Musician Experiences with Gestural Interaction

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ABSTRACT
This paper highlights issues that emerge from the application of gestural control in contemporary performance practice. The primary focus is on a recent user study with musicians, using a gestural performance prototype system as a starting point for identifying insights into user experiences of engaging with gestural technologies. The camera-based motion tracking system for the study has functioned as my main instrument for the past three years. As both the performer and designer, I have reflected on gestural prototyping and performances to gauge the influence of this interaction on my own musical practice. The user study contributes to a larger research project that examines the nature of gestural control in interactive audiovisual performance.

Keywords
Gestural interaction, non-tactile, augmented instruments, vocal, Kinect, audiovisual.

1. INTRODUCTION
For contemporary electronic musicians, the challenge of creating dynamic and engaging performances with digital technology has contributed to widespread interest in gestural interaction. Yet the seamless integration of gestural technologies in contemporary musical performance remains a challenging task for musicians. Technical mastery in areas of mapping and gesture recognition and are needed, balanced with a willingness to experiment with more physical forms of expression to achieve more nuanced gestural performance.

In a field dominated by customised and personalised approaches, the absence of standard gestural libraries makes prototyping an integral part of creating gestural compositions and performances. In the absence of a suitable commercial system, I developed a prototype system to experiment with different forms of gesture capture and gesture-to-sound mappings. Subsequent reflections on prototyping and performance experiences helped identify opportunities and challenges associated with gestural performance. This process of autobiographical and musical analysis is complemented by a user case study to examine the ways in which expert users interact with the system and discover they require. The study aims to highlight areas in which user experiences and engagement with gestural systems can be improved.

2. BACKGROUND
This research is concerned mainly with non-tactile gestural controllers, defined by Rovan and Hayward [9] as alternative performance interfaces that rely on non-contact sensing technologies such as near-field capacitive measurement, infrared, ultrasounds and video. They are controlled by “open air” gestures that are not traditionally associated with music-making. This type of interface has also been referred to as an immersive controller by Axel Mulder [6] in which the sensing field surrounds the performer to establish an all pervasive control surface. Without the physical constraints of hardware, such a controller is potentially more adaptable to performer capabilities and ways of moving. However non-contact interfaces pose several major challenges, notably the absence of tangible feedback to establish precise control and repeatability for the performer and transparency for the audience.

The research methodology is framed within performative inquiry, first introduced by Lyn Fels [2] to denote the spontaneous insights that emerge from performance. Performative inquiry embodies a balance between critical and creative action, borrowing from the tradition of reflective practice, linked to research practices including action research and autoethnography. It also relates to performative ethnography, which offers the potential to develop a deeper awareness of practical and expressive aspects of gesture in a live work [4].

In addition to gathering insights from performance experiences, I sought feedback from professional musicians on a prototype developed for my own personal use. The system, called Gestate, has been customised for my own creative purposes through scaling and mapping different movement qualities such as energy and extent of motion to a range of audio parameters in order to develop mappings that ‘feel’ right during performance.

The research methods incorporate a user-centred design perspective. The experience of gestural interaction and its affect on the feeling, sensing body forms a central component of the user study undertaken for this research. This approach is aligned to embodied interaction design that places the experiential body at the forefront [5, 10].

The aim of the user study is to measure user satisfaction with the prototype system, ascertaining its applicability to a range of musicians’ purposes. The evaluation component of the research includes ethnographical approaches – interviews, video-taping and analysis to access first-person experiential understandings of performers’ movement.

2.1 System Overview
Gestate aims to provide a framework to improvise with the temporal and spatial aspects of gestural control in a “natural”, non-inhibitive or artificial way. The system has so far been used to augment instrumental performance with virtual instruments, effects and visualisation. The exemplar refers to performances for voice and piano.

The ideas of mapping gesture and intuitive gesture extend work in the areas of (i) flowing gestural manipulation, e.g. by exploring the continuous control potential of movement to shape the evolving movement to shape the evolving timbral characteristics of a sound,
and (ii) naturalness, intuition, non-tactile gestures [2] for musical control and augmenting expressivity, especially from the perspective of visualising music, visual monitoring and efficacy of mapping in the predictability, control and expression of gesture-controlled augmentation of sound. The latter draws on questions of correlation, spatial and proprioceptive awareness, responsiveness, latency and accuracy in flowing gestures. Unlike particular cues that are recognised through gesture-recognition, this kind of system that analyses continuous flowing gestures does not require an instrumentalist to fundamentally or radically alter their approach to their conventional instrument. This sets it apart from gesture-only interfaces or dancer-actuated systems.

