Transforming musical performance: activating the audience as digital collaborators

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Abstract

Digital technologies have transformed the performance practice, recording and distribution technologies, economy and sonic landscape of music in a process of change that began in the early 1980s. Recent technological developments have opened up the possibility of *embodied interaction* between audiences and performers, reframing music performance as a *collaborative improvisatory space* that affords *Interactive Musical Participation*.

The research in this *practice-based* thesis looks at the relationship and experience of audience members and musicians exploring *Interactive Musical Participation* within the wide stylistic framework of contemporary jazz. It also studies the potential for the creation of compositional, technological and performance protocols to enable successful *Interactive Musical Participation.* This has been achieved through a process of mapping the methodology behind the composition, technical infrastructure, performances and post-performance analysis of a series of musical artefacts.

Cook (2001 and 2009) suggests that researchers in this field should *"Make a piece, not an instrument or controller*" and this dictum has influenced the development of the technical infrastructure for this research. Easily accessible and low-cost digital audio workstations Ableton Live (2017) and Logic Pro X (Apple, 2019) as well as the digital protocols Open Sound Control (OSC) (Opensoundcontrol.org) have been utilised to deliver the programming and networking requirements. A

major innovation stemming from this project has been the development of the *Deeper Love Soundpad App*, a sample playback app for Apple smartphones and iPads, in collaboration with Dr. Rob Toulson.

The theoretical background to this research has been informed by *actor-network theory*, the sociological approach developed by Bruno Latour (2005), Michel Callon (1986) and John Law (1992). *Actor-network theory* (ANT) provides a framework for understanding the mechanics of power and organisation within heterogeneous non-hierarchical networks. Mapping and analysing the ANT networks and connections created by the research performances has provided valuable data in the *Interactive Musical Participation*

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Author's Declaration

I declare that all the material contained in this thesis is my own work.

Chapter 1

1.1 Introduction

> *"Though the mass audience can be used as a creative participating force…it is, instead, merely given packages of passive entertainment"* (McLuhan, 1967, p22).

This PhD brings together a series of musical artefacts that examine the potential for *Interactive Musical Participation* in the field of contemporary jazz. Recent developments in control surfaces, motion-tracking electronics, wearable technology and handheld controllers have opened up the possibility of *embodied interaction* between an *activated* audience and the performers, reframing music performance as a *collaborative improvisatory space* that affords *Interactive Musical Participation*. The research reviews the literature surrounding *Interactive Musical Participation* as well as the wider field of participatory art. Several research questions have emerged from the findings of the Literature Review leading to a pilot composition and a main research composition being composed and performed. A number of research instruments were applied to these performances creating a body of data that was analysed.

The performance practice elements of this PhD have been viewed through the critical lens of actor-network theory (ANT), an empirical approach to analysing social phenomena from a constructivist

perspective. ANT emerged from work undertaken in the field of science and technology studies by Bruno Latour and Michel Callon together with sociologist John Law (Latour, 2005), (Callon,1986) and (Law,1992). Conclusions and suggestions for further research are presented at the end of this thesis.

Audience collaboration in music performance is present in many contexts, from the pub sing-a-long to the call-and-response rituals of African and African-American cultures. There is a growing body of academic research presented in the Literature Review that explores *Interactive Musical Participation* using a variety of digital technologies. Many of the compositions and collaborative performances born out of this research have been driven by the affordances of these technologies. However at the time of writing no research has been found that investigates the compositional and performance protocols and technological framework to create successful interactive audience participation within a popular music genre such as contemporary jazz.

The artefacts generated by this research have been documented in video format and can be viewed at https://youtu.be/ZD6yiBJd7hM, https://youtu.be/6T03nNZWJDQ and https://youtu.be/oRYjKNtZvlA. This research is an extension of my artistic practice in the fields of *jazz performance*, *composition* and *improvisation.* However, because the artefacts are built out of conventionally tonal and metrically stable

musical structures, the results can be extrapolated and applied to other areas of music performance and composition that share these qualities.

1.2 Background and Motivation

In 2015 and 2016 I went to a number of performances that involved *audience participation.* Zoe Svendson's play *World Factory* (*World Factory*, 2015) is an interdisciplinary theatre piece that uses the textile industry as a lens for exploring the relationship between UK consumers and Chinese textile producers. At the performance that I attended at The Young Vic theatre in London, the audience was divided into sixteen management teams each tasked with running a factory. The teams had to react to pre-prepared scenarios and make decisions that affected the narrative. The actors managed the process making clear the outcomes of any decisions that were made. In my research I want to explore the model of a *narrative tree* as used in *World Factory* with *controlled* levels of *interactivity* allowing the audience to be in a more *immersive* performance environment.

CoSiMa (Collaborative Situated Media) is an ongoing project based at IRCAM in Paris (CoSiMa, 2017). The CoSiMa team have developed a series of smartphone-based web applications that allow the audience to become *sound transmitters*. I participated in a performance of a composition entitled *birds* at Music Tech Fest in Berlin in 2016 with several hundred other audience members. I noted the *ubiquity* of

smartphone ownership amongst the participants and the relative ease with which the web applications were downloaded and then triggered. These reflections subsequently played a role in the creation of the technical infrastructure for this project.

In 2016 I also attended a special test screening of the film *Late Shift* (2016). The invited audience had downloaded a smartphone application called *CtrlMovie* before the commencement of the film that was activated every few minutes allowing them to make a binary choice about a plot point. The majority vote determined the direction of the narrative and whilst the film had only one beginning there was the possibility of seven different endings and multiple plot pathways. The *interactive* element added something similar to the kind of active experience that is present in video gaming. I again concluded that the *ubiquity* of smartphone and WiFi technologies made the smartphone an accessible interface for my research as I want to explore the affordances of *interactive* hand-held digital technologies in the context of electro-acoustic semi-improvised music; as well as quantifying how the two novel performer categories *audience-soloists* and *audience-performers* respond.

My own artistic practice as a jazz and popular musician has included many examples of an informal and more passive type of audience interaction; from playing for sing-a-longs in London's East End pubs to performing hit songs with well-known pop artists or covers bands in concerts with the audience contributing by clapping and singing; from

conducting a choir and congregation at Westminster Abbey to appearing with bands that service the Armenian, Jewish, Trinidadian and Iranian communities in Great Britain whose members would again actively engage in the performance through embodied responses such as singing, dancing or clapping along with the performers. These types of informal interactions can lead to changes in the dynamics, tempo, form, musical arrangement and pitch and rhythmic density of the performance.

For performances at jazz clubs like Ronnie Scott's in London my improvised musical gestures have elicited responses from the audience which have fed back *autopoietically* into my performance output. As a jazz performer the musical forms that you improvise within can be open-ended and the excitement of an audience expressed through sonic and physical gestures including clapping, moving in time to the rhythmic pulse, dancing, cheering, whooping and shouting approval can create a feedback loop in which both the performer and the audience become active (Fischer-Lichte, 2008). It is my experience that this type of feedback can lead to the improvisation being extended and there might be an increase in note density and dynamic to the point where both audience and performer feel satisfied and able to move on to the next element of the music's compositional structure. This process is supported by Bailey who asserts that

> *"Improvisation's responsiveness to its environment puts the performance in a position to be directly influenced by the audience"* (Bailey,1993, p44)

and by Brand et al. that

> *"listeners have influence too, on each other and on the performers that can significantly contribute to the shared experience. Listeners become active agents who can significantly determine the overall nature of the performance outcome*" (Brand et al., 2012, p635).

Jacques Attali writes of a future where

> *"music could be lived as composition, in other words, in which it would be performed for the musician's own enjoyment, as self-communication, with no other goal than his own pleasure, as something fundamentally outside all communication, as self-transcendence, a solitary, egotistical, noncommercial act"* (Attali,1985, p32).

However, it is not Attali's onanistic fantasy that is the focus of this *practice-based* research, a space which has been designed to allow for exploration and a questioning of the traditional contract between audience and performer. Instead the audience is re-positioned from a state of *alterity* to being part of a new homogenous entity with the performer. In a novel analogy taken from biology, each composition then becomes *ontogenic*, with a new *organism* emerging from each performance and with the audience playing a much more transformative and active role as co-creators than in previous iterations of the

performance paradigm. This process can be described as *distributed creativity* (Sawyer and DeZutter, 2009). Unlike Attali, who asserts

> "*that listening to music is to attend a ritual murder, with all the danger, guilt, but also reassurance that goes along with that*" (Attali,1985, p28),

the *ontogenic* process is about giving birth, creating the new and collectively undermining the structures of control identified by Attali.

Attali also describes the economic transformation of the musician from the freelance *jongleur* who serviced both court and community, to the *minstrel* who was either a court functionary or a member of a professional guild.

> *"The musician, then, was from that day forward economically bound to a machine of power, political or commercial, which paid him a salary for creating what it needed to affirm its legitimacy. Like the notes of tonal music on the staff, he was cramped, channeled"* (Attali, 1985, p17).

In comparison to Attali's analysis this research has more in common with the idealistic practice of composer's cooperative Musica Elettronica Viva in the 1960s which "*set out to liberate the 'audience'", managing* "*energies"* and enable the audience to "*experience the miracle"* (Rzewski and Verken, 1969, p94). In comparison to Musica Elettronica Viva this research is not rooted in avant-garde practice and is instead directed

towards mainstream popular music. However, it is influenced by my experience of working within deprived communities and delivering many schools workshops in which I encouraged the social dimension of participation by involving children in improvisatory musical practice hence breaking down the distinction between performers and audience.

1.3 Context

The background to this research is a context of declining growth in the market for improvised music as well as a growth in *virtual* forms of music-making. The consumption of jazz is declining in millenials (18-34 year olds) despite jazz having a strong presence in music education. According to the Nielsen U.S. Music Year End Report (2016) sales of jazz in 2011 represented 2.8% of all recorded music consumption in the USA falling to 1.3% in 2015. Live attendance is also falling (NEA, 2009). However according to Miller (2009) many young people are now active participants in virtual music-making through game play in games such as Guitar Band so engagement with the type of activities and technologies contained in this project should not feel unfamiliar to audiences familiar with gaming and smartphone technologies.

Popular music composition has become much more modular in its construction since the advent of hip-hop. As Schloss notes

> *"Beats-musical collages composed of brief segments of recorded sound are one of two relatively discrete endeavours to form the*

> *musical element of hip-hop culture: the other element is rhymes (rhythmic poetry)"* (Schloss, 2014, p2).

The idea of building and editing music and sound in a modular way should be straightforward to explain to an engaged audience in a culture where music technology and production is now seen as cheap and accessible with barriers to access such as a steep technical learning curve, a need for musical knowledge and price all being made irrelevant. According to prize-winning artist Grimes she recorded her first album on Garageband, an app that costs £3.99.

> *"Embarrassingly, I recorded the entire album on Garageband. I really want to establish that I no longer use Garageband" she grimaces. "It's just mostly because I'm using hardware, but Garageband is actually stupid, I know it is. It really can't do anything, there's like one type of reverb, y'know? There's not a lot of stuff in Garageband that's good. It's good for recording something like a 4-track, but...."* (Murray, 2012).

Through a series of performances this research will aim to explore the hypothesis that digital natives familiar with accessing technology and engaging with music in a modular manner will engage constructively with *Interactive Musical Participation.*

1.4 Research Focus

The emergence of digital technologies in the early 1980s has changed the way music is performed, recorded and distributed as well as transforming both the music economy and the sound world of popular music. This point is amplified by Lauri Väkevä.

> *"The global eminence of digital music culture can be taken as one indication of the need to reconsider music as a transformative praxis. By examining the ways in which music is produced and used in digital music culture, we can prepare for new forms of artistry that have yet to emerge from the creative mosaic of digital appropriation"* (Väkevä, 2010, p59).

The idea of music as a *transformative praxis* is at the heart of this thesis. Recent developments in control surfaces, motion-tracking electronics, wearable technology and handheld controllers open up the possibility of audiences as well as performers interacting with both pre-programmed music as well as live performances and audio effects in ways hitherto impossible. In this new world sound events can be triggered or manipulated through mapped movement, via phone apps or gaming controllers to create a more *immersive* experience for the audience through a creative engagement with the music. This kind of interaction is just beginning to be seen in the video game market with the upcoming

release of new immersive virtual reality-based music games such as *Rock Band VR*. Journalist Adi Robertson explains,

> *"The current Rock Band VR expands on a freestyle system found in Rock Band 4, where the game would adapt guitar solos (or entire songs) to match what players were doing"* (Robertson, 2016).

In a world where the liminal boundaries between performance, technology, composition, consumption, improvisation and gaming are becoming more and more blurred there are many areas of research to be followed up and investigated.

1.5 Thesis Structure and Summary

This introductory chapter gives an overview of the background, research focus and context, methodology, outcomes and structure of this PhD. Chapter Two provides an up-to-date critical review of the literature and practice in my field of study looking at both artefacts and theoretical writing. It also provides a space to review the theory in light of the outcomes of my research. Chapter Three looks at the justification for and a description of the methodologies used, the *research questions* and the research design of this project. The rationale and process behind the two case studies provide the basis for Chapter Four and Chapter Five with Chapter Six being an evaluation of the research outcomes, a series of projected directions for future research and the conclusion.

