Collective Controllerism: a non-musician's perspective of interactive dance as controllerist practice

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Abstract

Music has been constantly reinvented by a multitude of inventions. In recent years, digital technologies have given rise to practices that not only break free from traditional canons of musical literacy, but further invite engagement by artists whose predominant expressive medium is other than sound. This chapter examines this emerging phenomenon through the perspective of a collaboration between a contemporary dancer and a controllerist, i.e., a non-musician performer of electronic music using tangible interfaces for real-time sequencing, manipulation, and generation of sound. The chapter begins with the author's reflection on his artistic identity, and the challenges of operating on the intersection of practices utilising different expressive mediums. A literature review follows, outlining the lineage of controllerism as an emergent practice borne out of commercial music technology and the transition of disc jockeys from analogue to digital equipment. Through a Practice Research methodology, a reflective work is analysed as to detail the different devices and mapping strategies that control sound, as well as designing an environment that affords dancer's cognition of the music-making processes and allows them to utilise movement towards actively participating in a controllerist performance. With controllerism extended to a hybrid collaborative domain, the (non-) musician's perspective shifts away from utilising movement data as merely a further input device complementing traditional controllers, and instead considers dancer collaborators as music performers that can be entrusted with commanding crucial sonic elements. The chapter concludes by suggesting ways for controllerism to become further established as a research topic through interface standardisation and the development of transcription systems.

Keywords: collaboration, interdisciplinary, controllerism, human-computer interaction, dance

1 Reflections on Identity

Alike many other individuals, the past eighteen months found my regular workflow disrupted. With the studio-based activities forced into a hiatus, the lessened rhythms brought along a rare opportunity for a reflection on my practice, which went to form the basis for this chapter. Having spent almost a decade producing just half of the work that I am credited for, with the remaining half created by the many collaborators I have had the privilege of working with, the aforementioned introspection led me to consider my role in those collaborations, or more specifically, how can my role be communicated and situated within the field of sonic practices.

I always thought of my position as rather uncomplicated; I work in the intersection of sonic and performance arts, collaborating with practitioners of disciplines focusing on physical movement, such as choreography, acting, physical theatre, and performance art, with my contribution concerning the creation of sonic elements, and the interaction design enabling my artistic partners to affect those sonic elements through their movements. This practice has enabled me to examine several aspects related to collaborative engagement: the social dynamics that emerge between artists engaging in collaboration, the different modes by which polydisciplinarity[1] manifests, approaches in abridging human-computer interaction principles for non-specialist audiences, intersections in the language of dance and music, and metaphorical interpretations of biological concepts as means of understanding dependency between practitioners, disciplines, and expressive mediums. In the process of researching interaction between sound and movement, I placed particular care in valuing and appreciating the inner workings of the artistic disciplines in which my collaborators identified their respective practice. However, it is only recently that I began to realise how little time I invested towards reflecting on my own disciplinary identity, and thus faced the possibility that my once thought uncomplicated viewpoint had perhaps naively underestimated the complexities of the field I claim to operate within.

Perhaps this was due to the constant migration I have experienced throughout my working life. Having traversed music-making via a reasonably diverse range of genres, aesthetics, methodologies, and technologies, appropriating this 'in-betweeness' in my sonic practice was often a source of succour against absolute labels and classifications, which to a large extent was inspired by the regular close encounters with artists outside the field of sound and music. Nevertheless, with hindsight I can now recognise the unease by which I replied to the innocuously complicated query: "*what* do *you* do?". Firstly, the "*you*" part was redundant, since there was no "*you*/*me*" in the work, but only "*us*", a creation borne out of collaboration in equal terms overall, notwithstanding the different responsibilities in respect to the involved artistic mediums. And then the "*what*" presented a further challenge; "*I'm a musician*" is a thoroughly tempting title, due to its wonderful simplicity. But I could never call myself one, certainly not in a professional capacity, considering I need to count semitones in order to determine simple diatonic intervals, and my keyboard prowess goes little beyond the one-handed rendition of "Frére Jacques" that I was so proud to master at the ripe old age of eight. With the title of *musician* out of the question, I have at times labelled myself a composer, producer, recordist, disc jockey (albeit long retired), noise improviser, soundscapist, and sonic artist, an approach akin to a chameleon blending into its current environment, with my title morphing according to the sonic milieu I found myself within, whether that was an acousmatic concert, an installation gallery, an urban soundwalk, or a small basement occupied by an ambitiously-sized sound system. Granted, these titles do reflect the nature of my work with sound, partly at the very least. Although providing a comprehensive list of

[1] While I acknowledge that "interdisciplinary" is the habituated term referring to work involving more than one discipline, it in fact refers to a distinct mode of interaction (Moran 2010, p. 14). I have been using the term polydisciplinarity to encompass all modes in which disciplinary interaction may potentially manifest. I provide a more thorough explanation of this in my thesis (Moriaty 2019) section 2.2.2

one's activities makes for a rather poor social interaction, that tactic seemed somewhat conducive in communicating the "*what*" of my practice among fellow sound makers. However, it proved to be less effective when liaising with practitioners of other fields who have little context of each subcategory of sound practices and their respective *outcomes*. And by *outcome* I refer to the visible *doing* of an artistic practice, rather than the specific processes by which the final output is reached. This is worth mentioning, because in the scenario of a prospective sound-movement collaboration, the question "*what* do *you* do" aims to identify firstly, the type of music one makes, and secondly, the way that music is delivered, whether from playback of a recording, or a live performance; and in the case of the latter, what instrument produces the music. In my attempt to intrigue interest in the aforementioned scenario, I often replied that I perform live computer music by manipulating sounds through operating dials, buttons, and switches on digital controllers (figure 1), and so do my collaborators through their movements by wearing motion sensors (figure 2). In my mind, this *simple* explanation provided a succinct overview of my approach for creating works featuring interaction between sound and movement. Or so I believed.

