Choreography in the Mapping of New Instruments

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ABSTRACT

This paper discusses the use of choreography in mapping sound to movement in the field of new instrument design. Using the analogy of the drum kit player utilising all four limbs in a similar fashion to a dancer, we investigate the notion of mapping movement to prerecorded sound in that order, as opposed to sound mapped to movement. In this way the mapping process becomes a type of 'choreography', where a particular piece of music is learnt to be played as the mapping is determined. We outline three main factors which must be balanced within the mapping process. We present findings from the development of a new gestural interface for electronic percussionists and several collaborations that this interface has been used in.

Author Keywords

Choreography; Mapping; New Instrument Design; Percussion.

ACM Classification Keywords

H.5.5. Sound and Music Computing; J.5. Art and Humanities: Performing arts (e.g., dance, music).

INTRODUCTION

This paper will report on the authors' experiences in designing and performing with a new gestural instrument. Over the past two years dozens of compositions and improvisations have been performed by the first author on this instrument in venues all around the world. In addition, several interviews with other musicians who have been involved have been conducted and analysed.

We begin by considering the way acoustic drum kit players 'choreograph' the way they play around the kit. We identify three main factors that affect this choreography. These three factors cannot coexist and hence must be weighed up against each other. Using these three factors, we outline our approach to the 'mapping problem' [1] in designing a new gestural instrument for electronic percussion. We use the analogy of a dancer choreographing her/his movement to prerecorded sound in taking a compositional approach to mapping, beginning with the music and working backwards to the choreography of the movement on the gestural instrument to best fit with the music.

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CHOREOGRAPHY

Choreography on the Drum Kit

The drum kit is one of the few instruments that require the coordination of all four-limbs. In this way it is similar to the art of dancing. Using this analogy, drummers, when transcribing drum kit music, often choreograph the way they play a piece of percussive music, making decisions on which of their four limbs should play each rhythm. Foot pedals have enabled drummers to play traditional hand percussion instruments like bass drums, cymbals, cowbells, woodblocks and snares with their feet to allow a different choreography of playing the kit. Interesting stickings result in dancelike choreographed drumming and when several drummers get together to perform a piece such as Steve Reich's *Drumming*, as much effort goes into the choreography as it does into the performance of the music.

Another distinguishing characteristic of the drum kit is that is it inherently adaptable. Though the standard kick, snare, hihat, crash, ride and toms can sustain a lifetime of exploration, shakers, shells, wheels, bubble-wrap, coins, anything imaginable can also become part of the kit. Even in the most experimental music, this element of deriving sounds from any material sparks interest in the more conservative audiences. 'A childlike fascination with the meticulous exploration of the sonic potential of 'things,' musical or otherwise, driven by the pleasure principle, is also common in much experimental improvised music' [2]. Since there is no way of utilising conventional harmony, melody or note duration on the drum kit, the instrument demands the musician explore rhythm and timbre to the highest degree. Drummers explore their instrument through hitting, caressing, rubbing and stroking different surfaces with different utensils, and in doing so, as in all acoustic instruments, appeal to the audience's knowledge or

literature [8] of the way movement is connected to sound in the real physical world.

But how do drummers decide to choreograph their performances? We have identified three main motivating factors in the way drummers choreograph their performances. They are:

- Efficiency
- Visual performance
- Exploration

Efficiency, or ergonomics, is similar to the notion of intimacy: 'a measure of the player's perceived match between the behavior of a device and the control of that device... The ultimate goal in the process is for the player to have a high degree of intimacy such that… [the instrument] behaves like an extension of [the player] so that there is a transparent relationship between control and sound. This allows intent and expression to flow through the player to the instrument and then to the sound and, hence, create music' [3]. The most virtuosic drummers, mostly those considered as jazz drummers, use as little energy as possible in their movements to glide over the kit. Their focus is in preparing for the next movement as early as possible to have the ultimate control over the way the sound is made. This more intimate and sensual experience with the instrument leads to positive responses from audiences in smaller venues. However, in larger arenas, these subtle movements, though leading to more nuanced expression, may not lead to a transparent, visual or theatrical performance.

Audiences feel a strong connection with the large movements and **visual performance** often needed to play the drums. Exaggerated movements in the style of big rock arena exhibitionist drumming, though the least efficient way to play the drums, has its context for when more subtle playing becomes too discreet. Many styles of music have developed from the need to be more theatrical when the audience is placed further away; the best examples of this include opera and stadium rock.

The last factor of **exploration** or breaking habits is dealt with mostly in experimental music. Drummers challenge themselves by setting up their kit in unusual ways in the hope that new and different musical ideas may reveal themselves.

Choreography on the Electronic Kit

These three factors become increasingly important when facing the 'mapping problem' in designing electronic instruments. 'The basic problem of these interfaces concerns the fact that the mediation between the different modalities (basically from movement to sound) has an arbitrary component, which is due to the fact that the energies of the modalities are transformed into electronic signals. This is in contrast with traditional instruments, where energetic modalities are mechanically mediated and where the user gets a natural feeling of the causality of the multimodal interface' [1].