1.6 Original Contributions to Knowledge

- The application of *Interactive Musical Participation* to an existing genre within popular music.
- The development of performance, technical and compositional protocols to enable the above.
- The creation of an easily accessible and low-cost technological infrastructure for *Interactive Musical Participation.*
- The development of the *Deeper Love Soundpad App* which addresses issues of *scalability* and *audience agency* in *Interactive Musical Participation.*
- The novel conceptions of *audience-performers* and *audience-soloists* as new performer categories, and a new performance context of *audience takeover.*
- Through the use of a number of research instruments, the *audience-performer* experience within the context of *Interactive Musical Participation* within popular music has been analysed to create a substantial new body of research. Positive findings on ease of technological access, the *audience-performers'* sense of agency, the value they attributed to their participation and their overall sense of enjoyment in relation to their contribution to the performance have created a valuable resource for further research and practice.
- The successful application of a Deleuzian-Guattarian approach to creative arts research and in particular to *Interactive Musical*

Participation within popular music, in which *molar* lines and more contingent *molecular* lines of flight combine to create an *ontogenic* outcome.

1.7 Publications and Conference Presentations

The following are publications and conference presentations that have been delivered during the period of PhD registration.

1) *Transforming musical performance: the audience as performer.* A paper and performance were presented at the *Innovation in Music* conference at the University of Westminster in London, September 2017.
2) *Transforming musical performance: the audience as performer.* A paper and performance were presented at the CREAM Summer PhD Symposium at the University of Westminster in July 2018.
3) *Transforming musical performance: the audience as performer.* Chapter for the *Innovation In Music* book published by Routledge in 2019.
4) *The post-jazz praxis: interactions between the audience and performers.* A paper and performance were presented at the *Crosstown Traffic* conference in Huddersfield in September 2018.

Chapter 2 - Literature Review

2.1 Introduction

This research project is investigating the emergent field of *Interactive Musical Participation* as applied to contemporary jazz. Hödl, Kayali and Fitzpatrick (2012) describe *Interactive Musical Participation* as being

> *"when a spectator can take part or at least make a contribution in a live concert through a technically driven system"* (Hödl, Kayali and Fitzpatrick, 2012, p236).

No previous studies within the field of *Interactive Musical Participation* have focused on its application to contemporary jazz; however, there have been many examples of writing on both the practice of and theory behind audience participation in music since the early 1960s and these will form the main body of this Literature Review. There is also an examination of ongoing debates within the world of contemporary art around both *dialogic* and *relational aesthetics* that provide valuable theoretical perspectives on the practice within this research.

In his influential study of musical performance, Small proposes that *"Music is not a thing at all, but an activity, something that people do"* (Small, 1998, p2). Small describes this activity as *musicking* which he defines as the set of relationships in the performance location between

all the stakeholders. For Small the protagonists in the performance include a cast of characters from everyone involved in the conception and production of sound to the venue management, cleaner, ice cream and ticket seller. However, although Small argues that music is an activity, he does not propose an alternate future where the audience is much more than a docile cultural receptacle. This research extends and reworks Small's premise with the notion of participation being extended into an *interactive* musical involvement thus trying to create a more democratic relationship between performer and audience.

Nyman expands on this idea.

> *"…experimental music emphasizes an unprecedented fluidity of composer/performer/listener roles, as it breaks away from the standard sender/carrier/receiver information structure of other forms of Western music*" (Nyman, 2009, p23).

Nyman is focussing on the works of *experimental* composers including John Cage for whom the audience is expected to play an active role but again only as an engaged spectator. Nyman quotes Cage.

> *"…we must arrange our music, we must arrange our art, we must arrange everything. I believe, so that people realize that they themselves are doing it, and not that something is being done to them"* (ibid., p24).

Cage seems to be staking a claim here for the audience as co-participant in a creative space with a dissolving of boundaries within the traditional binary audience/performer relationship. However, Cage does not propose any kind of active audience involvement beyond an immersive engagement with the performance or as an involuntary sound source as in his composition *4'33".* Bishop identifies a similarly "*passive mode of spectatorship"* in Brechtian theatre which "*relies on raising consciousness through the distance of critical thinking"*, and contrasts this with the physical proximity of the surrounded audience to be found in Antonin Artaud's *Theatre of Cruelty* which is described as *"a paradigm of physical involvement…"* that *"sought to reduce the distance between actors and spectators…*" (2006, p11).

This research focuses on the relationship between audience and performer within jazz and the performance protocols necessary to enable that. The interactivity that stems from this relationship can also have implications for compositional structures. Eco describes a series of examples drawn from 20th century art music as

> "*linked by a common feature: the considerable autonomy left to the individual performer in the way he chooses to play the work…not merely free to interpret the composer's instructions…he must impose his judgement on the form of the piece…"* (Eco, 1989, p20).

Eco describes these four compositions, *Klavierstück X1* by Karlheinz Stockhausen, Luciano Berio's *Sequence for Solo Flute, Scambi* by Henri Pousseur and Pierre Boulez's *Third Sonata for Piano* as *open works* and that they

> "*are to be seen as the actualization of a series of consequences whose premises are firmly rooted in the original data provided by the author"* (ibid., p19).

There are parallels here with the standard methodology utilised within jazz improvisation with the *original data* being *"one of the usual popular song forms or the blues"* (Bailey,1993, p48). The improvisations are built upon the repeated harmonic sequence of the song form using *"melodies, scales and arpeggios"* associated with the sequence as core material for building the improvised elements (Ibid., p48). Eco defines the situation of contemporary art as being a

> *"situation in the process of development. Far from being fully accounted for and catalogued, it deploys and poses problems in several dimensions. In short, it is an 'open' situation, in movement. A work in progress"* (Eco, 1989, p39).

This process is echoed in Bailey's description of the creative approach taken by some jazz musicians.

> *"The repertoire of a jazzman such as Dexter Gordon or Lee Konitz, for instance, contains probably a very small number of different 'songs'…Within these boundaries there is a continuous process of renewal in which old material is re-shaped and adjusted, sometimes rejected, and new material introduced"* (Bailey,1993, 48-49).

Keeping a degree of structural *openness* is an integral part of the performance element of this research allowing for *flexibility* and *movement* in the *zones of interaction*.

2.2 The Poetics of Participation

There have been a number of critical challenges to what Foster calls "*happy interactivity"* (2004, p195) with much of this writing focussing on the participatory art that emerged in the 1990s (Bishop, 2004, 2006, 2012; Martin, 2007). None of this work addresses the participative performing arts such as social dance and popular music which come out of performance contexts in which *the social turn* of participation is more firmly embedded. These analyses build on the Marxist tradition (Benjamin,1998) of aesthetic theory in which the artist's function is to create works that are revolutionary both in form and message. Although the field of *Interactive Musical Participation* is investigating novel

technologies and types of audience interaction, the research up to this point has not been subjected to these critical perspectives; however, that does not mean that there is no value in these approaches and critical responses which address the *social dimension* and the *dialogical aesthetic*, as a secondary lens for this research.

In a valuable study, Bishop (2006) has drawn together a number of theoretical writings on participation from critics, curators and artists, which provide some important positions for consideration. Bishop identifies Guy Debord, a major figure in the *Situationist International* organisation, as a key theorist behind the growth of participation in conceptual art. Bishop suggests that the "*three concerns – activation; authorship; community*" (Bishop, 2006, p12) have been both present in Debord's writing and implicated in "*almost all artistic attempts to encourage participation in art since the* 1960s" (ibid., p12). In *The Society Of The Spectacle* (Debord,1967), Debord proposes that "*In societies dominated by modern conditions of production, life is presented as an immense accumulation of spectacles*" (ibid., p10), and that the *spectacle* is "*a social relation between people that is mediated by images*" (ibid., p10). Debord bemoans "*the working class' incapacity to become politicised*" (Debord,1957, p98) and proposes an antidote to capitalist consumption, the apparatus of the state and the entertainment industry well expressed in Bishop's summary of Debord's articulation of the *Situationist theory* of

"*'constructed situations' – participatory events using experimental behaviour to break the spectacular bind of capitalism. Constructed situations, in which the audience is an active participant, have been an ongoing point of reference for contemporary artists working with live events*" (Bishop, 2006, p96).

Debord's recognition of the *spectacle* as a *social relation between people* resonates to some degree with Small's (1998) less directly political analysis of musical performance as a community transaction; and in relation to direct participation Debord argues that

"*The role of the 'public', if not passive at least a walk-on, must ever diminish, while the share of those who cannot be called actors, but, in a new meaning of the term, 'livers' (viveurs), will increase"* (Debord,1957, 98-99).

Debord is not alone in locating art in the social space; as Bishop notes, Guattari turns to "*aesthetics as the model for a new ethical behaviour opposed to capitalist rationality*" (Bishop, 2006, p79) and proposes that

"*art is a process of 'becoming': a fluid and partially autonomous zone of activity that works against disciplinary boundaries, yet*

which is inseparable from its integration in the social field" (Bishop, 2006, p79).

Guattari suggests that

"Beyond material and political demands, what emerges is an aspiration for individual and collective reappropriation of the production of subjectivity" (Guattari,1992, p81).

It is this *reappropriation* that is fleshed out by Rancière (2009) who recognises the desire of many artists to create interventions in the real world "*generating new forms of relations*" (Rancière, 2009, p53). Rancière calls for "*a theatre without spectators, where those in attendance learn from as opposed to being seduced by images; where they become active participants as opposed to passive voyeurs*" (ibid., p4). For Rancière this *activation* is not coming from power embodied in the community but from "*the capacity of anonymous people, the capacity that make everyone equal to everyone else. This capacity is exercised through irreducible distance; it is exercised by an unpredictable interplay of associations and dissociations*" (Rancière, 2009, p17).

Borriaud was the leading theorist and a key promoter of *the social turn* in his role as curator at the Palais de Tokyo, Paris. In the influential text *Relational Aesthetics*, described by Martin as "*the manifesto for a new*

political art confronting the service economies of informational capitalism" (Martin, 2007, p371), Borriaud (1998 a) argues that the way to subvert the Debordian *spectacle* is not to construct *situations*, but rather to produce art that embodies "*new modes of human relations*" (Borriaud,1998 b, p168). This emphasis on social exchange is manifested in the aesthetic of *relational art*.

> "*an art that takes as its theoretical horizon the sphere of human interactions and its social context, rather than the assertion of an autonomous and private symbolic space*" (Borriaud,1998 b, p160).

Bourriaud proposes that it is in the city and its enforced *proximity* where an imposed *state of encounter* takes place giving "*rise to artistic practices that were in keeping with it*" (Borriaud,1998 b, p161), and that: "*The artwork represents…a social interstice. The term interstice was used by Karl Marx to describe trading communities that escaped the framework of the capitalist economy*" (Borriaud,1998 b, p161). For Borriaud it is within the *social relationships* that emerge from this *interstice* that that the political value lies.

> "*Contemporary art is really pursuing a political project when it attempts to move into the relational sphere by problematising it*" (Borriaud,1998b, p162).

However, the *relational art* of the 1990s and its promotion of the *social* has come under closer critical scrutiny as it has moved into the mainstream of the art world (Bishop, 2004; Bishop, 2012; Martin, 2007).

Bishop has emerged as one of the main players in the debate surrounding the *social turn* in art both as critic (Bishop, 2004, 2012) and as editor (Bishop, 2006), bringing together the key theoretical frameworks and examples of practice. It is the "*open-ended, interactive, and resistant to closure*" (Bishop, 2004, p23) nature of the works by artists such as Rirkrit Tiravanija that creates the problematic for Bishop. *Tiravanija's* 1990 installation *pad thai* at the Paula Allen gallery in New York saw the artist cook and serve food for the gallery visitors, creating "*functioning 'microtopias' in the present*" (Borriaud,1998 a, p13), with the *social* and *microtopian* ethos being central to Borriaud's understanding of the "*core political significance of relational aesthetics*" (Bishop, 2004, p54) and its emancipatory effect.

Within this type of *relational art practice* meaning is derived from the fluid social interactions that emerge leading to the work being "*in perpetual flux"* and "*willfully unstable"* (Bishop, 2004, p52). For Bishop this leads to a lack of clarity of meaning and art that is "*entirely beholden to the contingencies of its environment and audience"* with an emphasis on the "*experience*" of creativity within institutions that take on the mantle of the *spectacle* with the director-curator becoming the "*star*" (Bishop, 2004, p54).

This instability that Bishop identifies as being central to the ethos of *relational art* is also a core component of Eco's conception of *open works* (Eco, 1962, 1989). Bishop regards Bourriaud's position as a misinterpretation of Eco's arguments with Bishop proposing that Bourriaud places the emphasis on specific works that have audience *interactivity* at their core thus positioning the argument firmly in the area of "*artistic intentionality*" rather than "*audience reception*" (Bishop, 2004, p62). But the examples of *open works* that Eco provides are "*firmly rooted in the original data provided by the author"* (Eco, 1989, p19) and this a priori misreading of the nature of performative art and the relationship between artist, performer and the audience undermines Bishop's position. Bishop continues with an attack on the *democracy* inherent in the interpersonal relationships set up by *relational aesthetics* (Bishop, 2004, p67). Drawing on Laclau and Mouffe (2001) Bishop suggests that the sense of community engendered by the type of audience that is likely to be present in the *microtopia* of a performance of *relational art practice* and the subsequent lack of *friction* is by its very nature *unantagonistic* and therefore *undemocratic*, with the audience being *coerced* into following the instructions of the artist through an undermining of the *independent thought* which is necessary for political action (Bishop, 2004, p77). However, the lack of theoretical *fixity* upon which Bishop bases the critique of *relational aesthetics* is contradicted by the more nuanced understanding of *antagonism* presented by Laclau and Mouffe who contend that "*an antagonism cannot be a real*

opposition" (Laclau and Mouffe, 2001, p123). Laclau and Mouffe also argue that "*identities … never manage to be fully fixed"* (Laclau and Mouffe, 2001, p111), debunking the conception of the cohesive and pliant social identity that Bishop claims to identify in the audience for *relational art*.