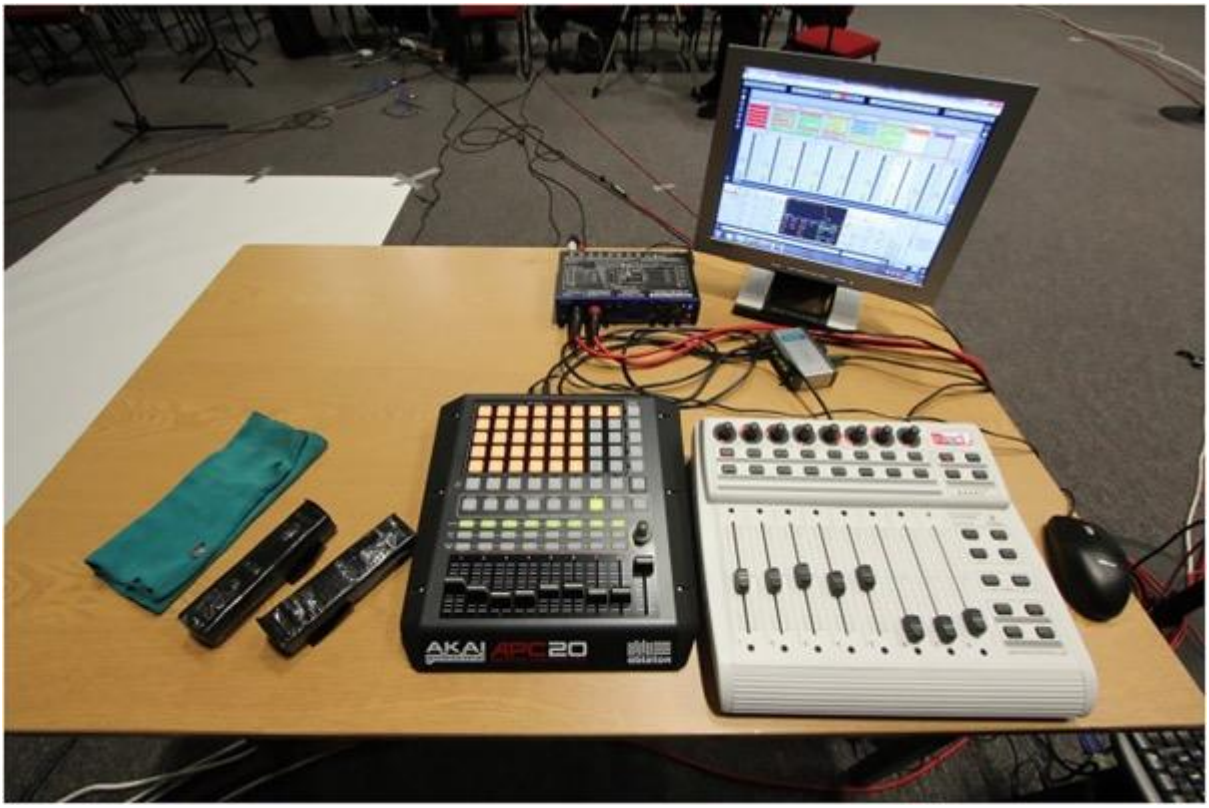

Fig.1 – Controllerist instrument & wearable sensors, circa 2011

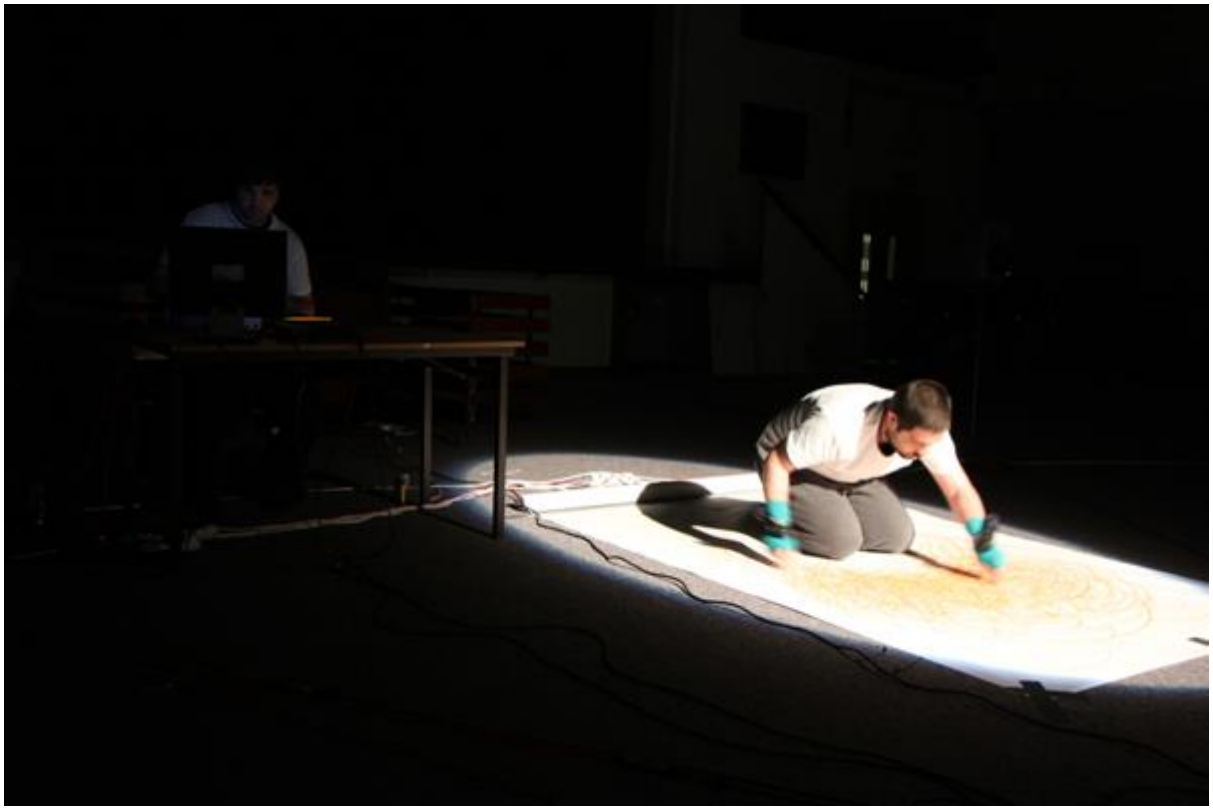

Fig. 2 – Performing with action painter Alex Alexandrou at the Salford Sonic Fusion Festival, 2011

2 Chapter aims & overview

Up until recently, I maintained that my previous statement situated my practice within the field of interactive dance, where motion-tracking technologies are used to control music, as well as any other media that can be affected by digital data (Siegel 2011). However, this field displays a staggering level of diversity in regard to the approaches by which technology is utilised to endow artists with the ability to control sound, visuals, lights, and so on. Moreover, subdivisions of interactive dance are characterised not only by any particular aesthetics evident in their creative outcomes, but often also through the methodologies and technologies that facilitate the connection between movement and the interactive media. Such practices have long been studied within established communities dedicated to the research of technologies, practices, and philosophies that facilitate and evolve the field of interactive music and dance, such as NIME[2] and MOCO[3], respectively for each disciplinary perspective. In interactive music, diversity in sonic aesthetics is further evident, with works ranging across the expanse of electronically generated music. As a result of this ambiguity in the outcome of interactive dance, my previous statement falls short of explaining the type of music I make, and instead goes only as far as describing the method by which it is performed. In other words, a further clarification is required to allow one to understand the evident outcomes of my work.

[2] New Instruments for Musical Expression, https://www.nime.org/

[3] Movement and Computing, https://www.movementcomputing.org/

Going back to the reflection of my identity, controlling sound in real-time via digital means can be traced in several practices and music-making communities. Examining the notion of sound control in relation to my background in Electronic Dance Music, the practice of controllerism appears now as an apt field within which to situate my current practice, as I will explain in this chapter. Beyond the personal reflection, I will posit that the real-time interaction of dancers with sound through motion-tracking systems not only constitutes a form of controllerism, but it in fact reaches at the core notion of the practice; that is the ability to perform music despite the absence of any formal musical training.

The engagement between the practices of interactive dance and controllerism forms the core topic of this chapter. Over the following pages, I start by presenting a brief overview of controllerism, highlighting the communities that appropriate and investigate the practice, with the aim of understanding its position within the wider arena of music performance practices. Drawing from current literature, I discuss an approach of defining controllerism and identifying controllerists through the cultural milieu that the practice and its actors operate within, and make a case for distinguishing controllerism from other forms of contemporary music performance that are also utilising digital interfaces for musical expression. Following the critical analysis of the associated literature, I then adopt a Practice Research methodology for discussing the potential of fusing interactive dance with the principles of controllerism. This is realised by analysing a collaborative performance developed and performed with four contemporary dancers, by describing the sound-generating system, the controllers affecting the sounds, as well as the role of each performer during the performance. Within this discussion, I will be referring to my framework for interaction between sound and movement (Moriaty 2020a). However, while the previous publication was concerned with describing the conceptual basis for the framework, here I aim to draw parallels with controllerism; by examining the ways dancers were assigned with commanding crucial sonic elements of the performance, I will reflect on whether this approach constitutes a new form of polydisciplinary controllerism. The chapter concludes with thoughts on future avenues for designing interaction strategies that are closer aligned with the principles of controllerism, and evaluate whether a controllerist approach in interactive dance holds latent potential for not only greater inclusion of physical performers as active participants in the music-making process, but also as means for increased visibility of controllerism within the music research community.

3 Origins of Controllerism

In making a case for controllerism being a contemporary music performance practice, it is important to first examine its relationship with the music research community. While stemming from a lineage of practices with rich histories and active research communities (as will be discussed later), it appears that controllerism has attracted relatively little attention from major academic journals. The majority of publications where controllerism takes up a significant part of the subject have been postgraduate and doctoral dissertations, most notable of which those by Michael Anthony D'Errico's (2016) on the emergence of a controller

culture as a result of the affordances of modern technologies, and that of Guillermo de Llera Blanes (2017) who combines ethnographic and Practice Research methodologies towards situating controllerism as a new evolutionary step in instrument design, perhaps one that the field of organology (i.e., taxonomy of musical instruments) has yet to accept (p. 32). As Llera Blanes observes, there is an observable trend of articles pertinent to controllerism being included in publications focusing on the production and cultures of Hip Hop music and Electronic Dance Music (EDM) (p. 18). This is to a degree understandable; not only is controllerism an emergent outcome from the fusion between these two cultures, but in fact both share a common ancestor in the production and performance of Dub music (p. 24), as will be discussed later.

While nowadays Hip Hop and EDM are distinguished sonically and socially in regard to their respective audiences, their histories are tightly enmeshed. Limiting this examination to the tools used to create and perform music in both genres, the analogue turntable emerges as the first link. While fixed recordings have been used by disc jockeys (DJs) in music venues at least since the disco era of the 70s, the birth of Hip Hop around the same time provided a new way of approaching turntable performance, where 'instead of playing whole records, [DJs] isolated and repeated brief percussion solos known as breaks' (Katz 2019, p. 313). This skill of creating new compositions out of pre-existing music recordings found its way into later styles of electronic music, such as techno and house, with the technique of 'beatmatching' allowing DJs to layer two (or often more) records (Reinecke 2009), and with use of equalisers and volume faders (Magana 2018) were able to perform entirely new compositions which did not exist outside of that particular performance. Llera Blanes (2017) notes the spontaneity and ephemerality in DJ performance, and notes the factor that brings us closer to controllerism:

'As technological developments advanced, the intrusion of digital software became increasingly apparent in the classic model DJ setup, shaping notions and experiences of what the art-form represented; putting into question the very nature of DJ performances, and launching debates on the concept of authenticity.' (Llera Blanes 2017, p.23)

Llera Blanes here suggests that a DJ performance is steeped in 'improvisational and spontaneous quality'. However, improvisation is not always the case for DJs, or at least for practitioners using analogue playback equipment as their performance interface, or the 'triumvirate made up of two turntable decks and a mixer' (p. 23). Katz (2019) describes turntablism as a practice where gestures and articulations are carefully choreographed into 'routines' (p. 314), designed to be executed verbatim between each performance. Here emerges the spectrum of provisions[4] in the operation of turntable performance practice, one which largely contributed to the emergence of controllerism. On the other hand, controllerism becomes distinct to turntablism by virtue of being a practice facilitated through the

[4] Here I aim to identify a range of performance approaches resulting from planned and premeditated to spontaneous and indeterminate outcomes. The 'spectrum of provisions' is a reference to one of the four elements making up the framework for sound-movement interaction, which is further described in section 7 of this chapter.

affordances of digital technologies. In the discussion between Tobias C. van Veen and Bernardo Alexander Attias (2011), the DJs and scholars further point out this distinction:

‘controllerism creat[es] new genres of tactile interface performativity… In this respect, controllerism shifts from turntablism entirely and is closer to the “live” performativity of an electronic musician… The main difference is that instead of playing one's own compositions, one is re/mixing the work of others’ (Veen & Attias 2011)

There are several aspects worth unpacking from this brief segment: firstly, Veen and Attias distinguish controllerism from live electronic performance on account of the material manipulated by the musician in each practice, respectively ‘one's own compositions’ and ‘the work of others’. However, here lies a grey area between creator and appropriator, largely induced by the affordances of modern music technology. The practice of sampling allows a producer to extract a segment from a recording, and potentially manipulate it to the extent that is unrecognisable from its source material. In the case that the source is a previously published composition (‘the work of others’), it raises the question of the threshold of manipulation after which ‘the work of others’ becomes ‘one's own composition’. This issue is further compounded by today’s music-maker market, strewn with sample compilations marketed under dubious reassurances of facilitating the creation of “professional quality” tracks. The second point of interest from the previous statement is the distinction between a controllerist and a live electronic musician; later in the same article, Veen and Attias discuss the lack of virtuosity in modern DJ performance, as a result of the affordances of new technology that includes automatic beatmatching. However, they also point out how skilful performers such as Richie Hawtin are able to utilise these technologies towards expanding the traditional form of a DJ performance by incorporating looping, synthesiser parts, and processing in ways that was previously impossible to do with analogue equipment. This part of the discussion then offers the bridge between DJs and live electronic musicians, and the transition of tools from the analogue to the digital domain:

‘Controllerism offers more possibilities here as a way forward (rather than just a reactionary stance), by which I mean controllerism also entertains virtuosity...’ (Veen & Attias 2011)

The subject of virtuosity in electronic music performance (of fixed or live material) has also been raised by the artist who coined the term controllerism. Moldover describes his practice as one borne out of disillusionment ‘with “press play DJs”, Moldover fans eagerly welcome electronic music’s return to virtuosity, improvisation, and emotional authenticity’ (Moldover n.d.). Once again, this statement provides evidence that controllerism emerged as a reaction against the perceived lack of skill, or virtuosity, that characterises modern digital DJ performances. However, it also inadvertently raises the point that digital tools afford more creative potential than simply manipulating previously published music. In an interview, Moldover resists the title of DJ or conflating controllerism with DJing, and succinctly defines the practice as ‘real-time music making with technology’ (Morse 2017). He then goes to align controllerism with turntablism, partly as means of justifying the term he invented, but mainly to expound that quite like turntablists’ conceived their title from their instrument, so did

controllerists, with the common thread being the virtuosic use of their respective tools. Katz also notes the subject of the practice's title as a way of not only distinguishing turntablism from DJ practice due to technique, but predominantly as means of highlighting the practitioner as a musician:

'The "ism" in turntablism is more than a suffix—it is a crucial signifier that lends a sense of seriousness to the art. There is a common perception among outsiders that DJs simply play records, reproducing rather than creating music. Yet turntablists, as they often assert, are musicians, instrumentalists in their own right.' (Katz 2019, p. 317)

This statement raises a question which is of crucial importance to the aims of this chapter; if turntablists have been established as musicians, and controllerists are the digital descendants of turntablism, does it follow that controllerism is a practice that exhibits musicianship? Answering this can perhaps lead to the loaded question of what constitutes a musician, which in the contemporary digital landscape can be obfuscated at best, and polemic at worst. In the next section, I aim to provide some clarity by delimiting the discussion within the chapter's topic.