Electronic pads have been used by drummers to open up more choreographic and sonic possibilities. They are just one part of an ongoing conversation between drummers and electronic beat makers. Early electronic beat makers began their art form by sampling drummers, and later cutting these samples up in various ways. This in turn led to drummers mimicking these electronically produced beats on the acoustic drum kit. As this conversation continues, acoustic drummer Chris Dave reveals that he transcribes electronic producer J Dilla's beats in his practice routine in great detail. This has led Dave to be one of the most sort after drummers in the world today, playing in some of the biggest live hip hop and nu-soul acts in the world, and doing so with a heavy electronically produced music aesthetic. He continues to reinvent the way acoustic drums are played as electronic pads struggle to make their mark.

The problem with electronic pads lies in the loss of the connection between movement and sound. This loss is mostly due to a lack of information that an electronic pad can receive from a strike as compared to the complex rippling effect that occurs when striking an acoustic drum. To overcome this, some percussionists have explored the use of 'open-air controllers' to both mimic and sonically expand the potential of a physical drum kit and 'unchain the performer from the physical constraints of holding, touching, and manipulating an instrument' [11]. We have been developing our own working prototype gestural instrument for musical expression, the *AirSticks*, using the Razer Hydra Gaming Controllers [1]as the open-air controllers. These controllers send continuous control changes of XYZ absolute position and orientation. We currently also utilise the SoftStep Foot Midi Controller [2]to incorporated foot movements in not only trigger samples but also manipulating them with various expressive moments. For more details on this instrument see previous work [4,5].

A COMPOSITIONAL APPROACH

With the *AirSticks*, the drummer is freed of restriction of needing to strike a physical surface. Her/his movement is constantly tracked and hence every movement can be choreographed and mapped to a sound. In dealing with these types of 'composed instruments' [6] we have decided to take a compositional approach, making 'a piece, not an instrument or controller' [7].

An example of this approach lies within a piece for voice and *AirSticks* entitled *Narcissus (Vocal Vacuum One),* one

[1] http://www.razerzone.com/gaming-controllers/razer-hydra-portal-2-bundle

[2] http://www.keithmcmillen.com/products/softstep/

of a series of duos with various performers called *Vacuums*. Here the compositional approach started with the essential elements of the piece being composed and produced on a computer. The *AirSticks* player then turned his attention to learning to play this piece while adapting the mapping. This is the part of the process we are calling the choreography - making decisions on which movements should represent which sound, and taking into account the three factors outlined in the paper. Once the *AirSticks* player has learnt the choreography of the piece, and is comfortable enough to improvise around the piece's main structures, they can add more layers of manipulation of parameters to the mapping. The *AirSticks* player then collaborated in the rehearsal room with a vocalist and the two of them arranged the piece further as the *AirSticks* player began to integrate the live manipulation of the vocalist. It is this part of the process that the vocalist described as 'fluid,' utilising the *AirSticks* as a 'compositional tool' with which 'we perform every time we write'.

In the example above, the process begins with composition and moves to gesture mapping or choreography, then to rehearsing improvisations or playing with the written material, and finally to performing the work.

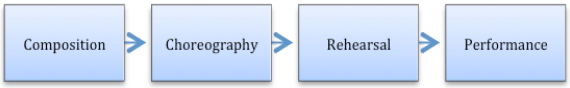

Fig 1: Composition led trajectory of the creative process

In the field of instrument design, this trajectory more commonly begins with the gesture mapping. The term choreography can only be used when it occurs after at least part of composition has been written. Though changing this trajectory does not necessarily solve the mapping problem, starting with a more complete composition can inspire different ways of mapping sound to movement, or in this more choreographic approach, movement to sound. An example of this can be found in *Dark as a Dungeon,* a live performance to silent film for guitar, electronics and the *AirSticks*. In this piece, the *AirSticks* gestures were deliberately confined to a very restricted space to represent a section of the film in which men were going down a mineshaft. This was juxtaposed against the choreography of another section which use much larger, more open gestures to represent the vastness of a mountainous landscape.

In an interview after the performance, the collaborator mentioned that 'it was great to have that visually [the choreography of the *AirSticks*] as part of the performance.' This approach allows the instrument designer to more comprehensively weigh up the importance of visual performance against the other two mapping factors. Without starting with some degree of composition, it is difficult to imagine the connection between visual performance and the yet to be heard music. Indeed the first author has often been told that when improvising on the *AirSticks*, even though he looks connected to the instrument, and plays with great expressivity, certain key visual elements of the performance are missing, as opposed to the very stylised approach taken in playing the instrument when the music is pre-composed. Being aware of the constant tension between the concepts of efficiency, visual performance and exploration in the mapping of a new gestural instrument can lead to more informed decision-making throughout the process.

