that are designed to maximise the generative autonomy of a machine. This mutual dependence can be expressed both inside and outside of a performative encounter with such a musical system. As illustrated throughout the *narrative of development*, an inherent tension existed between designing for unpredictability and surprise, and a focus upon *sampling-led* musical generativity, where live sampling formed the basis of both algorithmic and sonic structures expressed by the software. Whilst an improviser does not directly control *_derivations* in performance, the system can only express its material agency by having previously interacted with an improviser – its sonic material and generative structures are siphoned directly from the performer's past performance. Its performative agency is therefore dependent upon the input of a human performer, and conversely, the performative context of improvised human-machine performance places the performer in a somewhat dependent relationship with interactive software.

4.2 Project 2: Group Reflection on Action

Reflection-on-action, as articulated by Schön [21] and as applied in Project 1, is a predominantly individual process in which the solo practitioner reflects upon their actions in relation to past experiences and broader creative/professional practice. However, where larger numbers of people are involved in a creative project it is often necessary to get a broader perspective from multiple stakeholders. In the case of Project 2, this involved conducting interviews and focus groups at key points during development of the creative work. The result is a facilitated, collaborative reflection-on-action, in which the researcher (who in our case was also a participating practitioner) and artists look back on the creative process, identify key themes and place their experiences in a broader context.

We believe that this process provides significant benefits for the artists as well as researchers. While effective creative teams are adept at the development of effective "theories-in-use" [21] more formal studies help make these theories more explicit and therefore open to examination, evaluation and critique. The performers involved in Project 2 generally had less interest in formal studies than in the immediately practical concerns of creating works and putting on a show. However, it is often the case that beyond the higher-level theories which emerge from these studies, artists do receive immediate practical benefits. The process of sitting down for an hour or longer and talking in depth about their creative practice and the interactive systems which have been developed often leads to new insights for the interviewee as well as the interviewer.

A final benefit of these kinds of studies is that they help document both the work of the performers concerned and the artistic concerns which drive their work. As video technology becomes more sophisticated and ubiquitous, artists are becoming increasingly adept at documenting their performances and artworks. However, it is less common to document performers' perspectives on their performances and the motivations behind them. Given that these creative concerns are likely to change over time, there is value in capturing and reflecting on these more ephemeral concepts as well as the artworks themselves.

4.2.1 Encoded

In this section we present a practice-based research project which examines the relationships between creative practices and new technologies in the context of physical theatre performance. At the core of this work is an ongoing collaboration between the second author and a Sydney-based dance/physical theatre company which began in 2010. This collaboration has resulted in the creation of two major (hour long) works which have toured internationally and have been seen by approximately 20,000 people in Hong Kong, the Netherlands, South Korea, Mexico, Australia and the United States.

The second author was responsible for designing and creating the interactive systems around which these works are based. As the focus of this paper is on examining the relationships between new technologies and creative practices we will not provide a great deal of technical detail here. It should suffice to say that the systems used a combination of large (up to 30m wide) and small (body sized) projections which responded to performer movement. Performer movements were tracked using infrared motion-tracking system developed for this work.[4] In this paper, the focus will be on the first of the works, *Encoded*. The second work, *Pixel Mountain* was aesthetically similar and made use of the same basic technologies and creative strategies.

As with Project 1, the aim was to document and understand the creative practices and processes at play, with particular consideration of the various interactive technologies which were created and used. However, *Encoded* involved a much larger team comprising four dancers, director, choreographer, costume designer, lighting designer, composer, animator/compositor, two digital artists/interaction designers, theatre technician, producer in addition to the company's chief executive officer and administration staff.

Because of this, examining the creative process necessarily involved gathering a far broader range of perspectives than Project 1. Personal reflections and observations by the second author, as interaction designer, were important but in addition a number of interviews were conducted with all members of the creative team during and after the development of the work. Interview data was transcribed and analysed using grounded theory methods [8] which resulted in the identification of a number of key themes which we will summarise here. The findings have been presented more fully in [14].

It was observed that while participants in this project

[4]Video documentation of the works, *Encoded* and *Pixel Mountain* can be seen at `https://vimeo.com/55150853` and `https://vimeo.com/85911669`.

were interested in exploring the use of interactive systems in their work, and could sense that they had significant potential, the precise nature of the systems and their overall contribution was still unclear. Unlike lighting design or choreography, interactive dance systems do not yet have clearly defined and widely understood practices and associated languages.

For this reason, from the interviews it was clear that participants had a wide range of conceptions of the interactive systems and their role in the work. At different times, they described the systems as acting as contact improvisation partners, as mirrors, resonators and amplifiers of movement, as masks and even as fragile, sometimes temperamental, 'beasts'. Each of these conceptions suggest different criteria for design, strategies for use, and range of performer experiences.

For interaction designers, conceiving of interactive performance systems as contact improvisation (CI) [18, 24] partners is challenging and intriguing. In CI, performers use physical contact as a starting point for movement improvisation. Generally, performers stay in physical contact during performance and communicate through touch as the improvisation develops. This view of interactive performance systems suggests designers search for highly expressive and communicative 'touch points' through which performer and system interact.