4 Non-musicians Performing Music

The traditional DJ instruments, the 'triumvirate made up of two turntable decks and a mixer' (Llera Blanes 2017, p. 23) share more in common with studio equipment such as the mixing console, which was the result of the production and performance approaches utilised in the first popular[5] music practice to incorporate the manipulation of pre-existing music recordings, Dub music (p. 24). While Llera Blanes provides a thorough investigation of Dub in relation to controllerist culture, what is pertinent to this chapter is that the practice's origins can be traced to the contributions of a non-musician. Osbourne Ruddock was a 'talented radio repairman' (Thompson 2002, p. 139), who although possessed a 'deep love for Jazz music' (Veal 2007, in Llera Blannes 2017, p.27) had not received any musical training. Through being known to studio owners in Kingston, Jamaica, Ruddock (under the moniker King Tubby) began making "versions" of existing songs, a practice common for the time (circa 1970). However, while versions would usually simply omit the song's vocals, Ruddock's approach of heavily reworking the existing song's multitrack recordings by playing a custom-designed mixing desk akin to an instrument (Du Noyer 2003, p. 356) resulted in a radically distinct aesthetic from that of Reggae music, and combined recording studio equipment and the performance style commonly used by soundsystem DJs of that time. This type of performance instruments and techniques persisted through the development of Dub from simply versions of Reggae songs to a distinct genre through the 1970s. What is of particular interest for the aims of this chapter here is that Dub music practice began through the vision of a technologically literate fan of music, rather than that of a trained musician. Similarities with this trajectory are evident in the emergence of another genre related to controllerism;

[5] Reworking of pre-existing music had by this point in time already been explored by avant-garde composers, such as Bernard Parmegiani's 1969 "Pop'eclectic"

Clive Campbell, better known as DJ Kool Herc, is widely considered as the father of Hip Hop (Toop 2000). A compatriot of Ruddock, Campbell migrated from Kingston, Jamaica to New York's Bronx in the late 1960s. Having absorbed the essence of his home country's soundsystem culture, and despite having no formal musical training, he became involved as a performer in local "block parties" (Llera Blanes 2017). Campbell went to invent the earliest forms of turntablism through the merry-go-round looping technique (p. 60), which set the foundation for today's practice.

In discussing the origins of Dub and Hip Hop musics, the contributions of Ruddock and Campbell are undeniable by scholars and fans, with their lack of musical training never coming into question as means of diminishing their standing as musicians. One could conclude that their musicianship focused on the virtuosity by which Ruddock and Campbell performed their makeshift instruments, which for their respective time appeared innovative and unprecedented, and to an extent restricted to the equipment and recordings used. Nowadays, exclusivity in instrument design is rare within controllerist culture. While discussing the practice's origins in the previous section, the subject of performing music with controllers was unavoidably touched upon, such as the discussions between Veen and Attias where they distinguish the performance approaches between DJs and controllerists. What is interesting from this discussion (and other similar ones) is that the focus is less on the sonic outcome of a performance, but rather on the ethics employed by the performer. In describing his transition from using analogue records into Digital Vinyl Systems (DVS), Veen criticises performers who make use of the software's auto synchronisation function as 'an ethical call, really, like plagiarism' (2011). At another point in the same discussion, the subject is again raised by Attias, who mentions a finger-drumming[6] competition where participants are required to disable the auto-quantize function, and thus rely solely on their own rhythmical awareness. More to this, Katz brings up the rules set by the DMC[7] turntablism competition in regard to acceptable practices for entries (Katz 2019, p. 315). So, the question here is why all these rules and restrictions? Shouldn't the discussions on using technology focus on the quality of the performance's outcome?

Perhaps the aforementioned ethical matters are raised as a way of establishing a practice within the wider field of musical practices, or more precisely, as means of *evaluating* the quality of a performer's virtuosity. Some of these battles have already been won; in recent years, pedagogical approaches in DJ practice have been cemented in music education (Thompson 2012) (Tobias 2015) (MacCutcheon et al 2016) (Campbell 2016), and turntablists are not only governed by the DMC rules, but have furthermore gone to develop notation and transcription systems (Carluccio et al 2000) (Sonnenfeld & Hansen 2016) by which performances can be both planned and appraised for their accuracy and innovation, or to use the term introduced by Veen and Attias, their virtuosity. Shifting the focus from DJs and

[6] Finger-drumming is a technique for playing percussion and/or sequencing segments of sound through touchpad interfaces which were first developed by Akai with the MPC60 sampler. Thomas Brett (2016) provides a thorough overview of virtual percussion techniques and technologies, including finger drumming.

[7] An international competition for turntablists, hosted by the Disco Mix Club http://www.dmcdjchamps.com/

turntablists to controllerists, similar appraisal systems are yet to be invented[8], perhaps due to the practice's still early stages of development relative to turntablism which can be traced from the late 1970s (Hansen 2000). Moreover, considering that the affordances of digital audio workstations (DAWs) allow not only the playback of entire musical phrases (or even entire performances), but also the recall of specific articulations via parameter automation, it is easy to see how suspicions can be raised about a performer's inputs by their peers.

Such questions of authenticity are a direct result of the technologies used in contemporary electronic music performance. What could once only be achieved through manual inputs on analogue equipment, is now able to be planned and recalled at will. Notwithstanding this issue, Veen and Attias are not prepared to dismiss the value of modern performance technologies, but rather call for a context in which their outcomes can be evaluated:

'there are also sonic and performative possibilities available to those who go digital that aren't really possible or practical with vinyl—looping, cue point juggling, overlaying multiple effects on multiple decks, sampling, etc. The point is not to diminish the virtuosity of the turntablist but rather to understand that virtuosity, if it is perceived as virtuosity at all, has to be recognized and authenticated in a cultural context no matter what its physical dimensions.' (Veen & Attias 2011)

The point about *understanding* virtuosity is of crucial importance; unlike the meticulously choreographed turntablists routines that are restricted to manual inputs, using software for live music performances opens up a new realm of possibilities, with the same performer inputs now able to produce a range of sonic outcomes that can often be obscured to audiences and peers alike. To compare two examples of controllerist practice, Abraham Orellana, better known as AraabMuzik, has developed a performance approach based on finger-drumming by triggering samples through velocity-sensitive touchpads (Dombal 2012). Although the input method is rather simplistic, where a press of a button will initiate a sample, complexity is evident in the way Orellana arranges samples of different lengths, rhythms, types of phrases, etc. over the thirty-two touchpads available in his two controller instruments (Mass Appeal 2016). Moreover, Orellana's performance style showcases a high level of dexterity and rhythmical accuracy (FACTMagazine 2013), one which arguably matches that of acclaimed drummers. As such, this leaves little doubt of the performer's input towards the produced sonic outcomes, and thusly his evident virtuosity. While finger-drumming is a relatively comprehendible technique (i.e., a direct relationship between key press and triggered sound), complexity in controllerist instruments can also manifest in the instrument design. Tim Shaw is a well-known EDM producer under the moniker Tim Exile, who in many ways is one of the pioneers of controllerism, even before Moldover coined the term (Morse 2017). Shaw has been performing with such instruments for well over fifteen years. In his demonstration video for Native Instruments (Tim Exile 2005), Shaw can be seen performing with an array of

[8] It is worth mention that in Llera Blanes's thesis (2017), the author proposes a controllerist transcription system based around the Indian Tabla Kaida notation (pp. 66-69)

faders, buttons, MIDI and laptop keyboards, and a makeshift touch interface. He goes to discuss how the system allows him to go through variable rhythmical arrangements and time signatures while resampling and adjusting signal processing parameters. What is of particular interest here is that Shaw's system includes a "panic" button (Tim Exile, 2005, 10:51). Shaw explains that during his performances he will often reach a state of such sonic complexity that the outcome of his inputs could not be predicted, and the panic button can initialise elements of the system back to a comprehendible state. In this approach, it could be argued that virtuosity is diluted to an observer. However, another perspective would be that the system acts generatively, with the controllerist now acting as the catalyst[9] whose inputs coax the system into unpredictable areas. Therefore, with instruments such as the one created by Shaw, virtuosity is evident not only in the performance, but also in the creation of the instrument and the diverse options for improvisation that it facilitates.

Far from providing exhaustive analysis of controllerist technique, these two examples serve a basis on providing evidence of virtuosity within controllerist practice. Nevertheless, digital music performance is still facing scepticism, even from within; Moldover's assertion of his practice being a response against "press play DJs", i.e., those who may rely on the affordances of equipment rather than their own virtuosity, or Veen and Attias suggesting that unlike analogue interfaces, digital controllers lack tactile interaction[10], and so on. Llera Blanes (2017) investigates this 'series of prejudices' around the use of controllers and the 'deeply ingrained preconceptions' (p. 143) about what constitutes a composer and a performer. Raising this topic in his interview with controllerist Pedro Coquenão, the two discuss about the attitudes of classically trained musicians towards controllers, and that perhaps this 'prejudice' manifests due to lack of understanding when faced with a new instrument, comparable to the attitude that emerged when voice and instrument amplification was invented (p. 144). Coquenão summarises his thoughts:

'Controllers can be seen as mere tools for artistic agency; tools with intricate implications. Tools that have enormous potential for individual configuration, and hence musical expressivity. As a customizable instrument, a Controller cannot fix the user into a preformatted canon of usability, for it is the Controller that adapts to the artist's needs and limitations and not vice-versa, as it traditionally experienced with music instruments.' (Llera Blanes 2017, p. 145)

While not without shortcomings, I strongly believe that this eloquent statement supports Llera Blanes' original aims, that is making a case for controllers being the next evolutionary step in instrument design (p. 32). The reality is that although talented performers have found

[9] The notion of the performer as catalyst with complex and/or unpredictable systems was articulate in Aufermann's 2002 thesis on zero-input synthesis.