In later writing Bishop (2012) moves away from the criticism directed at *relational aesthetics* contending that the artists working in the participatory sphere who emerged in the wake of Borriaud (1998a) and brought the movement into the mainstream of the art world "*are less interested in a relational aesthetic than in the creative rewards of participation as a politicised working process*" (Bishop, 2012, p2). This may not seem too far away from Borriaud's conception as "*they all aim to place pressure on conventional modes of artistic production and consumption under capitalism*" (ibid. p2).

Martin (2007) questions how the *social exchange* that is implied by *Relational Aesthetics* uncouples itself from *capitalist exchange* and "*at the heart of this issue – how the form of relational art relates to or opposes the commodity form or the value form*" (Martin, 2007, p371). Martin goes on to argue that "*Anti-art and pure art are two faces of the same currency*" (ibid., p373) with the anti-art position needing to accept the "*dissolution of art into capitalist life*" (ibid., p373) as well as the way in which *capitalist culture* has taken on the role of anti-art (ibid., p373). This reframing of the debate that has split the art/anti-art factions and has

centred on both the commodity and the heteronomous or autonomous status of the work, allows Martin to propose that his critique of *relational aesthetics* revolves around the proposal that relational art is a "*novel inflection of this transformed dialectic of commodification and art*" (ibid., p373).

This research is investigating the possibility of creating a performance space for both performers and audience thus reflecting Guattari's ideas about the audience's re-owning of artistic production through its reintegration into the *social field*. At the heart of this model is a more obviously collectivist and *dialogical performance praxis* that has the potential to move away from capitalist business models of performance that foreground the individual or the star collective. This is the opposite of the alienation techniques used by Brecht to distance the audience and create critical engagement, with the collective model providing both a practical and theoretical framework to achieve the outcome as outlined in Rancière's definition of *critical art*, that it "*intends to raise consciousness of the mechanism of domination in order to turn the spectator into a conscious agent in the transformation of the world"* (Rancière, 2004, p83).

With its focus on providing a technical and musicological framework for the less ideologically contested field of *Interactive Musical Participation* within jazz, the research in this thesis does not claim to be sowing Debordian revolutionary seeds, but may make a more modest pitch to

be seen as ploughing the field and readying it for planting by whosoever may take ownership of the space.

2.3 Non-Music Performance Audience Interactivity

Audience interactivity has long been an established element in non-musical fields of creative practice. Bishop quotes from Italian Futurist poet Filippo Tommaso Marinetti's 1913 manifesto on variety theatre.

> *"The Variety Theatre is alone in seeking the audience's collaboration. It doesn't remain static like a stupid voyeur, but joins noisily in the action, in the singing, accompanying the orchestra, communicating with the actors in surprising actions and bizarre dialogues. And the actors bicker clownishly with the musicians.*"
>
> *"The Variety Theatre uses the smoke of cigars and cigarettes to join the atmosphere of the theatre to that of the stage. And because the audience cooperates in this way with the actors' fantasy, the action develops simultaneously on the stage, in the boxes, and in the orchestra. It continues to the end of the performance, among the battalions of fans, the honeyed dandies who crowd the stage door to fight over the star; double final victory; chic dinner and bed"* (Bishop, 2012, p45).

Theatre performance along with their other artistic interventions were seen by Marinetti and his fellow Futurists as a call to arms and a series

of provocations to stir the audience into action with the explicit political goal of establishing an expansionist, militaristic, nationalist and techno-futurist Italian state. Audiences flocked to their disruptive performances that often descended into violent brawls encouraged by the Futurists who viewed the turmoil as an energy to be directed.

Less obviously political, *Tony and Tina's Wedding* (Cassaro and Nassar, 1985) was an immersive theatre piece that ran for over twenty years in New York and was performed in more than 150 cities. The audience played the wedding guests and mingled with the characters as they ate, drank and danced.

Based on a stage musical, the film of *The Rocky Horror Picture Show* (The Rocky Horror Picture Show,1975) has inspired audiences to dress up as the characters, recite the script and sing along to the songs. There have also been a variety of interactive film formats including *CtrlMovie* (CtrlMovie, 2014) that give the audience a way of steering the narrative via real-time engagement and narrative decision making through the medium of an app. This approach is now also being used for TV shows such as Netflix's 2018 show *Black Mirror: Bandersnatch* which offers you multiple narrative paths through to five different possible endings but in this case using your TV remote to navigate the binary choices on offer (Rubin, 2018). The type of *curated freedom* on offer here where choices are controlled by the producers of the artefact is similar to the interactive opportunities in this research.

Since 2000 theatre company *Punchdrunk* have created productions that "*focus as much on the audience and performance space as on the performers and narrative"* so rejecting any traditional notion of audience passivity (Punchdrunk, 2018); and from 2009 *Secret Cinema* have created "*360-degree participatory secret worlds,"* based on classic films, *"where the boundaries between performer and audience, set and reality are constantly shifting"* (Secret Cinema, 2018).

Performance artist Marina Abramović has used audience interaction in her practice on many occasions and in a variety of contexts. In a 2015 TED talk she says

> *"Performance is mental and physical construction that performer make in a specific time and a space in front of audience and then energy dialogue happen. The audience and the performer make the piece together …It's all about being there in the real time. You can't rehearse performance, because you can't do many of these types of things twice"* (Abramovic, 2015).

A more virtual if constrained role for the audience can be found in ILMxLAB's *Secrets of The Empire* (The Void, 2018), a *Hyper-Reality* experience set in the *Star Wars* universe, in which the participants dress up as stormtroopers and are led through a series of adventures and interactions by a friendly droid. Real interactivity is limited to a few *Artificial Intelligence*-driven options but the overall experience is

"immersive, exhilarating, fast-paced, and feels like you're in one of the films" (York, 2018).

2.4 Modes of Participation

2.4.1 Performance Contexts

Performance practice and audience modes of reception and interaction vary markedly between different musical genres, cultures and sub-cultures. Pitts notes that *"The traditional practices of the Western concert hall assume a relatively passive role for listeners,"* (Pitts, 2005, p257). This contrasts with Williams-Jones' assertion that *"audience involvement and participation is vitally important in the total gospel experience."* (Williams-Jones,1975, p383). A typology of audience/performer relationships can therefore be divided into a dichotomy between participatory and non-participatory interactions, between activity and passivity. It is the participatory paradigm driven by the use of Hödl, Kayali and Fitzpatrick's *technically driven system* and with the audience responding to what Gareth White calls an "*invitation to participate"* (2013, p9) and so becoming *co-creators* that is the focus of investigation within this research.

In his taxonomy of research and artistic practice in the field of *Interactive Musical Participation* Freeman creates three ranks of interactions (Freeman, 2005 b, 757-760). The first covers compositions in which the audience has a directly *performative* role, generating gestures that either

form the whole of the soundscape or are integrated into the overall sonic and compositional architecture of the performance. The second category turns the audience into *sound transmitters* of pre-composed or curated sonic material through the medium of ubiquitous personal handheld digital computing devices such as mobile phones. Freeman's final category sees the audience as *influencers*; this process can involve interactions as diverse as voting via handheld digital devices and waving light sticks in the air. The data from these inputs is then analysed and presented to the performers as some kind of visual cue that triggers a pre-determined sonic gesture.

2.4.2 The Audience as Performers

Of the three ranks identified in the taxonomy of audience interaction it is the one that functions as a container for artefacts that give the audience the potential for performing which is the most heterogeneous. The audience's affordances within the performance environment range from the realisation of pre-composed material to the interpretation of abstract instructions, from the triggering of samples to the triggering of notes on an automised piano.

The Fluxus composer Tomas Schmit's composition *Sanitas no.35* (Schmit,1962) has a performance script or score that reads as follows

"Empty sheets of paper are distributed to the audience.

Afterwards the piece continues at least five minutes longer".

These instructions are in tune with some of the principles laid out in the Fluxmanifesto on Art Amusement from 1965 by George Maciunas, the founder and central co-ordinator of Fluxus. Maciunas says

> *"He (the artist) must demonstrate self-sufficiency of the audience, He must demonstrate that anything can substitute art and anyone can do it"* (Maciunas, 1965).

Berghaus (1994) views the type of instructional compositional device proposed by Fluxus artists as an opportunity to unlock the creative potential of the audience.

A more obviously active role for the audience is conceived in Frederic Rzewski's recipe/performance instructions for *Free Soup* (Rzewski,1968), a performance piece devised for Musica Elettronica Viva (MEV). MEV was a composer's cooperative set up in 1966 in Rome by Allan Bryant, Alvin Curran, Jon Phetteplace and Frederic Rzewski for the performance of new compositions using live electronics. By 1969 the group had integrated both acoustic and found sound sources into their practice and with *Free Soup* Rzewski calls for "*listener-spectators"* to be gradually blended in with "*player-friends"* (Rzewski and Verken, 1969). Rzewski says

> "*In 1968, after having liberated the 'performance', MEV set out to liberate the 'audience'. If the composer had become one with the*

player, the player had to become with the listener. We are all 'musicians'. We are all creators." (ibid., p94).

The recipe/performance instruction for Rzewski's *Free Soup* specifies a mix of traditional instruments and instrumentalists combining with novelty instruments (duck call, police whistle, pots and pans) for the "*listener-spectators"* as well as microphones, amplifiers, mixers and speakers.

In the *Sound Pool* (1969), which Rzewski describes as "*a form in which all the rules are abandoned*", the audience is asked to bring along their own instruments and to perform with the MEV. In the context of *Sound Pool* (ibid., p94) musicians are no longer elevated to the position of a star but instead work with the audience managing *energies* and enabling the audience to "*experience the miracle"* without overwhelming the audience/performers with their *virtuosity.* The outcome of this process is that the audience no longer exists as a discrete entity.

Rzewski's negation of the audience as an *alterity* creates an opportunity for the *collaborative emergences* of creativity characteristic of the processes of group improvisation (Sawyer, 2003). It is Rzewski's reshaping of the role of the audience that this research will seek to explore using digital technologies and modular compositional building blocks.

In Jean Hasse's composition *Moths* (Hasse,1986) the audience are the performers being asked to whistle a variety of pitches and rhythms from a graphic score as directed by a conductor. The mass of overlapping pitches creates an eerie soundscape with the score's instructions call for several minutes of rehearsal followed by three minutes of performance. Hasse reflects upon her creative process.

"*Continuing a deconstructionist line of thinking, in 1986, while living in Boston, I had a chance to broaden my compositional scope away from that of a 'conventional' performer, through the simple device of bringing an audience into the performance. During a concert interval years before, I had been intrigued to hear people whistling casually in the hall and wondered what it would sound like if this were formalized and even more people whistled in synchrony. My earliest sketches involved passing out whistling instructions to selected members of the audience, something akin to a Yoko Ono conceptual event. In Boston, however, when a concert appearance allowed me to develop the idea, the result became a graphic score for an entire audience to perform"* (Hasse, 2017).

Hasse's 2001 composition *Pebbling* follows a similar model with the audience clicking and rubbing together pebbles on cues from a conductor. Comparing the composition to *Moths* Hasse comments that *"it has a relatively similar graphic score, and was conducted, by gestures, to the gathered crowd. They produced a 'chattering' percussion piece, amplified by flutter echo effects arising from the cliffs – an interesting extra dimension."* Hasse concludes *"Ideally, audience involvement*

should feel somewhat natural…and necessary, in a variety of performance contexts" (Hasse, 2017). Hasse's analysis that audience involvement should be *"natural… and necessary"* runs counter to some of the examples of compositions within this Literature Review which focus more on process and research rather than musical outcomes.

A more intimate approach to audience performance is taken in Claudia Molitor's 2011 composition *10 Mouth Installations* (Molitor, 2011). Three bowls are placed in front of the participant; one filled with popping sugar, one with pretzel sticks and the third pumpkin seeds. The participant is presented with ten different orders in which to eat the food/sound sources. Molitor says

> *"The aim of the piece was three fold, to create an incredibly intimate piece, one that only the participating individual could feel, hear and taste; to draw attention to the fascinating sounds that occur even when engaging in something so every-day as eating; and of course it was a great way to draw attention to the interconnectedness of the senses"* (ibid.).

Terry Riley's *In C* was performed by the Eos Orchestra at a fundraising banquet for the orchestra in 2003 (Bianciardi, et al., 2003). Pods were set up on each of the thirty banqueting tables that the audience would touch on a cue from the conductor. This haptic gesture triggered a sample of one of the fifty-three melodic units that make up the composition. Each

trigger was synced to a main clock with the sample coming in on the next available quaver/eighth note entry. The hardware and software system design allowed for mass audience participation but problems were reported with the triggering instructions as some audience members did not realise that the sample would only be triggered once the hand on the pod was removed. The conclusion that can be drawn from this research is that assumptions can too easily be made about the audience's technical understanding of a system by the system designers and implementation team who are familiar with its functionality and that clear instructions to the audience and some degree of training may be necessary.