To display sound for the audience and promoting more precise control for Core effects parameters and evolving particle systems in controlling multiple parameters simultaneously. performer to calibrate their motions, particularly when prototyping as a means to providing more nuanced control and it more familiar to musicians from a range of backgrounds.

The mapping scheme is divided into two layers - continuous control for amplitude and effects parameters, and discrete gestural control for chord change triggers and activating the looper functions of record and playback. Combinations of gestures control multiple audio parameters in a few-to-many mapping connection [3]. This mapping strategy was chosen as it most closely reflects traditional instrument design, making it more familiar to musicians from a range of backgrounds.

Different forms of visual feedback were explored during prototyping as a means to providing more nuanced control and immersion in gestural performance. The visualisation assists the performer to calibrate their motions, particularly when controlling multiple parameters simultaneously. Audio signal information and movement position data is mapped to video effects parameters and evolving particle systems in Isadora Core, highlighting evolving relationships between gesture and sound for the audience and promoting more precise control for the performer. The visual feedback provides explicit cues to encourage intuitive understanding and mastery of the interface. To display simultaneous feedback to the performer and audience, a transparent scrim is used as the projection surface, revealing a silhouette of the performer behind the projections. The projected imagery amplifies and draws out key characteristics of captured movement data, including trajectories of motion.

The abstract visualisation has evolved from a custom application called Smokescreen, an Open GL visualisation coded in C++, and has evolved into individual patches in Isadora Core, allowing the performer to switch through different audiovisual environments during a live set. Smokescreen detects movement position and audio level messages that disturb a 2D fluid simulation.

3. EXPERT USER CASE STUDY

The expert user case study is primarily focused on gathering information about the main control features and applicability of gestural systems to experienced, practicing musicians’ work. Rather than evaluating how a particular technology performs, the study focuses on how effective the system is in meeting potential users’ needs and preferences. The questions that have arisen during this process include:

- What is the experience of performers using gestural technologies?
- How does this type of physical engagement influence the creative process and output of musicians?
- What alterations or level of customisation needs to be achieved to ensure the viability and integration of such systems in practicing musicians’ skillsets?

To achieve uniformity and for the sake of comparison, augmented instrument applications were substituted with free air virtual instrument applications to cater to musicians from diverse backgrounds.

Three contrasting system applications were selected for the user study. The first example, an Arpeggiator, mimics the direct mapping of the Theremin. Right arm movements control pitch, while the left arm regulates the intensity of effects. The second application, the Cube, shown in Figure 2, is an audiovisual instrument that requires the user to punch forwards, backwards and sideways with their right arm to trigger chord changes in a virtual physical mallet model. These triggers are visualised as rotations of a three dimensional cube. The third application, a mixer, allows the user to control the amplitude of pre-composed MIDI parts, increasing levels as the arms move away from the body.

3.1 Methods for Evaluation

A group of eight musicians (four female and four male), each with over ten years professional performance experience were recruited for the study. Participants were asked to improvise with the system for as long as they wanted. A paragraph of basic instructions for each application was provided on a printed sheet with additional information provided verbally for clarification.

Video recordings of the sessions are reviewed and compared with the retrospective interviews with participants. The goals of the case study evaluation process are:

- To investigate the experiences of expert users interacting with a gestural performance system;
- To discover how the system is in meeting user needs and preferences.

Levels of expert user satisfaction with Gestate, were assessed according to the following usability guidelines:
- Discoverability
- Consistency
- Feedback
- Reliability
- Creative exploration

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1. http://synapsekinect.tumblr.com
accompanying notes, the following observations emerge:

From the video recordings of the improvisation sessions and 3.2

- The first application, the Arpeggiator, was perceived as the most engaging and the majority of participants spent the longest amount of time using it. Some found it delivered a type of real-time composition that stimulated creative ideas and encouraged physical exploration.
- The two participants with the most extensive past experience of movement-based interactive audiovisual systems got bored with the system quite quickly.

Most participants faced the screen, paying attention to the visual feedback, but several ignored it, concentrating rather on the audio feedback.

Most participants voiced a strong need for a high level of customisation, including less overlap between effects and pitch control functions, more control over individual virtual instrument parameters and the ability to switch easily and seamlessly between a range of user-defined effects and instrument banks.

Commonly identified limitations relate primarily to the system architecture, which is arranged into distinct scenes within Isadora Core, each representing a distinct audiovisual environment. Participants generally wanted more ability to transition fluidly between system states so as to have more detailed control over audiovisual combinations.