[10] Attias' states that 'the spinning record allows infinite possibilities circumscribed by its circumference whereas the button allows two possibilities, "on" and "off".' (2011). This may have been the case at the time of this discussion, but it is worth mentioning that digital technologies have since made huge leaps in this respect, with the inclusion of touch sliders, velocity-sensitive controls, and the MIDI Polyphonic Expression protocol.

ways to extend an instrument's capabilities in search of new modes of expression, the affordances of controllers transcend this notion and present virtually limitless capabilities for configurability. And perhaps once the controllerist community is able to highlight these capabilities through a system or language that can be comprehensible by both audiences and musicians, the aforementioned prejudices can be put to rest.

5 Towards a definition of controllerism

With the previous discussion providing an overview of the instruments, aims, and the developments in live performance that led us to controllerism, I will conclude the discussion on the practice's culture by attempting to define controllerism through the perspective of a non-musician, perhaps the same imaginary character who at the introduction asked me "*what* do *you* do?". It would be understandable if they struggled to distinguishing controllerism from other forms of computer-based live electronic music performance, as they all appear to share much of the same aesthetics, tools, and delivery methods: a performer, usually male, standing behind a table strewn with a heap of boxes comprising of switches, dials, and buttons, who they then proceed to touch before sounds begins to emanate out of the speakers, some of them soft and simple, others loud and complex. Setting aside the clear differences that us music researchers can identify between the performances of a live electroacoustic composition and a post-rave improvisation, such distinctions often elude the field's outsiders. In seeking balance to this confusion, Holly Herndon brings a fresh perspective on controllerism, when discussing that audiences often find difficult to accept devices and practices that they do not immediately recognise as musical instruments:

'The thing is, with a lot of the controllerism, I think it's fascinating research, and I love that people get really nerdy about it and dive really deep, and I want people to continue to do that. With what I'm trying to do, I'm really interested in communicating first and foremost and I don't want to create a barrier between what I'm doing and the audience, and I think sometimes when things are so new or so alien to people—like a lot of my sounds are quite alien, a lot of the processes, the things I'm doing with my voice are already quite alienating, so if my performance method was also something completely new for people, I think it might be too much for people to take at once. I'm not saying I'm trying to water anything down, but I'm trying to communicate and sometimes you can put up barriers for yourself in that way.' (Young 2016)

With an incredible lightness, Herndon suggests that the main issue with the controllerist label is that, quite like the DJ and turntablist lineage from which it emerged, is firstly defined by the tools, before any sound is even produced. And it is this which creates an often-impassable gate for audiences to accept it as a spectacle akin to a performance with an acoustic instrument. And unlike its predecessors, who were limited to tools most of their audiences already had in their homes (records and turntables), the wonderful technology that allows controllerists to do so much more has also brought with it an opaque barrier for the audience.

At this point I should reassure controllerists reading this article that I am not about to declare controllerism as a fringe practice for gear-nerds, as Herndon puts it. In my mind, what salvages and characterises the practice begins to emerge once we go past the controller, and concentrate on the controllerist. There, the two aspects that further distinguish the practice from other forms of contemporary live electronic music are revealed: risk and legible virtuosity. To explain both aspects, I will compare controllerism with two other forms of live electronic music performance practices[11] of our times: acousmatic diffusion and live coding. The former is a practice that once displayed a performer's virtuosity in manually spatialising a fixed stereo composition over multichannel speaker arrays (Austin 2000). Nowadays, this practice is increasingly replaced by predetermined ambisonic arrangements in search of presenting the ideal spatial form of their compositions[12]. Here we see a practice which is absent of the risk of imperfection that comes from a live performance. Veen and Attias (2011) point out that the virtuosity of a live DJ performance is concentrated on the tension emanating by the risks taken by the performer:

'When the mix is riding through a beatmatch, even if seamless, the risk of failure is transferred as tension-affect... This tension in turn generates feedback for the DJ who feels it from the dancefloor as the intensity of the room increases, leading to heightened mixing, etc. When this feedback loop is in place it is, I would argue, a quasi-cybernetic stimulus-response of affect engendered by the phenomenology of slightly imperfect rhythms' (Veen & Attias 2011)

Although modern controllerist instruments can minimise these risks, as in the example of Shaw's panic button, the imperfection of such a performance is much closer to that of an acoustic instrument when compared to fixed ambisonic arrangements.

In describing the context of legible virtuosity, we approach the terminology of interactive dance and the communities researching interfaces for music expression, who use the term *transparency* to describe a 'direct relationship between… movements and their musical consequences' (Siegel 1998) (Salter 2008). It is this immediate connection between seeing a string being plucked followed immediately by the emanating note that dissolves all barriers between artist and audiences, allowing the latter to appreciate and identify with the artists, notwithstanding the level of skill and dedication that goes into mastering the instrument. Similarly, watching the videos of Shaw's 2005 controllerist demonstration or Orellana's frenetic finger-drumming, once the shock of the incomprehensible devices subsides, there

[11] The comparison here does not intend to evaluate one practice over another; it instead focuses on identifying the stated performance aspects of virtuosity and risk practices. I should further say that I am calling the two mentioned practices for this comparison for the simple reason that I am already actively engaged with through my work.

[12] The transition from live acousmatic diffusion to fixed ambisonic arrangements in electroacoustic composition is an on-going trend, confirmed through my discussions with Dr. Nikos Stavropoulos, an early adopter of the practice. His 2018 paper illustrates some of the benefits of High Order Ambisonics in the translatability of compositions between different multichannel systems, and potentially presents a new evolutionary step in sound spatialisation.

transpires an undeniable connection between the performer's inputs and their 'musical consequences', with only just few presses of a button or twists of a dial going unanswered by the emanating sonic consequence. The same tactility once evident in turntablist battles, fascinating peers and audiences alike, is back at the centre of attention. This is to an extent comparable with live coding, which also necessitates a performer's manual inputs towards manipulating sound through programming languages (Magnusson 2013). However, the relation between inputs and sonic manipulation can often appear even more obscured than those presented in controllerist practice, with a line of code able to initiate an array of algorithms who will begin to transform sound over the course of seconds, minutes, or even millennia (Wallace 2018). While these approaches contain an incredibly thorough mastery of combining computer science and artistic expression, as a non-musician musician (i.e., one bereft of a formal music training and instrumental abilities slightly more advanced than a one-handed piano rendition of 'Frère Jacques'), lack of correlation between movement and sound leaves me somewhat in awe of technology, and perhaps subconsciously invokes Herndon's aforementioned quip about nerdy scenes.

This contrasts the uncomplicated relationship that controllerism has with technology. The nerdy-ness is perhaps only skin deep, and under the thin surface, lies the most basic of technologies, utilised in a way that often tests the limits of human dexterity. In his doctoral thesis, Michael Anthony D'Errico makes a case for that simplicity in the utilised tools:

'digital musicians distinguish themselves as "musicians" in the context of a media landscape in which music producers and performers use the same tools as office workers, people shopping or watching Netflix, and children learning how to use computers for the first time… performers in the "controllerism" movement—electronic musicians who use hardware "controllers" to manipulate software in performance—integrate hardware peripherals with laptop computers in an effort to foreground the corporeal, "live" nature of performance in the digital age… In doing so, controllerists imply that the underlying cultural valence of performance with digital computer music tools is similar to existing practices of musical performance.' (D'Errico 2016, pp. 128-9)

I cannot but agree with this sentiment. Surely, the turntable was once as alien as today's MIDI controllers. Yet, the former became household items, and the latter are about as complicated in their physical operation as using a modern kitchen appliance, with their digital principles carefully illustrated over instruction manuals and demonstration videos from companies competing to earn your trust and dedication.

Pedro Coquenão echoes this sentiment in his interview with Llera Blanes. In discussing the prejudice of microphones affording 'unfair' advantages to vocalists, he suggests that it is simply a different approach in vocal performance:

'Not worse, nor better, only different. Therefore, I always see it as a process of summation. So, the world does not belong to those with better vocal projection but to those that can touch us through their voice. That is what we want to hear; feeling. And Controllers allow us just

that, to express with feeling, be it by interpreting keys, or a beat or whatever else we chose to express. It is a democratizing agent.' (Llera Blanes 2017, p. 145)

It is this democratisation where the power of controllerism as a new evolutionary step in instrument design lies. Though certainly not impossible, the reality is that not everyone can understand what an algorithm is, let alone program one, and even less utilise it for artistic expression. In contrast, everyone can depress a button, flick a switch, twist a dial, move a fader along its rails; and therefore, understand the corresponding motion. And if the consequence of that motion is the creation of sound in real-time, we have reached the aforementioned example of the guitarist plucking a string. Combine this with rhythmical awareness, the dedication to develop the muscle memory to traverse swiftly across the aforementioned tactile controls, the ability to understand manufacturers' instructions for using their software and hardware products, and a not insignificant amount of distinguishing interesting sounds, and anyone can be a controllerist.

Falling short of provoking the masses into becoming controllerists, I will now divert attention to a practice that exhibits characteristics which reflect controllerism's real-time immediacy, instruments borne of sophisticated designs, and a high level of virtuosity. That is the field of interactive dance.

6 Situating controllerism within interactive dance

Wayne Siegel (2012) forewords his definition of interactive dance by drawing a parallel between the relationship of dance and music with Michel Chion's notion of '*synchresis*', that is the undividable connection between sound and image in film. Siegel maintains that such has always been the case for sound and movement, two expressive mediums that are presented as an 'integrated process' (p. 191). As such, it is not modern technologies that have shown this connection to their respective practitioners, but rather highlight it to external observers.