La symphonie du millénnaire (Boudreau, 2000) was a one-off performance at St. Joseph's Oratory in Montreal. Curated by Walter Boudreau, head of the Société de musique contemporaine du Québec, the composition involved fifteen ensembles of three hundred and fifty musicians performing music composed by nineteen composers all of which were built around a main theme, the Gregorian chant *Veni Creator Spiritus.* Within the audience there were two thousand bell-ringers playing handbells as well as recordings of fifteen church bells, two fire engine bells and the Oratory's great organ and carillon. Chénard (2000 a) reports that Walter Boudreau first had the initial idea for the composition when he was seventeen years old on the eastern slope of Mount Royal in Montreal. Boudreau provides detail,

> "*From my vantage point, the splendid panorama of Montreal gently awakening to the sounds of a thousand and one church bells unfolded before my eyes. I then imagined a kind of mega symphony that would blend the rich sounds of these bells with originally-composed music, performed live by hundreds of musicians strategically positioned on the mountain near those bell towers"* (Boudreau, 2000).

Chénard explains that it was only in 1997 that Boudreau started to develop the idea, prompted by the Conseil Québécois de la Musique (CQM) asking for submissions for musical ideas to celebrate the millennium. Denys Bouliane, the joint artistic director of the project, emphasises the importance of the two thousand hand bell ringers to the "*participatory and 'event-full' qualities of the Millennium Symphony",* proposing that "*The resulting ritual performed on the site would thus consecrate the celebratory ethos of the work, and give it the festive mark with which we wanted to stamp it"* (Bouliane, 2000). In a work of this complexity with multiple composers, pre-recorded and live elements, it is inevitable that participatory elements would have to be tightly organised and rehearsed.

Hödl et al. developed an interactive system that allowed the audience to pan the sound of a lead guitar across the stereo image. Their conclusion was that

> *"balancing constraints with affordances is the key to both the*

> *audience's and musicians' acceptance of such a system and that a playful participatory design process can lead to better results in this regard. It is also shown that using smart phones opens up a large possibility space but at the same time their use has to be subtle to not distract too much from the music."* (Hödl et al., 2012, p6).

Hödl et al.'s research focused on a "*rock band*" (ibid., p1) and their "*Findings include that musicians seem to be cautious about giving up control"* (ibid., p1).

Further work might explore if the researcher's reliance on "rock" musicians rather than improvising musicians who are more conditioned to react to unexpected changes in the musical language around them may have contributed to their findings.

A more directly performative role for the audience was demonstrated in Norbert Schnell and Benjamin Matuszewski's performance piece *88 Fingers* (Schnell and Matuszewski, 2017). At the performance attended by the author of this thesis audience members were asked to choose one note each of the eighty-eight on an automised piano such as a *Yamaha Diskklavier* to control, via a web browser accessed from their mobile phones. The audience then performed for ten minutes followed by a ten-minute discussion and a final ten-minute performance. The composers suggest that *"The experience establishes a metaphor of a free and responsible society"* (ibid.). However, at the performance

delivered at the *Web Audio Conference* held in London in 2017, the composers' idealism wasn't realised. With "*no constraints*" (ibid.), limitations or performance instructions for the audience beyond the one note rule, the performance was more of a Darwinian fight for survival than "*free and responsible*" (ibid.).

With a live audience of 75,000 and a global TV reach of nearly 2 billion, the rock group Queen's performance at the global pop music charity fundraising concert *Live Aid* on July 13th 1985, makes the scale of the previous examples of audience participative performance pale into comparison. In a poll for a 2005 Channel 4 documentary celebrating the 20th anniversary of the event, it was voted the best ever live gig (BBC, 2005). Queen guitarist Brian May, interviewed for *Johnnie Walker's Sounds of the 70s* in 2018 expressed his surprise that the *Live Aid* audience who weren't specifically Queen fans had learnt the clapping pattern for the song *Radio Gaga* from watching their video of the song on the television saying

> *"I will never forget the moment they put all their hands together in the right time for Gaga"* (BrianMay.Com, 2018).

The success of the interactive clapping element of this performance with no preparation of the audience suggests an area of further research as to how *Interactive Musical Participation* might be realised at stadium, festival or large concert events.

2.4.3 The Audience as Sound Transmitters

The second rank within the taxonomy of interactive models for music performance utilises the audiences own handheld digital communication devices to broadcast pre-prepared sonic gestures. The first systematic study of what has become known as *distributed music* was undertaken by Taylor (2017). Golan Levin's *Dialtones: A Telesymphony* (Levin, 2001), a composition that uses the audience's mobile phones as sound sources, is identified by Taylor as a *foundational composition* of this *emergent* genre. Levin explains the ideas behind the composition in his artist's statement.

> *"The mobile phone's speakers and ringers make it a performance instrument. The buttons make it a keyboard and remote control. Its programmable rings make it a portable synthesizer. Yet, although no sacred space has remained unsullied by the interruptions of mobile phone ringtones, there is no sacred space, either, which has been specifically devoted to their free expression"* (Levin, 2001).

Before the start of the performance audience members exchanged their mobile phone number for a seat at the concert; they then downloaded specially composed ringtones onto their phones. These ringtones were triggered by musicians via a *visual-musical* software instrument. Participants were lit up via a lighting system

> *"becoming an audio-visual pixel, a twinkling particle in an audio-visual substance—and the visitors, as a group, could at once be audience, orchestra and (active) score"* (Levin, 2001).

One of the earliest examples of *distributed music* dates back to 1922 and a composition entitled *The Hooter Symphonies.* Performed in Baku and instigated by music theorist Arsenii Avraamov, Bishop describes it as

> *"one of the most mind-boggling cultural gestures of the post-revolutionary period"* reinventing the *"entire concept of instrumentation by harnessing the sirens and industrial noise of the modern city into a new understanding of what constituted an orchestra"* (Bishop, 2012, p65).

Bishop adds that

> *"The event used sirens and whistles from navy ships and steamers, as well as dockside shunting engines, a 'choir' of bus and car horns, and a machine-gun battery. The aim was to evoke the struggle and victory of 1917, and involved versions of 'The Internationale' and 'The Marseillaise' with a 200-piece band and choir, and a large portable organ of steam-controlled whistles on the deck of a torpedo boat"* (ibid.).

Possibly less mind-boggling and more contemporary if less revolutionary was Laurie Anderson's symphony for car horns. Entitled *An Afternoon of*

Automotive Transmission the composition was performed in 1972 by the audience at a drive-in bandstand in Vermont (Grosenick and Becker, 2001, p36).

Another ambitious project was Filipino composer Jose Maceda's 1974 composition *Ugnayan*, translated as *Interlinking*. Bringing together influences from Edgar Varèse, Pierre Schaeffer, John Cage and Karlheinz Stockhausen (Taylor, 2017), Maceda created a twenty-channel radio simulcast utilising all the radio stations in Manila in a state-sponsored cultural intervention to combine traditional Filipino instruments with a modernist musical aesthetic. The city's population were encouraged to bring their radios onto the streets to create a distributed *"collaborative sound collage"* (ibid.). Maceda's *"Xenakis-like clouds of sounds"* (Brown and Santos, 2010) were realised by an ensemble performing a one hundred-page score of complex polyrhythms using

> *"Kolitong (zithers), Bungbung (bamboo Horns), Ongiyung (whistle Flutes), Bangibang (yoked-shaped Wooden Bars), Balingbing (buzzers), Agung (wide-rimmed Gongs), Chinese Cymbals, Gongs and Echo Gong"* (ibid).

Although the bulk of the local population did not engage with Maceda's vision he was successful in establishing a powerful precedent and model for *distributed music* in the 21st century.

Die Neukoms are an electro-acoustic group based in Zurich, Switzerland made up of four laptop and one analogue modular synthesizer performer. Their audio outputs of their performances are mixed together down to stereo, converted to the mp3 audio file format and then live streamed via a local network in the concert space to the phones of the audience members. These *audience-performers* can then each broadcast the performance forming a *reproduction collective* and a *sonotope* – a performance space where *"similar acoustic events induced by the musicians are spread in time by differences in processing speed and buffer sizes of mobile devices"* (Visser and Vogtenhuber, 2015). Some sonic reinforcement was needed from a PA system with a subwoofer for the lower-end frequencies but despite some technical issues with the streaming the six performances reported on seem to have delivered successful sonic spatial diffusion.

CoSiMa (Collaborative Situated Media, 2017) is a project based at IRCAM in Paris and run by Norbert Schnell that has been developing a platform to turn *"the smartphone in everybody's pocket into a means of collaborative production and collective expression".* CoSiMa have also developed smartphone-based web applications such as *drone, birds, monks* and the *rainstick* which are dependent on the motion of the device. The project is also involved in more *collaborative scenarios* including web applications such as *WWRY:R* which features a selection of samples from the Queen song *We Will Rock You*, *Shaker* which allows user generated and recorded sounds to be uploaded and then

triggered at 110 beats per minute, and *Matrix* in which a 3 x 4 grid of mobile phones create a matrix of loudspeakers and screens with light and sound being triggered on and across the screens by a performer on one of the phones.

A more *interactive* approach has been taken in a piece and application called *Weather.* This was developed by CoSiMa at the *Sonar+D* international conference on creativity and technology as part of the *Sonar* Music Festival in Barcelona in 2016. Participants use gesture to trigger sounds and visuals on the mobile phones related to four different weather states, the bird chirps associated with a sunny afternoon, wind, rain and thunder. The *audience-performers'* weather states create a weather profile on the server that then controls visuals appearing on a public screen and environmental sounds on the PA system. A dialogue takes place between the soundscapes generated by the audience/performers and a DJ who is playing live electronic music.

The CoSiMa platform was also used by *orbe,* a cross-disciplinary French research group who design accessible open environments to create novel experiences involving new media and the body. Their experiment *Collective Loops* which comes under the framework of the *Collective Sound Checks* project

"is a collective musical experience with smartphones. Each event proposes to the participants to play together in the context of musical

and playful proposals, in group or in interaction with a performer (group, DJ, ...)" (Orbe, 2017).

CoSiMa have also been developing the open-source *Nü* framework, a tool for composers to control web-based audio processes on the audience's smartphones during performances (Poirier-Quinot et al., 2017). Audience members can either be sound sources or more active participants controlling *Nü* modules. The *Nü* framework is still in the testing phase but may be of value for this research as it develops.

Distributed performance and *listening* are emergent modes of participatory art. *Distributed listening* is the focus of the *liveSHOUT* interactive audio streaming mobile app (Schroeder, F. 2016). Designed by a team at the Sonic Arts Research Centre at Queen's University Belfast it allows users to both stream from and broadcast audio into a global audio network. The Lyric Theatre in Belfast hosted a performance of a theatre piece entitled *Once More* created by artistic director Amanda Coogan. Performers were distributed throughout the theatre space with their performances being audio-streamed to *liveSHOUT*. The audience moved between these areas whilst live-streaming up to three audio feeds simultaneously. The outcome from an audio perspective was that in any of the performance spaces you could hear the sound of the performer located in that area blended with other performances being broadcast via *liveSHOUT* on the audience members' mobile phones. The timing delays inherent in *liveSHOUT* make it unsuitable for use in this

research but if the audio latency can be improved it opens possibilities for researching distributed audience participation.

A more practical technology for audience collaboration through distributed performance is SynkroTakt, a digital tool developed at the University of Georgia which can stream synchronised audio tracks to over 250 mobile digital devices allowing for multi-track synchronised composition (SynkroTakt, 2016). A performance of SynkroTakt developer Cody Brookshire's electro-acoustic composition *Honeycomb* (2016) at the UGA Hugh Hodgson School of Music featured an acoustic ensemble playing together with 250 audience performers whose phones performed the electronic elements. The conductor and percussionists were fed a click track through SynkroTakt ensuring the synchronisation of the two ensembles. This first public performance showed great potential in terms of scalability and reliability. The decision to deliver the technology via a website rather a downloaded app makes it very accessible; however, there may be an issue resolving the spatialised nature of the phone *audience-performers* and the relative balances between the performer groupings. If a public version is released it is a tool that could afford subsequent research.

Lee and Freeman (2013) developed a networked musical instrument application for mobile phone called *echobo* that audience members could download and perform on instantly, engaging with other members of the audience and generating sound that contributed to the

performance. This combination of audience performance and sound transmission creates a *hybrid* rank within the taxonomic system of participatory performance modes. *echobo* combines two types of instruments, one for the audience and one for the *master musician* who controls the harmonic structure of the piece whilst not generating any sounds. The *master musician's* chord choices are reflected in the eight note scales available to the audience on their version of the *echobo* app.

> *"The aggregated sound results in a dense and stochastic combination of the notes in the scale and can be employed as a background harmonic texture*" (Lee and Freeman, 2013).

Melody is supplied by a stand-alone acoustic musician, in this instance a clarinet player.

In the process of designing this app Lee and Freeman proposed a set of criteria to enable a successful audience participatory experience.

i) to make participation easy (accessibility)

ii) to collect gestures from the audience and turn them into a single musical composition (musical security)

iii) to drive audiences to start participation without reservation (initiation)

iv) to motivate people to participate and sustain the interest (attraction)

v) to provide a clear relationship between their gestures and outcome in music (transparency).

These principles were valuable in the design of the research undertaken in this thesis as they provide a strong foundation for interactive composition. Audience feedback (ibid.) pointed to a greater sense of *connection* to the clarinet player rather than the other audience members/musicians and to a frustration with the rate of harmonic change as determined by the *master musician* as it was perceived to have *limited* the audience's musical expressivity.