The notion of composing with the body became a recurring theme. The spontaneity and immediacy of this type of composition attracted enthusiasm, particularly in its potential to contribute to the early stages of composition – such as building rhythmic beds and exploring harmonies. Many participants were interested in further exploring the system’s compositional potential – recording and layering tracks in real-time through the use of a looping function. The three vocalists involved in the study particularly stressed the need for a loop-based feature that would allow the layering of harmonies for performance. Although looping is possible in the current system, it was not tested during this evaluation.

On the whole, the visual feedback component was seen to aid control of the system. However for the arpeggiator application, where many participants viewed the audio feedback as satisfactory, visual feedback was perceived largely as a distraction, particularly by those with a strong auditory inclination. For those with a stronger visual preference, the visuals were seen as an indispensable part of reinforcing relationships between movement and sound.

A lot of work had already been done before the sessions to set up the instruments and effects banks, making it easy for participants to walk in and start experimenting with the system immediately. Users were not working exclusively with note data but also with pre-composed elements, so a lot of initial creative decisions were already made for them. A particular context was presented, incorporating my own aesthetic decisions and style, which limited levels of explorability for some participants.

Different groups will need different things – electronic musicians accustomed to performing in a mostly stationary position are polarised – some embrace gestural control while others feel inhibited by the formlessness of it.

Figure 2. A screenshot depicting skeleton tracking in Synapse and visual feedback in Isadora Core for the audiovisual instrument, Cube.

The guidelines are adopted from Norman and Nielsen’s usability guidelines for designers of general gestural systems [8]. Both authors stress the need for standardisation to maximise the effectiveness of gestural control for first time users.

As the participants had no prior experience with the system, user feedback on explorability and discoverability in particular was sought during the interview. The following questions were asked of participants:

1. Overall, how did you find the experience of using this system?
2. Do you have any comments about how easy or hard it was to understand how to use the system?
3. Did you feel in control of the audio output?
4. Were the visual effects altered by your movement? How?
5. Did you find that the visual feedback was assisting in the control of the system?
6. Do you have any comments about the relationships between your movements and the sounds the system made?
7. How did you find the latency?
8. Did the system offer room for exploration and development of new ideas?
9. What areas of improvement would you suggest?
10. Would you consider adopting a similar system in your own work? If so, what would need to be changed or improved?
11. Are there any other applications you could envisage for this system?

Each session was video recorded, accompanied by participant observation during the session. Selected segments of the video were analysed rather than transcribing the entire session to identify core control movements and patterns that emerge with different users. The feedback gathered forms a mixture of feelings, impressions, initial reactions and perceptions on expression and experience from participants exposed to the system for the first time. Although certain effects, sounds and functional gestures are featured, users were informed that the system could be customised if they wish to explore it after the session

3.2 Early Results

From the video recordings of the improvisation sessions and accompanying notes, the following observations emerge:

Figure 3. Visualisation of mixer application in Gestate.
4. DISCUSSION

For musicians engaging in gestural interaction for the first time, there is a need to transcend habituated ways of moving [7]. For a participant with conducting experience, this form of control also easily fitted with established styles of moving. It also resonated with musicians from a movement background, like those who had participated in theatre-based movement workshops as well as movement awareness education such as Body-Mind Centering. These participants also had less issues triggering sounds with pre-defined gestures and managed quite varied effects by activating and processing sounds by experimenting with a range of different movement patterns and styles.

Some participants wanted the system to emulate instrumental interaction, commenting, “this thing has to show the tactile nature of how I move and when and where I feel the tension in my body.” The desire for implied tactility in open-air performance was reiterated by a suggestion from another participant that the system should allow musicians to “mould sound like clay.”

The user study has revealed that a high degree of customisation is needed by certain musicians, placing doubt on the possibility of developing a generalised system that applies to a wide range of performers. Most users emphasised the need to access a range of options regarding gestural libraries and a mixture of explicit and abstract visual feedback.

Reported physical sensations ranged from a feeling of being over-exerted to invigorated. As many gestures required raising the arms above the head, this was seen as a source of fatigue for some participants. Others found the energy exertion beneficial compared to stationary ways of creating music electronically, either on stage or in the studio, and recognised the system’s potential to maintain fitness in an unstructured and low-cost way.

Overall, more subtlety of control was required from users, who sought to combine smaller, more detailed gestures with the large scale gestures afforded by the Kinect.

5. CONCLUSION

This research aims to improve user experience by contributing to performability while also broadening our understanding of gestural interaction. Early results from an expert user study indicate strong personal preferences expressed as the need for a high degree of system customisation.

As analysis of this study progresses, themes relating to the value of combining physical awareness, visual feedback and intuitive mapping, will be explored as a means to improving the effectiveness and accessibility of gestural performance systems for musical performance.

6. REFERENCES