The field of interactive dance holds a staggering wealth of knowledge that touches both scientific and artistic domains. The international conference on Movement and Computing (MOCO) is a community dedicated to the advancement of interactive dance, where music often intersects as its sister art, to borrow a Wagnerian notion (Berry 2004). At the same time, the counterpart to MOCO for the discipline of music and sound is the conference New Instruments for Musical Expression (NIME), in which the sentiment is returned, with dancing being the first point of call whenever polydisciplinary collaboration is enacted. Readers wishing to learn more about the field of interactive dance and music could do much worse than delving into the rigorously peer-reviewed proceedings of those two communities. For the purposes of this article, I find it more conducive to use this brief section towards describing my approach when engaging with practitioners of choreography in collaborative interactive dance.

There is an on-going cliché in dancer-musician collaboration, which places the musician as the gatekeeper of devices, whether these concern acoustic instruments or interactive technologies, while the dancers appear less enthusiastic about technology (Moriaty 2020b, p. 551). This harmful stereotype has been all but dispelled through the evident contribution of dance practitioners in interactive technologies research. Testament to this is the aforementioned MOCO community, and on a personal level, the many practitioners I have had the pleasure of meeting and calling my peers, such as Lisa May Thomas, Vilelmini Kalampratsidou, and my good friend and collaborator Lucie Lee Sykes, who all continue to push and test avenues at the intersection of choreography and technology. Perhaps then, it is by mere coincidence that from the more than twenty dancers I have worked closely with, only one could comfortably discuss technological matters pertinent to interactive technology (and often surpass my own knowledge), with a further two motivated enough towards learning interaction applications. But the vast majority of my dance collaborators have been keen to explain in no uncertain terms that they hold little love for technology beyond the ubiquitous type. As a result, I was tasked with explaining the concepts of interaction between sound and movement in basic terms, and made a conscious effort to align my utilised nomenclature with that of dance. And indeed, to this day, I remain grateful for that. Partly due to the fact that my knowledge of interactive technologies concentrates on a user-level rather than their in-depth design. But the main value I identify in this conceptual abridging and crossdisciplinary exchange of language is that I was able to get a glimpse into the dancer's mind, and begin to learn how she or he can best be made to understand the ways their bodies can inspire and be inspired by sound. And as apt as it is for this chapter, controllers are to thank for this.

As mentioned, the tactile controls of controllerism comprise buttons, dials, and faders, with their movements coupled to sonic events of varied complexity. Unlike piano keyboards and some of the newer types of MIDI Polyphonic Expression (MPE) devices, the majority of the controls I have used are not velocity-sensitive, meaning that the force by which they are moved will make no difference to the resulting sound. However, I have often found myself making extra-functional movements around the controls while reaching a flow state during a performance or a particularly pleasant rehearsal. These types of movements are described by Imogene Newland (2014) as 'instrumental gestures… that arise as a consequence of physical manipulation to an instrument' (p. 152). Far from these gestures being superficial, Newland cites Claude Cadoz in explaining that such gestures 'carry additional communicative "information", which acts as a supplement to the sonic ideas implicit within the music itself' (ibid). In the context of our practice and rehearsals, the use of my instrumental gestures on the controls serves the purpose of mimicking and anticipating the musical consequence of my inputs. This is a point often commented by my dancer collaborators, who perceive my frankly choreographically uninformed "moves" as a way of distinguishing which of the many sonic layers that emanate from the speakers I am engaging with at any given moment. This provides a rudimentary albeit useful ear training. A conducive manner of explaining the ways the wearable devices that are now attached on their bodies may affect sound is to demonstrate it directly on the controllers, by temporarily coupling the parameters in question to the tactile control that best describes the intended movement. If a stretch of upper body is needed, a fader will present it rather aptly; if light footwork accents are appropriate choreographic

responses, finger dancing on the drum pads will illustrate it well; and potentiometers take good care of core twisting. With the dancers witnessing these bodily movements, coupled with their musical consequences, they are then able to better realise how their body might affect sound, and utilise this understanding in their interactive performance.

As mentioned in my previous publications, in my early practice I maintained that the dancer wearing motion sensors is little more than an extension of my controllers: 'my perspective at the time could be described as sonic-centric, where the performer's actions were utilized as merely another source of modulation to augment the previously used [modulation] devices' (Moriaty 2020a, p. 123). I was indeed very close to the truth, yet so far. In reflection, the dancer does not represent a controller, but in this scenario, the dancer becomes a controllerist, with a responsibility as critical towards the performance's sonic development as that of the (non-)musician.

Following this critical reflection on literature related to controllerism, and experiences of working with and learning from dance practitioners, the remaining of this chapter goes to present some of the outcomes that have emerged from my collaborative practice: firstly, the theories of sound-movement interaction, followed by a detailed view of the strategies for interaction and mapping in one of our live work for dance and music.

7 Modes of interaction for dance-music collaboration

The following section is derived from my two previous publications (Moriaty 2020a, 2020b), where I describe a framework for collaborative interaction between dancers and musicians via gesture recognition technologies (GRT). The framework's concept draws inspiration from the biological phenomenon of symbiosis, first detailed in my doctoral thesis (Moriaty 2019). While describing the biological concept in its full complexity is beyond the scope of this paper, the framework is presented here as means of providing a basis from which my collaborative practice will be further explained in the following section, and connected to principles deriving from the practices of interactive dance and controllerism.

The typical approach of using GRT in music-dance interaction concerns the change of sound through movement. This effect is achieved by mapping movement data to various parameters of digital signal processing (DSP) devices, with the sound consequently affected as a result of the movement data performing alterations on the parameter's values. Considering this relationship between the two media, sound can be understood as the symbiont medium, with movement being the host governing the development of sound. With this principle in place, and taking into account a host's different fitness outcomes during each of the three types of symbiosis, an equal number of interaction modes can be derived, where the 'host' movement can be 'benefited', 'harmed', or 'unaffected' by its 'symbiont' medium of sound (see figure 3). The biological notions describing changes in fitness outcome are related to the restrictions, or lack of, placed on the expressive range of the associated media and their respective practitioners during a performance. The most efficient way to establish these relationships is by first observing the resulting sonic outcomes, followed by the restrictions

placed on the movement, the provision in which the two performers develop their respective sonic and movement material, and finally the dancer's awareness of how their movement affects sound while operating the system.

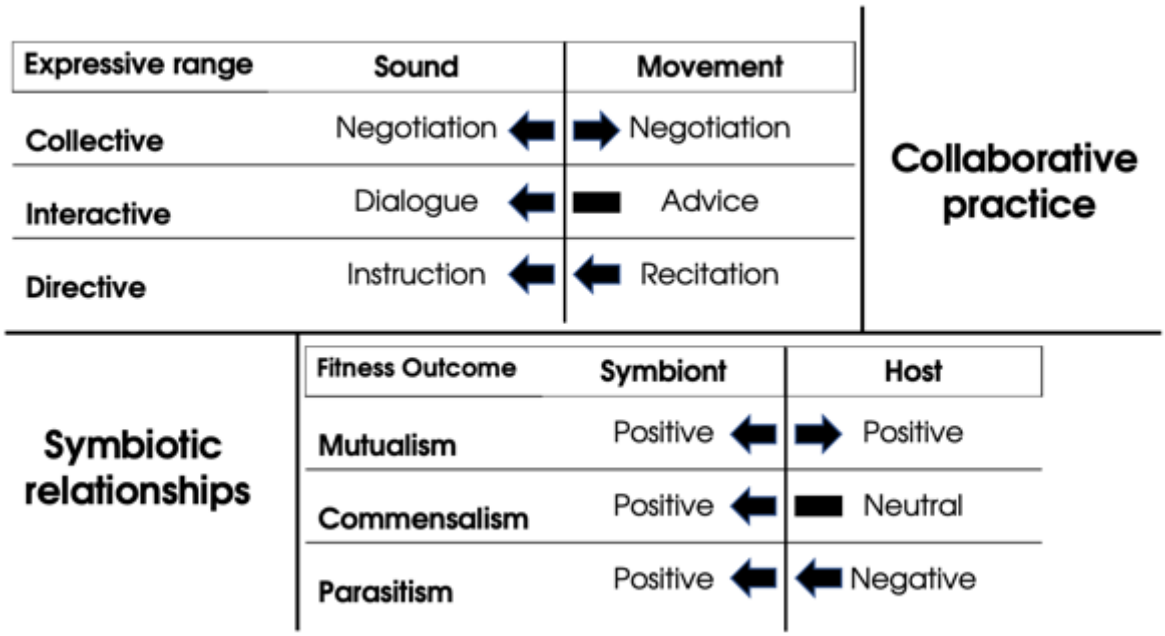

Fig 3 – Direction of effect, in different types of collaborative practice (bottom) and symbiotic relationships (top) (Moriaty 2020a, p. 127)

Looking at the first association, when the collaborative performance requires a determined sonic outcome (akin to a fixed music score), the dancer must perform a specific set of movements in order to alter the values of the DSP parameters in a predefined manner. As a result, this interaction mode imposes restrictions on the movement's range of expression in order to accommodate the desired sonic outcomes. Furthermore, with the mappings between movement data and DSP parameters having been created by the music practitioner, she or he needs to communicate to the dancer the required movements needed to achieve the determined development of sound over the duration of the performance. Consequently, the dancer is relieved from having to fully understand the ways her or his movements may affect sound beyond the predefined movements. As such, this interaction mode assumes movement as a predefined modulator for the sound. In other words, through the previously discussed subjective interpretation of the biological notions describing fitness outcome, the 'host' movement is 'harmed' in order to 'benefit' its 'symbiont' sound, thus establishing a parasitic symbiosis between the two expressive media.

On the opposite spectrum of sonic outcome, an indeterminate score entirely alleviates any requirement for the dancer to become familiar with the mappings between movement data and DSP parameters, with movement remaining independent to sound. However, from the musician's perspective, the mapping must be designed to accommodate the dancer's full range of movements which she or he may deploy in any manner and time throughout the duration of the performance. In a way, the randomised alteration of DSP parameters during this interaction mode can be related to a generative music system, or to provide a further

simplified reflection, to the modulations derived by a low frequency oscillator (LFO) set to random or noise waveform. In the context of the symbiotic interpretation, the 'host' movement is 'unaffected' due to enjoying a full range of expression, while the 'symbiont' sound extracts 'benefit' in the form of randomised modulations that can be used to develop and expand its outcome. As such, this interaction mode forms a commensalistic symbiosis between sound and movement, which on reflection can be associated with the interaction employed in John Cage's and Merce Cunningham's *Variations V*, where dancers had an effect on sound despite being unaware of the ways their movements specifically controlled Cage's tape players. However, while Cage revelled in employed indeterminacy as a compositional approach, Cunningham directed his dancers through an explicit choreography[13]. Nevertheless, this is but one manifestation of a commensalistic interaction mode, and as I present later in this section, free improvisation presents itself as fruitful provision for the dancer to follow, with the musician tasked with designing a system able to generate meaningful sonic outcome through random modulation inputs.