Another *hybrid* composition is Ben Houge's and Josef Youssef's *Quiver, Pop and Dissolve: Three Essays in Gastromorphology* (Houge and Youssef, 2017). The focus of Houge's artistic practice is *Gastromorphology,* a field which investigates the communicative potential of the dining experience. The audience are served three food courses by chef Josef Youssef's team: *Miso Soup?, Praline Progression* and *Monochromatic Jellies.* Each course is accompanied by a matching composition accessed on a website and then played by audience members on their mobile phones. The audience are the performers through the act of taking and eating the food and by the sounds which that creates, by interacting with those around them and through their phones being an embodied distributed audio sound source. The entextualisation of embedding audio within a fine dining experience can be found in chef Heston Blumenthal's 2007 dish *Sound Of The Sea*

(Square Meal, 2014) served at his Fat Duck Restaurant, however Houge's involvement of the audience in the broadcast of the sounds, as compared with Blumenthal's passive headphone-wearing diners, creates a more collaborative form of participation design.

2.4.4 The Audience as Influencers

The third and final rank of Freeman's taxonomy consists of compositions in which the audience neither generate nor trigger any sound but in some way affect the performance content and direction. Thomas C. Duffy's composition *The Critic's Choice* for wind band (Duffy, 1995) is a soundtrack for an unmade movie with a choice of three endings – *Happily Ever After*, *Everybody Dies* and *Projector Breaks Down*. The audience votes to choose the pathway that the performance takes in a limited nod to audience interaction.

As Berkowitz notes (2013) having the audience engage in a process of voting to generate new performance outcomes can be seen as an emergent trend in the last twenty years. Kevin C. Baird's interactive music performance/installation *No Clergy* (Baird, 2005) is composed for a small monophonic acoustic ensemble playing from a score that is then altered via audience feedback. Information on parameters including note durations, dynamics and articulations is transmitted using a Common Gateway Interface (CGI) form dedicated to a particular instrument by an

audience member. The *conductor* runs a Debian GNU/Linux system that first analyses the audience's inputs and then outputs new pages of traditionally notated score in real time. The musicians proceed to sight-read the newly generated music via a web browser.

No Clergy starts with a pre-composed score that develops through the audience's interactions. In contrast Harris Wulfson's 2006 composition *Livescore* (Barrett and Winter, 2010) starts with no pre-composed material. Before the performance begins the audience is asked to express preferences on parameters including *sparseness, pitchi-ness, stasis, togetherness, range* and *dynamics* via a Knob-box MIDI (musical instrument digital interface) controller. The Knob-box sits in front of the ensemble (a harmonium, a violin, two guitars and a keyboard) with each musician having access to a laptop computer. MIDI messages are transmitted from the Knob-box to the LiveScore server computer which creates an algorithmically generated score based on the audience's inputs. As with *No Clergy* parts are fed to each musician's laptop in real time with the audience continuing to contribute through the duration of the composition. Wulfson (2006) explains that the piece was composed with the aim of demonstrating how a click of a computer mouse can cause "*tangible action in the world"* and to encourage the audience to consider whether this type of mediated action is *"empowering or alienating*". He describes the performance as a *"focus group"* with the audience's "*satisfaction*" being gauged as well as the musical performance. With the application of this methodology it seems apparent

that elements of Human-computer Interaction (HCI) are embedded into the composition. This methodological approach is compatible with the proposed design of the research presented in this thesis.

In 2003 Graham McAllister, Michael Alcorn and Philip Strain from the Sonic Arts Research Centre, Queen's University of Belfast developed a prototype system that allows audience members to communicate directly with individual musicians via a graphic interface (McAllister et al. 2004). Building upon the graphic notation scores from the mid 20th century (Penderecki,1959), randomly chosen audience members were asked to input graphic instructions onto a HP iPAQ 5450 PDA which were transmitted via WiFi to an IMac computer to their target musician. The ensemble consisted of guitar and live electronics, bass clarinet and live electronics, acoustic bass and drums with all the instrumentalists being experienced improvisers. The system allowed for information on *gesture, tempo, density, pitch* and *duration* to be transmitted and successfully created a feedback loop between audience member and musician with the PDA performer reporting

> *"that the two-way communication with their musician gave way to a more significant performance experience*, *namely that they were jamming with other people in the audience via the performers on stage"* (McAllister et al., 2004).

This hybrid experience of being an *influencer* and *performer* leads directly into the design of the research presented in this thesis, which will

create a sense of autonomy for each *audience/performer,* influencing the other performers directly through sonic gestures and not being mediated through an interpretive software or a graphic interface or score.

Jason Freeman's *Glimmer* (Freeman, 2005 a) uses hardware controlled by the audience in conjunction with software to control the actions of musicians in the orchestra. However, all the sound is directly generated by the musicians. The audience is divided into seven groups with each group controlling a small unit of musicians. The audience are provided with novelty light sticks which they can wave about with the movement being tracked by video cameras. The visual information is then analysed by a computer running a control software generating instructions for the musicians and a video animation for the audience. This process builds upon *audience motion-tracking* technologies for video gaming described by Maynes-Aminzade, Pausch and Seitz (2002). They in turn cite Loren Carpenter's research (1993) using reflective coloured paddles to control an onscreen video game.

Freeman's 2007 composition *Flock* for four dancers, four saxophonists and one hundred audience members also uses motion tracking to generate a score in real time (Freeman and Godfrey, 2008). The saxophonists wore baseball caps each having a different coloured LED attached on its top; the audience members were similarly attired but with a white LED sphere replacing the coloured one. The variety of colours allowed a data-mapping system to differentiate between each of the

performers and the audience. Dancers were tasked with guiding and managing the audience's movements around the performance space. *Flock* has five sections each involving different combinations of the performers and audience. Freeman and Godfrey note that

> *"It is difficult to describe the music itself, since the musicians' response to the notation had a tremendous effect on style and content"* (ibid.).

However, they report a clear correlation between the amount of actively mobile performers and audience members as well as the type of activity they were undertaking with the density and levels of improvisation within the musical outputs. These levels were found to increase with greater and more random levels of movement. Conclusions drawn from post-performance audience questionnaires included some uncertainty as to whether the respondents had been creative and whether the performance would have *been different* without their participation. There was also a wish expressed by several audience members that the process had been better explained in advance of the performance.

In 2016 the brewing company Heineken realised a new marketing campaign entitled *The Takeover* (Bea World Festival, 2016). Wearers of customized Heineken wrist-bands at festivals had the opportunity to choose the next song in the DJ's set by switching between a red or green light and then raising their hands and bottles in the air. Two song choices were listed on a large screen each matched with one of the

colours. A camera linked to a computer programme counted the votes with choice of the majority winning the vote. The company claimed a rise in media exposure of 110%, in sales on site of 240% and in event attendance of 40%. This evidence points to the possibility of young audiences being attracted to performance events that involve an interactive element.

In 2010 as detailed in Oh and Wang (2011), the Stanford Mobile Orchestra experimented with a variety of audience participation techniques. In both Nick Kruge's *Madder Libs* and in *Converge 2.0* by Jieun Oh and Ge Wang, the audience created audio-visual samples before the beginning of the performance that became part of the composition; in Nicholas Bryan's *Orkestra* members of the audience were live sampled making grunting noises with the samples being recorded to a central computer via a mobile phone. The main performer live coded the samples which were spatialized across eight speakers building in intensity as the composition progressed. Oh and Wang note that

> *"These experimental pieces tended to yield a socially engaging experience that is difficult to achieve without having the audience-participation model. In fact, this social element can be regarded as an emergent property of having a group of people behaving extemporaneously under a common goal of music-making"* (ibid.).

For anyone who has been present at a pub sing-a-long or within a football crowd the idea that the *social element* is an *emergent property* may seem slightly naïve.

Oh and Wang conclude that

> *"Beyond offering a rich set of physical interactions for controlling and interacting with music, personal mobile phones introduce a much lower psychological barrier to entry to participation as audience members get to use their own, familiar device*" (ibid.).

Social media becomes the medium for audience interaction in Dahl, Herrera and Wilkerson's *TweetDreams* (Dahl at al., 2011). The audience sends tweets via Twitter on their smartphones incorporating a *local search term*. These tweets combine with those from the global network identified by *global search terms* with each tweet forming a node in a tree-like structure of associated tweets. The tweets are processed by a Python server that manages a process of displaying the tweets and visualising the nodes and tree-like structures, as well as delivering the sonification of the tweets. Six-step melodies are derived for each tweet and a new associated tweet's melody is developed from that of the previous tweet/melody in the node. The performers determine the density and shape of the performance by controlling the volume of the search terms. In practice this means that as a greater amount of search terms are activated, that more tweets and associated melodies are

generated. The composition's sonification is realised by a wavetable synthesiser.

R. Benjamin Knapp and Eric Lyon (2011) developed a concept entitled *Integral Music Control (IMC)* for a piece called *Stem Cells* that uses *physiological indicators of emotion* as well as *physical gestures* as a way of allowing the performer and audience members to interact with the computer music composition. Knapp and Cook (2005) defined the *IMC* as a device that

> *"1. Creates a direct interface between emotion and sound production unencumbered by the physical interface.*
>
> *2. Enables the musician to move between this direct emotional control of sound synthesis and the physical interaction with a traditional acoustic instrument and through all of the possible levels of interaction in between"* (Knapp and Cook, 2005, P798).

The performer in *Stem Cells* wears a BioMuse system that transmits data derived from changes in emotional/physiological states and physical movements via body sensors through a wireless connection to a PC running Eyesweb, a signal-processing software. Having been processed in real-time this data is then transmitted to Max/MSP using Open Sound Control (OSC). The audience were attached to custom-built sensors that could read Galvanic Skin Response (GSR) and Electrocardiography (ECG) data transferred through a MIDI connection to an Apple Macintosh

(Mac) computer. This data was then aggregated and again transmitted via OSC to Max/MSP on another Mac.

Stem Cells has been performed on several occasions internationally. Performances took place at the International Conference on Music and Emotion (ICME) 2009 in Durham, UK and at Virginia Tech in the USA in April 2012. Preliminary data analysis from the findings of post-performance questionnaires point to the audience being able to intuit how gesture created change in the music, but not finding the sonification of the performer's emotional state so easy to discern.

Jason Freeman created a composition called *Sketching* (Freeman, 2013) for musicians along with audience participation via mobile phones. The *audience-performers* created a graphic score collaboratively using massMobile, a client-server smartphone participation system. The design of the composition creates a constant *feedback loop* between the *audience-performers* and performers with the *audience-performers* responding visually to the musicians and the musicians taking direction from the score. The massMobile system has been utilised on a number of projects including choreographer Johan Bokaer's 2011 dance piece FILTER (Weitzner et al., 2014). During the performance of FILTER the audience voted on lighting preferences and configurations via massMobile and the ensuing changes triggered the dancer to alter the choreography. The affordances of massMobile (ibid.) are to offer a scaleable and flexible digital framework for mass audience participation.

Zachary Berkowitz's *Anywhere, U.S.A.* (Berkowitz, 2013) for five performers and a conductor uses SMS text messaging as the medium for facilitating interaction between the performers, the audience and the composer. Berkowitz's rationale for using SMS is its availability on non-smartphones and smartphones alike opening up access to participation in the project to as many participants as possible. A phone number for the texts to be sent to was registered with a company called Twilio who then forwarded the text content via Hypertext Transfer Protocol (HTTP) to a PHP application that housed a MySQL database. Each performer and the conductor sat in front of a computer with the conductor's computer polling the database every two seconds for new messages and then forwarding them to the specific musician they were addressed to. Pre-performance the audience were given a set of possible message instructions to send that would include the name of one of the performers and a number (from 1 to 4) that would relate to a particular segment of the score and an associated video that would be played concurrently. There were also instructions such as *"Fred louder"* that would affect the relative dynamic level of each performer. Unlike many of the other compositions discussed here *Anywhere, U.S.A.* has a fixed metrical framework and a soundworld familiar to consumers of popular music which Berkowitz concluded helped audience engagement. Feedback from the performers included an acknowledgement of the stress created by the uncertainty of "*not knowing what's coming next*". Berkowitz addresses this through a suggestion that the performers

memorise all the musical material. Berkowitz identifies a flaw with many of the recent audience participation works in that if the performer is concentrating too hard on a computer screen then the very engagement with the audience that this class of composition is meant to engender is lost.

Diamonds in Dystopia (Allison et al., 2016) is an interactive, live-streaming poetry web app that sends text from a foundational data-mined poem to the audience members. The audience then individually select word selections which trigger Markov chain reactions to data mine the text of two thousand five hundred TED talks. Using advanced coding techniques this *found* language is recombined into stanzas to be performed by a poet on stage. The word choices made by individual audience members also trigger

> *"synthesized audio effects at varying pitches to create a musical experience as well as contributing to the visual projection of the poem"* (ibid.).

A performance *Diamonds in Dystopia* at the Web Audio Conference in London, 2017 attended by the author of this thesis did not meet all of Lee and Freeman's proposed set of criteria to enable a successful audience participatory experience. In particular there was an issue with

> *v) to provide a clear relationship between their gestures and outcome in music (transparency)*

The experience of attending the Web Audio Conference performance emphasised the importance of making an obvious connection in any *practice-based* research where *Interactive Musical Participation* is being explored between any audience action and the related musical outcome.