CHOREOGRAPHY ON THE AIRSTICKS

The *AirSticks* explores the role of 'metaphor for improving the amount of expression possible with a device. Metaphor depends on a literature, which forms the basis for improving transparency' [8]. With the *AirSticks* this literature is the movements made by performers on a traditional drum kit. Using drumming as a metaphor for mapping the *AirSticks* also helps lower the entry level of the instrument, allowing experienced drummers to transfer their motor skills from playing the traditional acoustic drum kit to this new instrument [9]. In designing the *AirSticks* special consideration is given to how confidently and easily an expert percussionist could play the instrument on her/his first attempt. A practice regime has been created for the new instrument with a tutorial style guide for learning to play the *AirSticks*. This guide breaks down all the layers of mapping possibilities by starting from the metaphor of an electronic drum kit.

Distinct from a 'conceptually complete' instrument like the drum kit, piano or Theremin which can be explored within its physical and sonic constraints, new instruments undergo 'a constant series of revisions, redesigns and upgrades' [10]. The performer must constantly ask herself/himself whether to keep practicing a difficult passage or simply design the instrument in a way that allows an easier playing of this passage. In other words, does the designer put efficiency above visual performance and exploration in order for the passage to sound the way the performer or composer want it to sound?

Exploration becomes a greater factor in the choreography of new instruments compared to that of a drum kit. Since it is very easy to dramatically change a mapping of a new instrument, the exploration of movement and sound can shadow the concerns of efficiency and visual performance. One example of this occurred when, after an improvised performance of the *AirSticks* with an acoustic bass player, an audience member suggested that a certain movement made on the *AirSticks* looked uncomfortable and visually unpleasing. This particular movement, an overextension of the wrist towards the underarm, was made by the performer to attain a desired sound within the improvisation, even though the movement was an uncomfortable one to make. For the next performance the movement was remapped so that the sound could be attained and explored without discomfort. Exploring a mapping with these other concepts

in mind can lead to great breakthroughs in making a mapping more efficient and/or visually appealing. A similarly uncomfortable movement could be desirable in pushing the body to the limits to get some sort of physical feedback.

FUTURE WORK

We have begun to design the hardware and software for the next incarnation of the *AirSticks*, taking into consideration the concepts discussed in this paper. Our next version of the instrument addresses the 'mapping problem' in three ways.

- We are working on a morphing algorithm to allow more exploration of sounds within the mapping
- We are designing hardware with haptic feedback that feels more like a real drum kit.
- We will utilise the controllers themselves further in the mapping process, alleviating the need to use the keyboard and mouse of the computer to choreograph movement to sound.

CONCLUSION

In this paper we have described an approach to new instrument design which puts greater emphasis on the choreography of movement. In this approach, the composition of parts of the music takes place in advance of the design of the mappings between gesture and sound. We argue that this approach can improve the visual impact of performance and provide a new perspective on composition and design that leads to a blurring of boundaries between dance and live music performance.

REFERENCES

1. Maes, P.-J., Leman, M., Lesaffre, M., Demey, M., and Moelants, D. From Expressive Gesture to Sound, *Journal on Multimodal User Interfaces*, 3, 1-2 (2010), 67-78.
2. Arias, R. I Know It's Only Noise but I like It: Scattered Notes on the Pleasures of Experimental Improvised Music', *Leonardo Music Journal*, 12 (2002), 31-32.
3. Fels, S. Designing for Intimacy: Creating New Interfaces for Musical Expression, *Proc. IEEE 2004*, 92, 4 (2004), 672-685.
4. Ilsar, A., Havryliv, M., and Johnston, A. The AirSticks: A New Interface For Electronic Percussionists, *SMC'11 2013*, (2013) 220-226.
5. Ilsar, A., Havryliv, M., and Johnston, A. Evaluating the Performance of a New Gestural Instrument Within an Ensemble, *Proc. NIME 2014*, (2014) 339-342.
6. Schnell, N., and Battier, M. Introducing Composed Instruments, Technical and Musicological Implications'. *Proc*. *NIME 2002*, (2002) 1-5
7. Cook, P.R. 'Music, Cognition, and Computerized Sound: An Introduction to Psychoacoustsics, The MIT Press (2001).
8. Fels, S., Gadd, A., and Mulder, A. Mapping Transparency Through Metaphor: Towards More Expressive Musical Instruments', *Organised Sound*, 7, 2 (2002) 109-126.
9. Mulder, A. Towards a Choice of Gestural Constraints for Instrumental Performers, *Trends in Gestural Control of Music* (2000) 315-335.
10. Ostertag, B. Human Bodies, Computer Music, *Leonardo Music Journal*, 12 (2002) 11-14.
11. Rovan, J., and Hayward, V. Typology of Tactile Sounds and Their Synthesis in Gesture-Driven Computer Music Performance, *Trends in Gestural Control of Music,* (2000) 297-320.