With mutualism being the remaining type of symbiotic relationship, such an interpretation into the context of collaborative performance requires for both sound and movement to mutually extract 'benefit' from their interaction, which considering the earlier connection between fitness outcome and expressive range, suggests a simultaneously full range of expression for both media. While the provision of free improvisation may at first appear salient to this mode, developing this mode through practice showcased that an intermediate provision is more appropriate, that of structured improvisation. Examining this provision in the context of music performance, structured improvisation differs from its free counterpart by the approach of creating real-time compositions by connecting pre-established material over an arrangement which is not predefined. As such, while the resulting sonic outcome is not determined, its characteristics can be anticipated. Structured improvisation shares a slightly different meaning in the context of choreography, with dancers adhering to a predefined temporal arrangement in relation to stage placement and clustering, while retaining freedom towards their performed movements during each section of the arrangement. Considering this provision for music and dance respectively in the context of GRT-facilitated interaction, the dancer is allocated freedom towards her or his movements, with the caveat that these movements need to result in anticipated sonic outcomes. As such, the dancer must be well-familiarised with the system's mappings, and be aware of the ways each movement may affect sound. In other words, the mutualistic interaction mode presents a mutual compromise between the expressive ranges allocated to sound and movement, with both media mutually extracting 'benefit' up to the level at which one of them can be said to experience 'harm', thus resembling the mechanisms by which mutualistic symbioses are developed over evolutionary scale in the natural world.

The three symbiotic modes of interaction are summarised in figure 4, with each mode identified according to their specific affect awareness, provision, operation, and outcome borne of the interaction between the two media. At this stage, it is worth pointing out once

[13] A more extended discussion on the Cage & Cunningham collaboration, see section 2 in Moriaty 2020a

again the subjectivity and conceptual nature of this interpretation, and furthermore the Practice Research methodology employed towards reaching these findings, with the latter derived through the accumulated knowledge from numerous years of collaborative practice alongside several practitioners. As presented later in this chapter through the work *Symbiont Zero*, in addition to employing distinct modes of interaction, multiple modes can also manifest during a performance, either consecutively during different sections, or simultaneously while operating different layers of sound, each controlled via a different mode.

Precepts	Interaction Mode		
	Mutualism	***Commensalism***	***Parasitism***
Awareness	high	low	moderate
Preparation	structured improvisation	free improvisation	score/ choreography
Operation	exploration	detachment	instruction
Outcome	anticipation	indeterminacy	determinacy

Fig 4 - taxonomy of symbiotic interaction modes with associated strategies and intentions for the dancer (Moriaty 2020b, p. 554)

8 Practicing collective controllerism

While the previous discussions on the implications of interactive dance through the lenses of controllerism has emerged through a critical analysis of the two fields' associated theories, the framework for interaction between the mediums of sound and movement emerged from my collaborative practice with four practitioners of contemporary choreography. Apart from artistic expression, the work titled *Symbiont Zero*[14] was created as to illustrate how the interaction modes manifest in practice. Initially developed with my long-term collaborator Shona Roberts, and subsequently performed alongside Lucie Lee Sykes, Joseph Lau, and Kelsea-Leigh Cunliffe, the premise of the work concerns a musician-dancer duet featuring music that is generated in real-time, with the different sounds making up the music controlled

[14] Video of the performance and a series of demonstration videos are available at https://manolimoriaty.com/symbiont-zero/

by both performers through the respective controllers they are using. Moreover, and in line with controllerists approaches, the utilised software are limited to out-of-the-box commercially available devices, or those made available through maker communities (e.g. maxforlive.com), with any modifications restricted to the controller devices and the sometimes unorthodox connections between these. In this chapter section, I describe the devices used and the mappings through which they are attached to the controllers, the role and responsibilities of each performer during the work's different sections, and finally I reflect on the modes of control enacted in those sections in relation to the desired sonic outcomes and the principles of controllerist performance.

8.1 Controllers and remapping matrix

The music for *Symbiont Zero* is created in an Ableton Live set comprising eight channels (see figure 5), each containing a series of plugins (processors or generators), designed as for each channel to generate a distinct sound object[15] (SO from hereon). The music develops throughout the duration of the performance by modulating different plugin parameters, which are controlled via two input systems operated by each of the performers: a set of desktop controllers for the musician, and a pair of wearable motion sensors attached to the dancer's forearms.

More specifically, the musician is using a Livid Instruments DS-1, a Native Instruments Maschine Jam, and a DJ Tech Tools Midi Fighter Twister (see figure 6) with each controller serving a specific role: the mappings of the DS-1's controls (faders, encoders, and buttons) are fixed to critical functions that may require immediate attention during different sections of the performance, such as channel/rack volume, clip launch, device view, as well as certain plugin parameters that enable each SOs' development. On the other hand, the Maschine controls are contained through different layers (or scenes), used to dynamically alter the mappings of the movement data (described in the next paragraph) across various plugin parameters, thus allowing the dancer to control different sound shaping functions. The Midi Fighter's endless encoders are mapped to a synthesiser controlled by the musician during the performance's final section, which is also a critical element of the performance. This addition to the two other controllers was implemented both due to the Midi Fighter's encoders possessing higher resolution that those found on the DS-1, as well as the control's design providing a better feel for the performer.

[15] This terminology follows Pierre Schaeffer's (2017) definition of the sound object as 'the equivalent to a unit of breath or articulation, a unit of instrumental gesture', thus describing a distinguishable unit of sound that may indeed comprise of many combined parts and layers

Fig.5 – Session view of Ableton Live set for *Symbiont Zero*

Fig.6 – Musician's controllers (left to right, Livid Instruments DS-1, Native Instruments Maschine Jam, DJ Tech Tools Midi Fighter Twister)

From the dancer's perspective, gestural control of sound is made possible through a pair of Nintendo Wii Remotes Plus gaming controllers (or Wiimotes), each attached to the dancer's forearms with wrist brace gloves that are modified as to firmly hold the controller parallel to the forearm (see figure 7 left). The Wiimotes' accelerometer is a relatively modest (for today's standards) three degrees of freedom (3DoF) design, transmitting four representative movement axes – pitch, roll, yaw, and acceleration – via Bluetooth. The movement data are translated into MIDI messages through the OSCulator application, with each data stream assigned to different Continuous Controller (CC) values, allowing Ableton to distinguish the

total of eight streams as unique inputs (see figure 7 right) that can ultimately be mapped across different parameters.

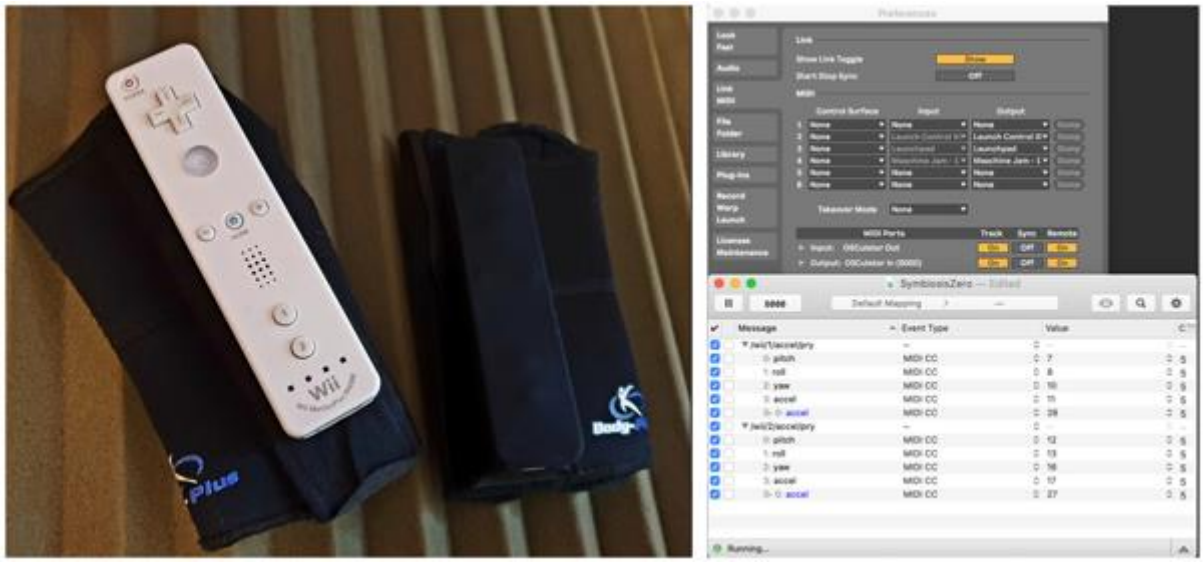

Fig.7 – (left) Wiimotes and wearable cases. (right) OSCullator and Ableton Live's MIDI input options

Once inside Ableton, the data streams are not directly mapped onto the plugin parameters. Instead, their first point of contact is the Max for Live device Map8, which acts as a mediator between control input and parameter destination. This approach makes Ableton's MIDI mapping mode functionality available in session view, allowing users to alter the range of modulation of each mapped parameter while maintaining full functionality. Moreover, Map8's range values and destination toggles are also mappable (see figure 8). This essentially turns Map8 into a mapping distribution matrix, with the musician able to dynamically change which parameters are controlled by the dancer during different sections of the performance. Each of the eight channels contains at least one instance of Map8, connecting the Wiimotes' data streams into the plugin parameters that are intended to be controlled by the dancer. In contrast, the musician-controlled parameters are mapped via Ableton's mapping mode, as these do not require remapping during the performance.

Fig.8 – Map8 Max for Live device with Wiimote data streams attached on the input dials

8.2 Arrangement and operating the sound objects

With a total duration of approximately fifteen minutes, *Symbiont Zero* is arranged over three sections of roughly equal durations. In each section, the dancer adopts a different mode of interaction to control sound (see chapter section 7). While the arrangement reflects the three modes of interaction, the sound design and control allocation of the performance also mirrors the number of performers, with each section featuring two SOs, each of which is controlled by a different performer. Describing every single plugin, mapping, and modulated parameter in the set is beyond the scope of this article; instead, the following description aims to provide an understanding of how the two performers are able to share responsibilities of shaping the music according to the notion of collective controllerism.