Zhang, Wu and Barthet (2016) created a web-based application called Open Symphony, accessible via smartphone, which allows the audience to vote for *musical attributes* thus becoming *co-creators* of any Open Symphony performance*.* Groups of audience members would be assigned to a musician/s and then have the option of voting for one of five playing *modes;* drone, two-note, motif, improvisation free improvisation and silence. Drawing from their research Zhang et al. identified four *novel contributions* to the development of interactivity within live performance systems.

> *(i) interactions are mediated through a voting system that can be operated by audiences from a web client application on their mobile devices*
> *(ii) audience-to-performer grouping assignments are automated based on client connection*
> *(iii) audience members are attributed unique digital identifiers which can be tracked for personalised feedback and analysis purposes*
> *(iv) quasi real-time visualisations are generated by a visual client following audience-driven creative data*

The application can also be adapted for the gathering of feedback. Zhang et al.'s research and the contributions identified are technologically driven without addressing issues of aesthetics, compositional and performance outcomes, the relationships between audience and performers, the levels of satisfaction for audience and performers and the suitability of genre and type of musician for this particular field of research. The research presented in this thesis will explore these latter areas. As Attali says "One produces what technology makes possible, instead of creating the technology for what one wishes to produce" (Attali,1985, p115).

2.5 Digital Interactions

There is a growing body of literature that addresses the technological and sociological processes at play in the delivery of *Interactive Musical Participation.* Oh and Wang found that

> "*Implementing a communication pathway between the audience and the 'master-performer' is a technical necessity for designing an audience-participation performance"* (Oh and Wang, 2011, p 671).

Yang and Coffey (2014) state that

> *"Digital technology is revolutionizing the way people consume media, creating opportunities for more interactive opportunities such as multimedia offerings and two-way communication…"* (Yang and Coffey, 2014, p78).

They also observe that audiences are familiar with interactive processes and this combination of digital *familiarity* with the *ubiquity* of smartphones creates the conditions for straightforward *digital interactivity* and the creation of Oh and Wang's *communication pathway.*

Maynes-Aminzade, Pausch and Seitz (2002) suggest that interactive element must be inherently *interesting* for the audience otherwise they will lose a sense of engagement; they also determined that the control interfaces must create an immediate response when triggered so there is a clear connection between the control action and the outcome.

Weitzner et al. (2014) note that in relation to the massMobile system

> *"as the number of participants grows, it becomes increasingly challenging to maintain a balance between the transparency of individual contributions and the coherency of the collective product".*

There has been research from Hödl at al (2012), Zhang et al. (2016) and Freeman (2005 b) that looks at the functionality of interactive controllers and the audience's responses to performing compositions that have been structured to fit in with the affordances of those controllers.

Oliver Hödl, Fares Kayali and Geraldine Fitzpatrick note that

> *"musicians seem to be ambiguous and cautious about giving control to the audience and that spectators want reasonable control and clear feedback when interacting with sound but that at the same time this feedback distracts the rest of the audience"* (Hödl et al., 2012, p.241).

Blaine and Fels propose that designing in limitations of both musical range and potential gestures to a controller aid its accessibility and conclude that *"If a player feels excluded due to a perceived lack of skills, she does not have a positive experience."* (Blaine and Fels, 2003, p411). On a related topic, for Rosenkransa (2010) *interactivity* is measured by the *frequency of engagement* within a *mediated communication*.

Cook (2001 & 2009) lists a series of principles for designing computer music controllers. Amongst them he suggests that researchers should *"Make a piece, not an instrument or controller*" and it is this somewhat counter-intuitive methodology that has informed this research. These findings form the basis of the methodology applied to the technological infrastructure for this project.

2.6 Performer and Audience Interaction within Jazz

Previous studies on the audience for jazz have focused both on its decline and its make-up with little or none addressing audience interactivity beyond the boundaries of Fischer-Lichte's *autopoietic feedback loop* (2008). The consumption of jazz in particular is falling in millennials (18-34 year-olds) despite jazz having a strong presence in music education. According to the Nielsen U.S. Music Year End Report (2016) sales of jazz in 2011 represented 2.8% of all recorded music consumption in the USA falling to 1.3% in 2015. The National Endowment for the Arts Participation survey for 2008 (2009) notes that live attendance is also falling. However according to Miller (2009) many young people are now active participants in virtual music-making through game play in games such as Guitar Hero (Guitar Hero, 2018), so engagement with the type of activities and technologies contained in this project should not feel too unfamiliar for audiences accustomed to gaming and smartphone technologies.

Bailey (1993) presents the performer-audience relationship as something problematic for improvising musicians with the need for *professionalism* leading to predictability of idiom and vocabulary. Brand et al. (2012) provide some valuable analysis of the relationship but only in the context of a traditionally formatted jazz gig and with no mention of interactivity beyond the standardised responses of audience and musicians. In both studies there is some hostility expressed towards the demands of the

audience and the pressures that this places musicians under. These findings suggest albeit with a very small amount of data that the contemporary model for jazz performance has an inbuilt tension between audience and performer.

Jazz musicians have been involved in performances involving interactive audience participation. Jason Freeman's composition *Sketching* (Freeman, 2013) was performed by musicians familiar with improvising. To contrast with the performance described in Hödl et al. (2012) the performers in *Sketching* were the musicians from the Georgia Tech Jazz Ensemble for whom being musically responsive to external stimuli was part of their artistic practice.

With a growing business case for reinventing jazz and the tension between artists and audience as detailed above there is a plausible rationale for artistic practice that explores a greater integration of the audience into the performance.

2.7 The Death of the Author?

Bishop (2006, p12) identifies three agendas behind the participatory art that has emerged since the 1960s. The first is motivated by

> *"the desire to create an active subject, one who will be empowered by physical or symbolic participation"*

and

"… able to determine their own political or social reality".

The approach derives legitimacy from the

"causal relationship between the experience of a work of art and individual/collective agency".

The second comes from

"The gesture of ceding some or all authorial control"

Which

"*is conventionally regarded as more egalitarian and democratic than the creation of a work by a single artist, while shared production is also seen to entail the aesthetic benefits of greater risk and unpredictability...Collaborative creativity is therefore understood both to emerge from, and to produce, a more positive and non-hierarchical social model."*

Bishop's final agenda relates to the

"perceived crisis in community and collective responsibility" through *"the alienating and isolating experience of capitalism"*

with

"One of the main impetuses behind participatory art"

having

"… been a restoration of the social bond through a collective elaboration of meaning".

Bishop summarises these three approaches as *"activation; authorship; community".*

The very nature of interactive performance implies a degree of *agency* being granted to members of the audience that inevitably diminishes the power of the primary authorial role. In Roland Barthes' seminal 1968 essay *Death of the Author* (Barthes and Heath,1977) he attacks the notion that the authorial voice exists at all in any text that doesn't engage *directly* with the real world. For Barthes the critical relationship is between the reader and the language, the interpretation of which must not be overshadowed by the position or personality of the author. He says

> *"As soon as a fact is narrated…this disconnection occurs, the voice loses its origin, the author enters into his own death, writing begins* (Barthes and Heath, 1977, p142)*.*

Barthes was influenced by the dramatic writing of Bertold Brecht who developed a theatrical style in the 1930s called *Epic Theatre* and its allied *alienation technique (Verfremdungseffekt or V-effekt)* of acting in which

> *"Instead of using conjuring tricks the actor must invite the audience to question what it sees on stage"* (Patterson, 1981, p178)*.*

For Brecht who was a Marxist the emphasis was on raising the audience's intellectual and participative curiosity by means of the issues being raised in his plays. This approach created a heightened political awareness by disallowing the audience any sense of emotional

engagement with the drama and the characters. As Barthes notes,

> *"The removal of the Author (one could talk here with Brecht of a veritable 'distancing', the Author diminishing like a figurine at the far end of the literary stage) is not merely an historical fact or an act of writing; it utterly transforms the modern text (or – which is the same thing – the text is henceforth made and read in such a way that at all its levels the author is absent)"* (Barthes and Heath,1977, p145).

Or as Bishop puts it *"Brechtian theatre compels the spectator to take up a position"* (Bishop, 2006, p11).

The chains that tie an author or composer to their work have long been loose and with a growing understanding of the realities of multiple authorships, unattributed and misattributed works, or the role of functional contributors such as artists' assistants and orchestrators as well as closer relationships such as those with partners or muses, then less emphasis is put on the vision of an individual. Or as Christopher Hitchens succinctly comments *"It does not matter to me whether Homer was one person or many*" (Hitchens, 2007, p150).

Since the advent of digital technologies, the internet and ubiquitous portable conduits to digital systems and information flows such as smartphones, there has been a broad phenomenological shift towards a more interactive and networked culture. The smartphone has become the most quickly adopted consumer technology ever gaining a 40%

market share in 2 1/2 years. With over 1 billion users worldwide and the availability of 2.5 million apps, mobile digital technologies have the enabled the breaking down of all previous boundaries of cultural engagement, music being just one aspect of this process (University of Southern California, 2017).

The *ubiquity* of digital communication systems has created markets for online gaming and sports, both of which have offered new models for audience involvement. As Steinkuehler (2007, p297) notes, "*games are, by definition, a thoroughly 'interactive medium'",* and Dwyer et al. (2011, p131) point out that *"Fantasy sport participation is primarily an online activity that is completely customizable, interactive, and involves nearly every major professional sport".* This interactivity is far from present in the concert hall for presentations of Western classical music. Not only is the music regarded as being culturally *elevated* but the performers are often literally *elevated* onto a stage and so are distanced from the audience. Small (1998, 64-65) proposes that the habitus of the classical musician is that of *male exclusivity*, separated by their dress-code, physically cut off from the audience with both that relationship and the one with the music itself being mediated through the conductor. Small further suggests that this disconnection from the performance was a phenomenon that only took hold at the beginning of the 19th century up until which point it was standard practice for orchestras to comprise of gifted amateurs with professionals assisting where necessary. He adds that his process was synchronous with both the rise of the charismatic

virtuoso such as Paganini and with the increase in the technical difficulty of the music demanded by composers including Beethoven.

It is no surprise then that the digital age has seen a decline in the public visibility of authorship and away from the dominant model of the cult of personality or what Barthes describes as *"the prestige of the individual"* (Barthes and Heath, 1977, p142). When a song is streamed from Spotify there is no information about the identity of the songwriters and with more interactive forms of performance where the audience have some agency as co-creators, the question arises as to whether this leads to co-authorship or no authorship? At the very least there is a blurring of boundaries as the audience becomes more empowered and active. For Barthes *"the birth of the reader must be at the cost of the death of the Author"* (ibid., p148). However, the cutting of the umbilical connection between author and artwork as proposed by Barthes may not be something that all audiences feel comfortable with, and raises the question as to what extent this research breaks the traditional contract between performer and audience? Some performers may not want interaction and some audiences may desire passivity.

In contrast to the field of jazz studies, there is at the time of writing a growing body of valuable work that addresses issues surrounding the field of audience participation within the area of performance studies. White (2013) focuses on how audiences respond to the invitation to participate and argues that the invitation has its own aesthetic. Rancière

suggests that

> *"being a spectator is a bad thing"*

and that

> *"the spectator remains immobile in her seat, passive. To be a spectator is to be separated from both the capacity to know and the power to act"* (Rancière, 2009, p2).

Fischer-Lichte (2008) determines that for an audience member to have agency, they need to perform an action intentionally that enables something to happen or change within the performance beyond the *inherent feedback mechanism* of the *autopoietic* loop.

Breel (2015) creates a methodology for examining aesthetic experience in participatory performance as well as a typology of participatory approaches. Breel identifies four types of audience involvement;

> "*interaction (where the work contains clearly defined moments for the audience to contribute within), participation (when the audience's participation is central to the work and determines the outcome of it), co-creation (when the audience are involved in creating some of the parameters of the artwork), and co-execution (where the audience help execute the work in the way the artist has envisioned)"* (Breel, 2015, 369-370).

Freeman's taxonomy, in comparison to Breel, is examining the notion of *Interactive Musical Participation* with the nature of the interactivity being mediated through *a technically driven system* (Hödl et al., 2012, p236)*;* whereas Breel's approach is less technologically centred and creates more finely drawn distinctions within the relationship between the audience and performers.

Breel also explores the notion of agency and suggests that its limits within participatory performance enable the audience to reflect upon their agency or lack of it within their lives. The traditional binary audience-performer relationship is challenged by Newton (2014) who argues that the two roles dissolve into co-authorship within a liminal performative space. Newton locates this transformative fluidity in the term "Metacommunicative Performative Competence" (MPC), which provides a valuable tool for developing a new ontological perspective on performance with the emphasis shifting to *experiencing* rather than *making* or *receiving*.

2.8 Process of data collection

The process of collecting data from performers and audience has been approached in a variety of ways. Monson (1996) uses both ethnographic and journalistic interviewing techniques in a study on the interactivity that takes place between the musicians performing during a jazz

performance. She is sensitive to the issues raised by the *entextualisation* of both spoken and musically transcribed content and presents her findings under a series of themed headings.

Brand et al. (2012) explore the relationship between jazz performers and the audience with both parties taking part in an open-ended piloted survey. The *NVivo* research analysis software was used to generate higher-level thematic categories based on *Grounded Theory*, an approach described by Robson as identifying

> "*a central core category which is both at a higher level of abstraction and grounded in (i.e., derived from) the data you have collected and analyzed*" (Robson, 2002, p493).