Similarly, conceiving of the interactive systems as a kind of theatrical mask opens up new ways of thinking about designing for creative interaction. The use of masks in theatre dates back to antiquity [23] and can take many forms. Perhaps most well-known is the use of face masks of various stock characters (the witty acrobat, the cowardly villain, the pompous doctor, etc.) in commedia dell'arte. More broadly though, any kind of costume can be seen as a mask, in the sense that it to some degree conceals the identity of the wearer, and helps shape audience perceptions and performer behaviours.

Performers in *Encoded* highlighted the fact that the interactive projections they were working with acted as masks and therefore suggested particular personas and movements. Thus the interactive systems were not just responding to movement but were also *shaping* it. In the context of NIME, this has implications for the way we frame the core concept of 'mapping', suggesting that it is not only about linking performer gestures to system response, but about considering how the gestures of the *system* shape the actions of performers.

Linking the tradition of commedia dell'arte to modern day interactive performance systems suggests that various kinds of well-known interactive 'building blocks', such as particle systems, flocking algorithms, etc might be usefully framed as stock 'masks'. It may be that these interactive technologies and techniques are the modern equivalent of stock characters in dance and physical theatre [14].

5. CONTRIBUTIONS OF PRACTICE-BASED RESEARCH

From the two examples discussed above, it is clear that practice-based research in NIME can generate varied research contributions about the practices that give rise to and develop from artefacts. From Project 1 we can see that through self-reflexivity, artefact development may be used as a valuable tool for investigating and uncovering otherwise tacit knowledge about the development of new interfaces for musical expression. By engaging in critical self-reflection, the practitioner can communicate insights into burgeoning creative practices, and articulate how they relate to the design and use of NIMEs. In order to connect to the wider community, such approaches should be engaged with deeply, through critical analysis and reflection. They can then be a valuable means of generating theory from practice. In Project 1, this approach helped to articulate three complementary perspectives on the development of human-machine performance practices: the entangled relationship between human and material agencies, the role of musical interpretation in human-machine improvisation, and a conception of symbiotic musical interaction.

From Project 2 we can see that practice-based approaches involving large groups of performers can lead to insights into how the various members of a creative team responsible for new work relate to and shape the design of interactive systems and how these systems alter and shape their performances. Part of the contribution of this kind of research activity is to simply document the thought processes and creative strategies at play, and we believe this is valuable in itself. Taking these observations further allows us to theorise about the links between the various conceptions of interactive systems (as masks, contact improvisation partners, etc) and creative practice. These theoretical contributions help us understand the creative work and, importantly, suggest new approaches for future creative work, for ourselves and others.

6. PITFALLS

> "Describing the true aesthetic core of live electronic music means writing about form, sound, timing etc.. It means describing, in great detail, every piece of music I know. And there are simply not enough words to discuss everything I've heard or created. It would all take so long that I'd have no time left to live or to create more music. Likewise my readers wouldn't have time left to listen to music after reading these detailed descriptive texts." [25]

In this paper we have argued that practice-based research which draws on in-depth personal and collaborative reflections and other qualitative data can be valuable in documenting and examining the co-evolution of musical technologies and associated creative practices. However, they are not without risk. Undertaking sustained, in-depth reflection on creative practice takes time, and practicing artists may be understandably reluctant to commit to this, given that it will inevitably take time away from creating and performing new works.

As the quote from Michel Waisvisz above highlights, exploring the complexity of the relationships between the immediate creative context, historical practices and technology design and use in full would preclude actual creative work. It is also the case that taking the time to document, reflect, analyse and write-up findings takes time away from experimentation and further technical development. We acknowledge this, but point out that, in some ways, slowing the pace of 'innovation for its own sake' may not be such a bad thing. It has often been pointed out that few instruments developed by the NIME community are used frequently enough to meaningfully evaluate their potential impact on creative practice. We argue that taking time to really document and explore the instruments we create, along with the creative practices they shape – and are shaped by – may be worth the cost.

With respect to self-reflective practices, such approaches to practice-based research may run the risk of being of value only to the practitioner-researcher, at the expense of generalised knowledge. Whilst self-reflection is of immediate

value in pushing forward the creative practice itself, without critical and in depth reflection it can difficult for such approaches to remain relevant to a wider academic community. To counter this, such approaches must engage critically with established theoretical frameworks, and position the research within a broader academic and practical context. The contributions of research of this kind cannot be evaluated only with reference to methodological rigour: any theories and insights which are generated are instead evaluated in terms of their contribution to practice. Worthwhile findings are relevant to practitioners and researchers, have a degree of explanatory power (in that they help show why certain situations arose) and/or provide new perspectives on creative practice which open up new areas for exploration.

7. CONCLUSION

In this paper we have presented two approaches to practice-based research the context of interactive systems for live performance: one based on auto-ethnography and the other on personal reflection, observation and interviews. Both approaches seek to examine the interplay between system design and creative practice and to provide a complete view of both the new interfaces that were created and the creative expression. A summary of some key insights from these studies has been presented along with some of the potential risks involved in applying these methods.

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