The first section features two contrasting SOs: the musician controls a sustained drone of relatively consistent characteristics, creating by feeding a synthesiser tone through a freezer-type granulator (K-Devices Holder). A four-band equaliser prior to the granulator allows the musician to alter the signal's spectral characteristics (see figure 9), which manifest only following the granulator's next quantized buffer refresh (ranging between 1/16 and 4/4 values), thus maintaining the slow pace of change in this SO. In contrast, the SO controlled by the dancer was designed for rapid and radical changes in texture, spectral shape, and spatial distribution, aiming to transparently reflect the dancer's arm movements. This is achieved through a device combining delay feedback and granulation (Amazing Noises Dedalus Delay) processing a relative quiet recording of vinyl record crackle (see figure 10), with the latter providing a basic sound source for the feedback network to process. The Wiimote's pitch axes data streams are mapped to the delay's two filters (Low Pass and High Pass), allowing the dancer to concentrate spectral energy at different frequency ranges by horizontal arm movements, and entirely eliminate the sound by pointing both arms upwards. The remaining movement data streams are mapped to parameters that further affect the SO's texture in different ways. However, these are engaged gradually as the section progresses, something which the dancer is aware of and further utilises as sonic cues towards determining their positions during the semi-improvised choreography. The first additional parameter to engage is the delay time (scrub), mapped to the right Wiimote's acceleration axis, enabling the dancer to perform textural variations whose intensity reflects the corresponding arm's movement speed. The most radical change in the SO's texture is produced by altering the pitch parameter, which is mapped to the left Wiimote's roll axis. At the beginning of the section, the musician sets the corresponding Map8 range of modulation at centre value, so it cannot be altered by the dancer's movements. As the section progresses past its middle point, the range begins to broaden, initially to only allow a modulation of few semitones, and ultimately reaches full range of pitch modulation over a range of four octaves. Combined with the dancer incorporating a faster rate of movement, the SO becomes glitchy and animated, accompanied by the musician's drone reaching its peak volume. The section concludes with the delay parameters returning to their initial range, and the drone subduing into a warmer spectral image by the musician attenuating the higher frequencies.

Fig.9 – Drone SO chain: EQ8 altering the spectral content fed into Holder granulator

Fig.10 – Feedback SO chain: Map 8 modulating Dedalus Delay parameters

During the second section, provision and operation turns to free improvisation and detachment respectively, which requires the dancer to abandon any conscious control, and treat the produced music as fixed rather than interactive. While the two SOs (granular clouds and sustained pads) are distinct, gestural control becomes less transparent from an audience perspective. At the same time, the musician rescinds from directly controlling any sound-altering parameters; instead, this control falls entirely on the dancer, or more accurately, on the data extracted from the dancer's movements, with the musician dynamically remapping the Wiimotes' streams as to modulate different plugin parameters. In other words, and in contrast with what was said earlier, the musician is in fact controlling the sound; however, this is only possible through the dancer's inadvertent actions. This approach is mainly evident in the granular clouds SO, created by layering three instances of a granulator plugin (Audiority Grainspace) which are processing short loops of drum samples, with the parameters modulated by the movement data being grain size, distance between grains, buffer position, buffer stretch, pitch, feedback, freeze rate, and smear. Each individual Wiimote stream (in this case only pitch, yaw, and acceleration axes are used) are initially mapped onto a Map8's macros, with each macro mapped to a further instance of Map8, this time occupying all eight macros (done so via a Multimap device). The final Map8 becomes the point of contact for the granulator parameters, with its mapping bypass toggles controlled by six columns of the Maschine's button matrix (see figure 11). In this arrangement, the musician is aware that each button column corresponds to an individual movement axis, with its eight buttons activating the gestural modulation of the granulator's parameters. Considering the complexity of this SO, due to density of layered grains in combination with the indeterminate modulations from the dancer's improvised choreography, the musician is unlikely to maintain precise control over the performance. It is at this point that controllerism morphs into its catalytic approach (as mentioned in chapter section 4), with the musician only

able to anticipate particular textures from the generated music while emerging gestures are at risk of disappearing due to differing inputs from the dancer. This precarity borne of improvisation is lessened in the other SO of this section, with the pad sound processed through a freeze granulator and a series of time-based effects. The latter plugins' frequency rate and depth parameters are modulated by a series of low frequency oscillators (LFOs), which in turn are modulated by three movement streams. While the combined modulations result in an aperiodic waveform (see figure 12), the design ensures that the resulting SO remains fairly consistent in terms of its texture, amplitude, and spectral characteristics, sitting in contrast to the much more unpredictable cloud SO.

Fig.11 – Clouds SO chain: three instances of GrainSpace granulator modulated by Map8

Fig.12 – Pad SO aperiodic modulation waveform

The music in the third and final section of the performance again comprises two SOs, with the dancer now performing a detailed choreography, which aims predominantly to accurately reproduce a particular sonic gesture via the controlled parameters. Although the interaction mode requires accuracy, the dancer needs less musical focus in their control of the system, since the choreography alone is responsible for reproducing the now determinate outcome. Similarly, the involved mappings are relatively simple when compared to those of the two

previous sections. The first SO is created by a synthesiser (Ableton Analog) playing a repetitive arpeggio sequence, with the left Wiimote's pitch axis mapped to the synthesiser's LP filter cutoff frequency, while the same axis of the right wearable controls a reverb effect's wet/dry balance. The parameters are oppositely mapped, meaning that the synthesiser's parameter will be at maximum value when the dancer's arms are pointing upwards, while the reverb's parameter will be at minimum (dry), and vice versa (see figure 13). The choreography aims to produce a filter sweep effect, akin to the built-up sections typically found in some EDM compositions. The dancer's core remains static while the arm movement is performed twice, coupled with sudden movements at the peak of the filter sweep, with the completion of the second sweep seeing the dancer returning to using the entire stage in a semi-improvised manner. In turn the musician disables the modulation range of the Wiimote mappings directly following the completion of the choreographed part, and assumes direct control of the parameters previously controlled by the dancer for the remainder of the section. The other SO featured in this section is made of two 808-style percussive samples, a kick drum and snare drum, with the mapping allowing the dancer to trigger the samples by performing sudden arms movements. This is made possible by using a MIDI message converter, translating a continuous control (CC) threshold value to note on/off messages (CCtoMIDINote). The Wiimote's acceleration streams are mapped to the CC value, with the threshold (sensitivity parameter on the device) adjusted by the musician depending on the intensity and frequency the drum samples are required for the composition (see figure 14). The DS-1 dial controlling the threshold value is also mapped the samples' velocity, and oppositely to enabling an arpeggiator MIDI effect. This combination allows for higher acceleration values to produce singular triggers of high velocity, while lower acceleration values will produce triggers of low velocity and randomly repeating patterns.

Fig.13 – Synthesiser SO chain: Ableton Analog modulated by Map8

Fig.14 – Percussion SO chain: CCtoMIDInote converting acceleration continuous data into MIDI on/off events

Symbiont Zero concludes with a short section of free-improvisation and detached operation, with a single SO created by using a buffer-scrub type granulator (New Sonic Arts Granite) that is processing two well-known drum breaks: 'Amen' and 'Hot Pants'. The Wiimote steams are controlling the granulator's space, density, time, and sample start parameters, (see figure 15) with their respective ranges of modulation constantly altered via LFOs set at random waveform. This provides an appropriately aperiodic development to the granulated drum breaks, coupled with the musician controlling the space parameter, which by decreasing causes the frequency and number of grains to reduce, and finally cease entirely once space is at minimum value, and the time parameter is decoupled from the Wiimote mapping, and is manually brought to its centre value, thus "freezing" the final grain. These sonic cues notify the dancer to reduce movement intensity, and finally stop once the grain appears frozen.

Fig.15 – Breaks SO chain: Granite granulator modulated by Map8

8.3 Performers and audience perception

I will conclude this section by offering some thoughts on the aims behind the interaction design detailed in the previous paragraphs, the perspective of each performer, and some audience comments that were obtained during a recent performance of *Symbiont Zero* during Angelfield Festival 2021 at Liverpool Hope University.

The first thing to point out is that the system generating the performance's music does not necessitate the inputs of a dancer, and perhaps had the musician alone commanded the different parameter modulations through the MIDI controllers, the resulting sonic outcomes could have potentially been closer to the composer's original musical vision. However, this would be the opposite of what this performance aims to achieve, which is to present the outcomes of a collaboration between two different performers whose exchange mutually enriches each other's output. How is this achieved?

From a sonic perspective, mapping movement data to sound-affecting parameters results in modulations that are radically different to those achieved through the means usually available to controllerists. The speed, range, and change of direction of arm movements generate data that would be impossible (or at least more difficult) to produce with finger gestures. Such is also the case for using modulation devices (i.e., LFOs, envelope generators, step sequencers etc.), with their repetitive and mechanically accurate value changes being in contrast with those generated by a performer's inputs, which are able to introduce a level of humanization

in the electronically generated music. From the dancer's perspective, the intention of creating sound provides a novel environment within which to design a choreography, with the dialogue between gesture and sonic response forming a new type of feedback-driven motivation for movement.

More specifically for the topic of this chapter, the collective controllerism activated in *Symbiont Zero* responds to two of the topics discussed earlier. Firstly, assigning control of music parameters to a dancer's actions provides a cultural context for virtuosity to become perceptible through translating and magnifying the sound-generating inputs; previously restricted to the space above the musician's controllers, the controllerist gestures are now projected on the dancefloor through the dancer's body, and furthermore embodied within the dance performance. Secondly, and perhaps importantly, through the low accuracy of the rudimentary motion sensors and the natural imperfections of human input, risk to the performance's accuracy is increased, which by extent amplifies the tension and perception of virtuosity. This echoes the sentiment described in the previous discussion on risk and tension in performance:

'there's an audible and tangible tension created by the sense of a human riding a machine in such a way as to illustrate virtuosity and that virtuosity depends in part in the performer practicing a particular technique to the point that it becomes a physical memory and then demonstrating that physical memory in a public practice that risks failure.' (Veen & Attias 2011)

And while musicians are capable of practicing 'a particular technique' on their controllers, this is perhaps less obvious for dancers operating motion capture systems, thus increasing the potential for failure, which results in added risk. But it is this added risk which enhances the performance, and where the value of polydisciplinary collaboration in a controllerist performance lies.