Sawyer and DeZutter (2009) study the process of *distributed creativity* within an improvisatory theatre group. *Distributed creativity* takes place when a *shared creative product* is produced by a group of people working together. The group processes that generate unexpected outcomes in the context of *distributed creativity* are known as *collaborative emergence* (Sawyer, 2003) which is

> *"a defining characteristic of social encounters that are improvisational because only when the outcome is not scripted can there be unpredictability and contingency"* (Sawyer and DeZutter, 2009, p82).

This research fulfils the criteria for both *distributed creativity* and *collaborative emergence*. The analytical methodology of choice applied within Sawyer and DeZutter's research is *interaction analysis*, a method of studying repeated patterns of observable behaviour using the medium of digital video. *Interaction analysis* is probably less suited to the relatively small movements generated by *audience-soloists* such as tapping a smartphone icon, pressing a switch on a games controller or even pressing down a note on a keyboard, than the broader gestures and vocal utterances of an improvising actor.

Schober and Spiro (2014) brought together two jazz musicians who together recorded the jazz standard *It Could Happen To You* three times whilst separated by a barrier. This anonymity continued post-recording when they were both individually interviewed about the performances as was an expert listener. The three sets of responses were anonymised and two months later the musicians listened again to their performances and rated their level of agreement with the various statements. The outcome of this research was that each musician rated their own responses the highest with the other musician's being ranked lower than those of the expert. This suggests that *"shared understanding of what happened is not essential for successful improvisation"* (ibid., p1), a conclusion that is relevant to this research.

The experience of audience members engaging in *Interactive Musical*

Participation with musicians who are fluent improvisers within the contemporary jazz idiom has been evaluated through the use of *Human-computer Interaction* (HCI). One of the main goals of *Human-Computer interaction* is *End User Computing Satisfaction*. This can be researched through the lens of activity theory which provides a qualitative research methodology to enable that outcome. Kuutti breaks down activity theory into the following components.

> *"An activity is a form of doing directed to an object, and activities are distinguished from each other according to their objects. Transforming the object into an outcome motivates the existence of an activity. An object can be a material thing, but it can also be less tangible"* (Kuutti,1996, p14).

In Kuutti's framework it is the *tool* that provides the mediating element between *object* and *activity*. Within this research the *activity* is the improvised performance, the *tool* is the digital controller and the *object* the performance outcome. This theoretical model should provide a robust framework for analysing the creative, technological and sociological elements of the process as well as being able to describe the interactional dynamics between actions and operations.

Hödl et al. followed Kiefer et al. in testing musical controllers in the context of the evaluation of musical interaction. Kiefer et al. presented a case study using HCI methodology to evaluate a Nintendo WiiMote as a

musical controller. They reflected that

> *"the results showed a detailed and intimate understanding of the controller in a musical context... but there is no data about their experience in the moment while they were using the device, something that would seem important for a musical evaluation"*

and concluded that

> *"The third wave of HCI holds promising potential for computer music; the two fields share the common goal of evaluating experience and affect between technology and its users"* (Kiefer et al., 2008).

Stowell and Maclean have investigated improvisation in the context of human-computer interaction and their findings suggested that

> *"For live music-making, what is needed is more of a 'third wave' approach which finds ways to study human-computer interaction in more musical contexts in which real-time creative interactions can occur. And live music-making can feed back into HCI more generally, developing HCI for expressive and ludic settings and for open interactions"* (Stowell and Maclean, 2013, p4).

The quantification of real-time interactions in improvisation is a research instrument yet to be developed but a more fruitful direction for this research may be drawn from Breel (2015) in a paper that focuses on

audience agency in participatory performance. Breel's methodology takes its inspiration in part from participatory action research (PAR), described by Kind, Pain and Kesby as being

> *"a socially constructed reality within which multiple interpretations of a single phenomenon are possible by both researchers and participants*" (cited in Breel, 2015, p371).

Using PAR as a tool creates an opportunity for the researcher to use a variety of methodologies and engage in research processes that afford collaborative knowledge production. The second element in Breel's methodology is drawn from interpretative phenomenological analysis (IPA) research which

> "*combines a phenomenological perspective of embodied, situated experience with a hermeneutic approach, encouraging awareness that experience is necessarily already interpreted when expressed and in IPA is then interpreted again by the researcher…IPA focuses on the attempt to make meaning out of the experience through interpretation*" (Breel, 2015, p372).

Breel's research utilises three survey instruments:

i) A questionnaire to try to identify which performance elements were most *meaningful*
ii) A *creative response* to the performance
iii) Individual interviews to add more detail to the responses to the

questionnaire

This research will use the first and third instruments from Breel (2015) as the *creative response* option was not suitable in a jazz concert and club environment.

2.9 Conclusion

The studies within this Literature Review provide important insights into the multiplicity of ways that Small's (1998) conception of *musicking* has at the time of writing been developed into a more collective and *social* approach to performance. With a typology of modes of interactivity within music performance having been constructed by Freeman (2005) and within broader areas of performance by Breel (2015) it has been possible to categorise and analyse many participatory artefacts.

Lee and Freeman's (2013) set of criteria to enable a successful audience participatory experience provide a solid framework for further research and Oh and Wang's (2011) conclusions on the value of the mobile phone are important signalling an ubiquitous and accessible technology that can be utilised for *Interactive Musical Participation.*

The evidence gathered from non-musical examples outline more immersive possibilities for interactivity than hitherto realised within the field of music performance and provide models both for integrating interactivity into existing performance models and for creating novel

experiences. The critical framework for these approaches is drawn from Barthes' conception of the *Death of the Author* (Barthes & Heath,1977) and Attali's understanding of the limitations of a technologically driven creative process (Attali,1985). The importance and understanding of audience *agency* as a necessity in participatory performance is drawn from Fischer-Lichte (2008) with Rancière (2009) suggesting that audience passivity is a disempowering act.

The writings of Bishop and Martin (Bishop, 2004; Bishop, 2012; Martin, 2007) provide an insight into the more contested theoretical world of contemporary art and participative art in particular. As much as anything this research has highlighted the divergence in critical approaches to the *social turn* in contemporary art and music and has identified a potential area for future critical engagement if the technologies and practice of participation in music move from the academic fringe towards the mainstream of cultural activities.

This study of the research presented so far has highlighted a gap in both the literature surrounding and creative practice of *Interactive Musical Participation* within contemporary jazz. This presents the opportunity for novel research and creative practice that will form the body of the next sections of this thesis.

Chapter 3 – Methodology

3.1 Key Gaps in Research and Knowledge

Interactive Musical Participation is an emergent field with ongoing work being undertaken to extend their research and address gaps in knowledge by many of the authors and practitioners covered in the Literature Review of this thesis. Levin (2001), Bianciardi et al. (2003), Hödl et al. (2012) and many other researchers have created a large and growing body of literature that investigates *technological interface development*; however, the research presented here is specifically *not* focused on the creation of novel interfaces and the exploration of their affordances. It does investigate interface scalability and flexibility following on from the questions raised by Levin (2001), Berkowitz (2013), Weitzner et al. (2014) and CoSiMa (2017).

Within the area of audience experience Bianciardi et al. (2003), Freeman and Godfrey (2008) and Hödl et al. (2012) identify the necessity of guaging the appropriate level of technical training in the use of the interface. Hödl et al., (2012), Wulfson (2006) and Lee and Freeman (2013) all study the creation of a balance between the affordances and limitations of the interface, also a key area of investigation for the case studies presented in chapters 4 and 5; and CoSiMa (2017) attempts to

ensure a *playful* and *satisfactory* experience for both musicians and audience, another desired outcome of this research. Wulfson (2006) considers the process of creating an awareness within the audience of the outcomes of mediated action via a computer-based interface and Freeman and Godfrey (2008) and Oh and Wang (2011) try to determine the relationship between the audience's input and the musical outcomes. These are all continuing areas of inquiry with each performance context and interactive technology demanding a different process.

Much of the literature such as Hödl et al. (2012) and McAllister et al. (2004) addresses both the suitability of the choice of musicians, in regard to their responsiveness to unexpected changes, and the accessibility of the genre, which can assist with audience engagement. Also from a sociological perspective McAllister et al. (2004), Berkowitz (2013) and Lee and Freeman (2013) analyse the relationships not only between audience and musicians but also between fellow members of the audience. All of these issues are relevant to this work but have previously been raised in the literature reviewed above.

Alongside the ongoing questions raised by previous studies, there are clear gaps in knowledge that have not been covered by the research undertaken up until this point in time. The primary novel element of this investigation is the application of *interactive performance technology* to an existing genre with its own defined compositional and improvisational

structures and performance protocols. Rather than designing the compositional and improvisational structures around the affordances of the interactive technology, the technology has to function within the parameters of tonal and metrically regular contemporary jazz which allows for an analysis of the effects of *Interactive Musical Participation* on the genre's compositional and performance protocols.

3.2 Research Questions

The diversity and scope of the areas identified in the Literature Review presented in Chapter Two are too wide to engage with fully. However, there are some clear lines of enquiry that can be extrapolated leading to the following *research questions*:

1) What is the experience of audience members engaging in *Interactive Musical Participation* within contemporary jazz?

2) What are the opportunities for incorporating *Interactive Musical Participation* within contemporary jazz?

Following on from these *research questions*, the following *research objectives* are devised.

1) To investigate how modern technologies can be utilised to engage audiences with improvisation in contemporary jazz performance.
2) To investigate a variety of software and hardware interface technologies, and the training that will be needed to use them, to enable *Interactive Musical Participation* within the contemporary jazz idiom.
3) To investigate how standard compositional and improvisational structures and performance protocols within the contemporary jazz idiom will need to be altered to enable *Interactive Musical Participation.*

These three *research objectives* are all related to the design or evaluation of *Interactive Musical Participation* within the contemporary jazz idiom.

3.3 Theoretical Underpinning

This PhD is a *practice-based* piece of research combining jazz performance, improvisation and composition with interactive musical performance. Jaaniste and Haseman conclude that

> *"Practice-led research in the creative sector inserts practice into research by offering creative works, designs, content and events as core research outputs."* (2009, p3).

As Haseman and Mafe suggest this type of research allows for heuristic and intuitive methodologies to problem solving as opposed to the *"established and authoritative research paradigms"* (Haseman and Mafe, 2009, p211) that drive traditional *objective* research. They also question the very existence of *objectivity* in a quantum universe seen through a post-structuralist lens. Scrivener (2002) extends the debate arguing that the research-led artistic practioner must create outputs that are *culturally novel* within the field of their practice.

There are a variety of approaches to defining the appropriate nomenclature within the research field that encompasses arts practice. Candy (2006) draws a distinction between *practice-based* and *practice-led* research with the primary difference being the centrality of an artefact to the research process. From Candy's perspective *practice-based* research uses the artefact to drive the quest for new knowledge whereas *practice-led* is driven by the study of the process within the practice and may not feature an artefact at all.

One of the major issues for the *practice-based* researcher is to find an overarching methodology. Williams in Macarthur at al. (2016) proposes a Deleuzian-Guattarian approach to creating a theoretical understanding of *practice-based* creative research. Citing Barad's conception of "*intra-action* which *signifies the mutual constitution of entangled agencies*" (Barad in Williams, 2016, p48), Williams argues that the *intra-action* of theory and practice is *immanent* to creativity and that creative arts

research should be seen as an assemblage constructed out of stable Deleuzian-Guattarian *molar* lines and more contingent *molecular* lines. Within this model *lines of flight* allow for the destruction of the fixed points of *molar* knowledge and this *molar/molecular* dichotomy can be used as a model not only for this research but also as a way of approaching the methodologies of jazz improvisation which are central to this thesis. Within the compositional structures of the artefacts presented in this thesis, the elements of *chord-scale theory* (Russell 1959; Mehegan 1959; Nettles and Graf 1997; Mulholland and Hojnacki 2013) are transformed into stable Deleuzian-Guattarian *molar* lines, and performance protocols developed through a more heuristic process are the *lines of flight* composed of the more contingent *molecular* lines. Each performance of any of the compositions featured in this research will be *molecular* because the improvisatory and collaborative elements that are built in will lead to different outcomes.

Drawing on a research perspective from the field of evolutionary developmental biology, an *ontogenic* model can be applied to the practice of *interactive* improvised musical performance (Gould, 1977). In this model the performance is perceived as a multi-cellular *organism* which can grow, is responsive to external stimulation, can develop and reproduce and in an *homeostatic* analogy remains within a regulated tempo. This *ontogenic* perspective provides a workable framework for an analysis of the musical outcomes of a performance and a useful analogy for comparing performances using the same source material.

Much as identical twins share the same DNA but aren't always exact copies of one another, so each performance of a composition starts with the same source material but grows into its own distinct identity.

Whilst the *ontogenic* perspective provides a focus on the artefact, Metacommunicative Performative Competence (MPC) (Newton, 2014) provides an effective tool for analysis of the liminal nature of the interactive audience/performer relationship *"with emotion and somatic sensation rather than intellectuality and causality"* (Newton, 2014, p8) as its focus.

As we move into the age of *Artificial Intelligence* which may be marked by human interactivity with machines on an equal and possibly subservient level, *actor-network theory* (ANT), the *"analytically radical"* (Law, 1992, p3) sociological method of research developed by Bruno Latour (2005), Michel Callon (1986) and John Law (1992) provides a useful framework for understanding the relational ties and mechanics of power and organisation within networks, and specifically within this research the networks of *Interactive Musical Participation*. Dankert describes ANT as being *"well suited for exploratory research in areas that have not been investigated much already"* sometimes giving new and sometimes unexpected conclusions (Dankert, p6).