'the tension between being in control of the machine and the machine escaping that control is palpable and tangible, and that it is what excites audiences about live performance… audiences can adapt to performers having new things to lose control of—and demonstrate virtuosity with' (Veen & Attias 2011)

Indeed, the sentiment of tension was reflected in the discussion I had with three audience members following our recent performance. Two of the individuals possess experience performing live electronic music, and commented on the positive contribution brought by the visible connection between physical and sonic events, at least for the first and third sections, while the second "detached" mode of operation appeared to have a less clear connection. The third audience member, who is not familiar with the inner workings of a live electronic performance, also commented on the coherence between music and dance. When asked whether they thought the dancer was acting as a musician, they responded that they initially thought that the dancer had simply choreographed their movements to the music, but my clarification now makes them better understand the connection.

The interesting part is that the comments did not mention the possibility of failure as a way of enhancing the performance, but as Veen mentions, ‘not all dancers [audience] might understand what is happening’ (2011) in regard to the performers’ inputs, but performing within the context where things can go wrong generates an ‘affective feedback’ that an audience can grasp and respond to.

9 Conclusion

In the face of today’s live electronic music performance, controllerism positions itself as an accessible, legible, and perhaps most importantly, entertaining practice. Despite some of the barriers it poses by its core applications and utilised instruments, its transparent virtuosity and risk tension bring it closer to a live music performance than electronic musicians had been able to previously approach with analogue tools. The still-emerging practice can benefit from further engagement from the research community in order to increase the visibility of its benefits, and address some of the aforementioned issues, such as the lack of a controllerist language and transcription method.

From a (non) musician’s perspective, adopting controllerist principles when in contact with the field of interactive dance holds the potential for mutual aid between the disciplines: firstly, it will provide our collaborators a deeper understanding of the sonic consequences of their movements through technologies and methodologies that require a moderate amount of specialist knowledge. At the same time, with dancers adopting the principles by which controllerists enact their performances, we allow our virtuosic hand gestures to be magnified into full body choreographies that span out of our controller-strewn desktops and into the dancefloor, and as a result increase the potential for our performance’s virtuosity to become more perceptible by peers and audiences alike.

On a personal level, this chapter has been invaluable towards understanding and situating my practice within a cultural lineage which is in line with my experiences and musical education. It will be some time yet until I can comfortably refer to myself as a musician; nevertheless, if my dance collaborators’ sound-generating inputs are perceived as musical, then perhaps so can my own. And while I am looking forward to more dancer musician collaborations once studio spaces can be safely used again, I extend a motivation to both music and dance interaction researchers to further explore the potential of controllerism as a collaborative approach for our work.

Notes

References

Aufermann, K.A. (2002) *Feedback processes: An investigation into non-linear electronic music (Unpublished master's thesis)*. Middlesex University, London

Austin, L. (2000) *Sound Diffusion in Composition and Performance: An Interview with Denis Smalley*. Computer Music Journal 24 (2): 10–21

Berry, M. (2004) *Richard Wagner and the Politics of Music-Drama*. The Historical Journal, 47(3): 663-683

Brett, T. (2016) *Virtual drumming: A history of electronic percussion*. In R. Hartenberger (Ed.), *The Cambridge Companion to Percussion* (Cambridge Companions to Music, pp. 82-94). Cambridge University Press. DOI:10.1017/CBO9781316145074.007

Campbell, M.V. (2016) *Control This! Digital Improvisation and Pedagogy*. in *Improvisation and Music Education: Beyond the Classroom*. Heble, A., & Laver, M. (Eds.). Routledge, 258-66

Carluccio, J., Imboden, E., Pirtle, R. (2000) *Turntablist Transcription Methodology (TTM)*. [accessed 15 June 2021] http://www.ttm-dj.com

D'Errico, M.A. (2016) *Interface Aesthetics: Sound, Software, and the Ecology of Digital Audio Production*. PhD Thesis. University of California: Los Angeles

Dombal, R. (2012 February 6) *AraabMuzik*, Pitchfork [accessed 30 June 2021] https://pitchfork.com/features/interview/8770-araabmuzik/

Du Noyer, P. (2003) *The Illustrated Encyclopedia of Music* (1st ed.). Fulham, London: Flame Tree Publishing

FACTmagazine (2013 March 4) *AraabMUZIK give a live MPC masterclass - Gear Guide* [Video] YouTube https://www.youtube.com/watch?v=_9qQouhoqQk [accessed 1 July 2021]

Hansen, K.F. (2000). *Turntable Music*. In: Musikklidenskapelig Årbok 2000 [ed] Jonsson, L., Oversand, K., Breivik, M., Department of Music, Norwegian University of Science and Technology, 145-160

Katz, M. (2019) *Authorship in the Age of Configurable Music*. in *Rethinking American Music*, Browner, T. & Riis, T. L. (Eds.). University of Illinois Press, 312-323

Llera Blanes, G.D. (2017). *Controllers as Musical Instruments and Controllerism as a Musical Practice: Practices of a new 21st Century musical culture*. Master's Thesis, Faculdade De Ciências Sociais E Humanas, Universidade Nova De Lisboa, DOI: 10.13140/RG.2.2.32611.60962

MacCutcheon, D., Greasly, A.E., Elliott, M.T. (2016) *Investigating the Value of DJ Performance for Contemporary Music Education and Sensorimotor Synchronisation (SMS) Abilities*. Dancecult: Journal of Electronic Dance Music Culture 8(1): 46–72, http://dx.doi.org/10.12801/1947-5403.2016.08.01.03

Magana, J.A. (2018) *Performance in EDM - A Study and Analysis of DJing and Live Performance Artists*. Capstone Projects and Master's Theses. 364

Magnusson, T. (2013) *The Threnoscope. A Musical Work for Live Coding Performance*. In Live 2013. First International Workshop on Live Programming.

Mass Appeal (2016 October 27) *Rhythm Roulette: araabMUZIK | Mass Appeal* [Video] https://www.youtube.com/watch?v=6sRBGplcBQ4 [accessed 1 July 2021]

Moldover (n.d.) biography & press kit, https://moldover.com/ [accessed 12 March 2021]

Moran, J. (2010). *Interdisciplinarity*. New York: Routledge

Moriaty, M. (Moraitis, E.) (2019) *Symbiotic Synergies: Adaptive Framework for Polydisciplinary Collaboration in Performance Practice*. Ph.D. thesis, School of Arts & Media, University of Salford, Manchester

Moriaty, M. (2020a) *Interspecific Interactions: interaction modes between sound and movement in collaborative performance*. in *Technology, Design and the Arts – Challenges and Opportunities*, R.A. Earnshaw, S. Liggett, P. Excell. and D. Thalmann (Eds.). Springer, Cham, Switzerland, 121-138

Moriaty, M. (2020b) *Symbiosis: a biological taxonomy for modes of interaction in dance-music collaborations*. Proceedings of the International Conference on New Interfaces for Musical Expression, 551-556

Morse, P. (2017, November 26). *Video & Interview: Moldover, Inventor Of Controllerism*. Digital DJ Tips. [accessed 17 March 2021] https://www.digitaldjtips.com/2012/04/video-interview-moldover-godfather-of-controllerism/

Newland, I. (2014) *Instrumental gesture as choreographic practice: Performative approaches to understanding corporeal expressivity in music*. Choreographic Practices 5(2): 149-168

Reinecke, D.M. (2009) *"When I Count to Four …": James Brown, Kraftwerk, and the Practice of Musical Time Keeping before Techno*. Popular Music and Society 31(5): 607-616

Siegel, W. and Jacobsen. J. (1998) *The Challenges of Interactive Dance: An Overview and Case Study*. Computer Music Journal 22(4): 29-43

Siegel, W. (2011) *Dancing the Music: Interactive Dance and Music*. in *The Oxford Handbook of Computer Music*. Dean, R. T. (eds). New York: Oxford University Press

Salter, C., Baalman, M.A.J., and Moody-Grisby, D. (2008) *Between Mapping, Sonification and Composition: Responsive Audio Environments in Live Performance*. in Kronland-Martinet, R., Ystad, S., and Jensen, K. (Eds.). CMMR 2007, LNCS 4969, 246-262

Schaeffer, P. (2017) *Treatise on musical objects: an essay across disciplines*. North, C. & Dack, J. (translators). Oakland, California

Sonnenfeld, A. and Hansen, K.F. (2016) *S-notation: A complete musical notation system for scratching and sample music derived from "Theory of Motions"*. [accessed 2 July 2021] http://www.alexandersonnenfeld.com/

Stavropoulos, N. (2018) *Inside the intimate zone: The case of aural micro-space in multichannel compositional practice*. In: Proceedings of the 15th Sound and Music Computing Conference (SMC2018). Sound and Music Computing Network 113-117. ISBN 978-9963-697-30-4

Thompson, D. (2002) *Reggae & Caribbean Music*, RLPG

Thompson, P.A. (2012) *An empirical study into the learning practices and enculturation of DJs, turntablists, hip hop and dance music producers*. Journal of Music, Technology & Education 5(1): 43 - 58. DOI: https://doi.org/10.1386/jmte.5.1.43_1

Tim Exile. (2005 – reuploaded 2013, August 23). *From the archives: The Keymasher* [Video]. YouTube. https://www.youtube.com/watch?v=vd5tJK5vmJs [accessed 18 March 2021]

Tobias, E.S. (2015) *From Musical Detectives to DJs: Expanding Aural Skills and Analysis Through Engaging Popular Music and Culture*. General Music Today, 28(3) 23–27 DOI: 10.1177/1048371314558293

Toop, D. (2000) *Rap Attack, 3rd. ed.*, London: Serpent's Tail

Van Veen, T.C. and Attias. B.A. (2011) *Off the Record: Turntablism and Controllerism in the 21st Century*, Dancecult 3(1)

Wallace, H. (2018 January 5) *Reaching into the future: Longplayer*. Kings Place. [accessed 28 February 2021] https://www.kingsplace.co.uk/digital/features/reaching-into-the-future-longplayer/

Young, J. (2016, August 25). *Holly Herndon: A Human Future for Computer Music*. SceneSC. [accessed 8 March 2021] http://www.scenesc.com/2014/09/17/holly-herndon-human-future-computer-music/