In ANT networks are both heterogeneous and non-hierarchical; they are heterogeneous because As Law notes they *"are composed not only of people, but also of machines, animals, texts, money, architectures -- any*

material that you care to mention" (Law, 1992, p2). The nature of a non-hierarchical network is well-articulated in a quote from Callon's seminal ANT analysis of the development and subsequent failure of the VEL (véhicule électrique) in France in the early 1970s.

> *"None of these ingredients can be placed in a hierarchy, or be distinguished according to its nature. The activist in favour of public transport is just as important as lead accumulators which may be recharged several hundred times"* (Callon, 1986, p23).

For Bruno Latour ANT

> *"… is a change of topology. Instead of thinking in terms of surfaces - two dimension- or spheres -three dimension- one is asked to think in terms of nodes that have as many dimensions as they have connections…"* (Latour, 1996, p3).

He continues

> "*This is the most counter-intuitive aspect of AT* (ANT). *Literally there is nothing but networks, there is nothing in between them, or, to use a metaphor from the history of physics, there is no aether in which the networks should be immersed"* (ibid., p4).

Law explains the radical analytic nature of actor-network theory positing that *"it treads on a set of ethical, epistemological and ontological toes"* by not elevating people over objects (Law, 1992, p3) and by uncovering the connections that link entities and that allow for the creation of new

entities. ANT can be seen as being an ontologically constructivist approach that is neither looking to challenge hegemonic structures nor to impose a socially constructed viewpoint on networks in which machines or objects have as much of a right to agency as humans.

As Latour points out *"It does not wish to add social networks to social theory but to rebuild social theory out of networks. It is as much an ontology or a metaphysics, as a sociology"* (Latour, 1992, p2) .

The people, objects, concepts and animals that can make up a network are known as *actors*, grouping together to create *actor-networks*. In ANT the term *actor* is sometimes replaced with *actant* defined as *"that which accomplishes or undergoes an act*" (Dankert, p3) and each actor also has its own network above and beyond any other networks it may be involved in (Law, 1992, p4). For consistency the word actant will be used throughout the rest of this thesis. Through the application of *agency*, actants interact and change each other with Dankert explaining *"that not only humans, but also non-human entities are influencing us constantly. Some people 'have to' watch when a television screen in their surrounding is turned on"* (Dankert, p3). Interaction is achieved in the form of *immutable mobiles* that enable the interactive *flow* between actant-networks. Dankert observes that

> *"An example of this can be information. When we want to flow information from the desk of a researcher to the meeting of the management team at a company where important decision are*

> *made, we have to put the information into a form that can be understand by the managers. Usually scientists do so by writing a popular version of their reports. In that case, the report would function as an 'immutable mobile' as it is able to let the information flow from one actant-network to another"* (ibid., p5).

Within the ANT network Latour identifies an *intermediary* as *"what transports meaning or force without transformation: defining its inputs is enough to define its outputs"* and a *mediator* as something that will *"transform, translate, distort, and modify the meaning or the elements they are supposed to carry"* (Latour, 2005, p39). With this threat of mediated uncertainty ever present, the actant-network embodies instability with the possibility of collapse at any moment as each actor reassesses its position in the network or, if an object, stops functioning effectively. Law describes the theory as

> *"a concern with how actors and organisations mobilise, juxtapose and hold together the bits and pieces out of which they are composed; how they are sometimes able to prevent those bits and pieces from following their own inclinations and making off"* (Law, 1992, p6).

In ANT terms through a process of *punctualisation* an actant-network of seemingly complex technical elements such as a television can become a discrete standalone entity known as a *black box.* However, if the television breaks down *"it rapidly turns into a network of electronic*

components and human interventions" (ibid., p5). As Law notes "*Punctualisation is always precarious, it faces resistance, and may degenerate into a failing network"* (Law, 1992, p6).

Attali states that "*Music is more than an object of study: it is a way of perceiving the world. A tool of understanding"* (Attali, 1985, p4). The manner in which the multi-dimensional, nodal, heterogeneous and non-hierarchical nature of ANT articulates the transitory nature and ephemerality of networked connections makes it an appropriate theoretical lens for the practice of *Interactive Musical Participation* as presented in this thesis. The studies featuring *Interactive Musical Participation* in Chapters 4 and 5 will be seen from an ANT perspective to bring together *"human and non- human entities"* in the *punctualised entity* or *black box* that is the performance. The analysis of the networks and connections in these performances adds theoretical depth and understanding to the two questions that are the focus of this research.

3.4 Research Design

The *practice-based* elements of this thesis are formed out of the creation of two artefacts, both combining jazz performance, improvisation and composition with *Interactive Musical Participation* to create a novel approach within participatory art. The artefacts presented in the portfolio have been developed in sequence with the methodology for each work stemming from an analysis of the outcomes of the previous performance. The pilot composition entitled *The Singularity* was

presented at the *Innovation in Music* conference, London, 2017. The performance was designed to investigate the feasibility of this research, and to draw conclusions that could be fed into the next stage.

The Singularity was performed by the author of this thesis. Backing tracks were live edited and a variety of sonic events triggered by five volunteer members of the audience via smartphones and games controllers. The performance established that the proposed technical infrastructure for this research was secure and provided an opportunity for the development of the novel *performance protocols* that are at the heart of the *research objectives*. Feedback was delivered informally in a question and answer session and by the author's subjective analysis.

The second composition titled *Deeper Love* was piloted in September of 2018 at the Crosstown Traffic conference in Huddersfield and then performed in December 2018 and March 2019 at the *Area 51* performance space - University of Westminster, at the *East Grinstead Jazz Club*, and finally at the *Toulouse Lautrec* jazz club in Kennington. These four performances integrated the *performance protocol* data gleaned from the performance of *The Singularity* into the compositional structure of *Deeper Love* and increased the scale of participation by using the audience's smartphones as sound sources triggering sounds from a bespoke app.

This confluence of *distributed performance* (CoSiMa, 2017), participatory performance (Hasse, 2017) and *Interactive Musical Participation* created

a new type of *blended performance* space affording both individual and collective *sonic dialogue.*

The challenges of this research include the management of a technical infrastructure that affords real-time interactivity within a performance environment, and to deliver creative content that will deliver to both audience and performers the visceral immediacy of Abromavić's "*energy dialogue"* in a format that can be quantified. A solid methodological underpinning is essential for three key areas of this research.

i) *Compositional structure and performance protocols*

ii) *Technological infrastructure*

iii) *Methods of analysis*

3.4.1 Compositional structure and performance protocols

Bailey describes improvisation in *"conventional jazz"* as being *"based on tunes in time"* (2009, p48). The improvisational material is built out of scales generated from the individual chords that make up the harmonic structure of the composition in a process that has become known as *chord-scale theory* (Russell 1959; Mehegan 1959; Nettles and Graf 1997; Mulholland and Hojnacki 2013). The repeating chordal sequences from which the improviser's scales are derived are typically drawn from the 12 bar blues or other archetypal popular song forms (Bailey, 2009).

This research does not attempt to move beyond these compositional and harmonic norms that make up the *domain* (Csikszentmihalyi, 1988, 1990) of contemporary jazz because its focus is on the relationship between improviser and *audience-performer* when co-creating in an interactive context. However, to make an interactive project work it will be necessary to build some rules into the compositional process. Soules has established that

> *"Protocols - 'long-established code' determining 'precedence and precisely correct procedure' - may at first seem antithetical to popular notions of improvised creativity. However, interdisciplinary research into the nature of improvisation shows that it typically occurs either within, or in close relation to, voluntary constraints. Pressing, for example, writes: 'To achieve maximal fluency and coherence, improvisers, when they are not performing free (or "absolute") improvisation, use a referent, a set of cognitive, perceptual, or emotional structures (constraints) that guide and aid in the production of musical materials'"* (Soules, 2004. p269).

Eno reinforces this argument when he says

> *"An experimental composition aims to set in motion a system or organism that will generate unique (that is, not necessarily repeatable) outputs, but that, at the same time, seeks to limit the range of these outputs.*" (Cox and Warner, 2004, p227).

It is one of the primary goals of this research to develop protocols that

can be applied to the field of *Interactive Music Participation.*

3.4.2 Technological Infrastructure

The technological infrastructure for this research has been built out of findings presented in the Literature Review. The evidence presented suggest that It is primarily *digital technologies* that create the possibility for novel types of *interactivity* such as that presented in this study.

Drawing from Cook (2001 and 2009), the design and prototyping of a DIM or controller was not the focus of this work as there were readily available technologies including digital audio workstations Ableton Live (2017) and Logic Pro X (Apple, 2019), and digital protocols such as Open Sound Control (OSC) (Opensoundcontrol.org) which could deliver the programming and networking requirements. The *ubiquity* and accessibility of mobile smartphones and gaming controllers from the Wii gaming console made them an obvious choice as a controller front-end for the *audience-performers*, allowing the research to concentrate on the creative *interactions* rather than the techn*ological process*.

To enable Rosenkransa's (2010) *frequency of engagement* and synthesizing the conclusions drawn from previous research, the design of the technological infrastructure for this project was based on eight principles. It needed to be:

i) *informal*

ii) *interesting*

iii) *immediate*

iv) *accessible*

v) *natural*

vi) *necessary*

vii) *affordable*

viii) *scalable*

Analysis of the artefacts presented in later chapters will determine whether utilising off-the-peg technological solutions with accessible interfaces such as smartphones and game controllers sets the conditions for successful *Interactive Musical Participation* and the delivery of the *research objectives*.

3.4.3 Methods of Analysis

The collection of information from performers and audience follows a mixed-method approach integrating both qualitative and quantitative data from a pragmatic perspective. Using a mixed-method approach can deliver a deeper understanding of the central research issues than either qualitative or quantitative methods on their own (Creswell, 2002). Quantative data has been gathered through the use of self-completion questionnaires for the *audience-performers*, with qualitative open-ended interviews of *audience-soloists* expanding on the quantative results. All

the studies were cross-sectional in nature with the individuals sampled for the questionnaire being self-selecting from the attendees at the four *Deeper Love* performance research events.

Figure 3.1. Deeper Love Performance in Area 51 10/12/18

The questionnaires were completed at the end of the performances which took place as follows:

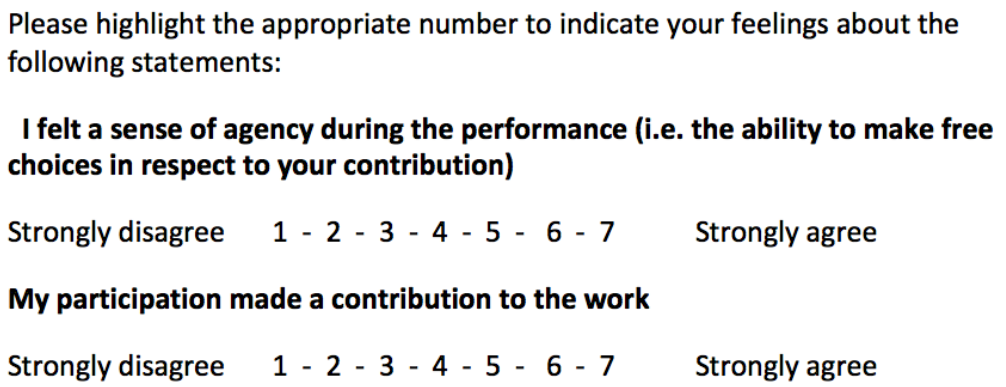
1) 10th December 2018 – *Launch event - Area 51* at the University of Westminster
2) 18th December 2018 - *East Grinstead Jazz Club*
3) 19th December 2018 - *Toulouse Lautrec* jazz club in Kennington, London
4) 20th March 2019 - *Area 51* at the University of Westminster

Given the nature of the events it was impossible for the sample population to be stratified with any level of accuracy. However, it would

be fair to say that these were all audiences interested in music - jazz, interactive performance or both, having responded to advertising as the trigger for attendance; it has therefore been necessary to utilise a heuristic approach to draw any conclusions based on income level, age and gender.

The purpose of the data collection is to gather information to explore the two primary *research questions* that are at the heart of this thesis as outlined in Chapter 3.2.

The first question has been addressed by means of a quantative instrument entitled *Audience Questionnaire.* The author of this research designed the questionnaire which was constructed on a continuously scaled *question and answer grid* based on ordinal variables and using a seven-point Likert scale with responses analysed separately and summed.


Please highlight the appropriate number to indicate your feelings about the following statements:

I felt a sense of agency during the performance (i.e. the ability to make free choices in respect to your contribution)

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

My participation made a contribution to the work

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

Figure 3.2 Audience Questionnaire Sample Questions

The questionnaire is modelled on an existing instrument in Breel (2015) but as recommended by Creswell (2002) many of the questions have

been amended after a process of informal pilot testing with friends and family. Using a different approach to Breel there was a deliberate lack of balanced keying in the formation of the questions. Having piloted the questionnaire the feedback received was that negative statements combined with the negative statement *Strongly disagree* caused some level of confusion in the respondents and a subsequent disinclination to complete the questionnaire. With time being an issue post-performance and wanting to ensure the highest level of completion possible, more positive than negative statements were included leading to the possibility of *acquiescence bias.*

From an ethical perspective it was important for there to be an awareness of the author's positionality as a person of power and influence within the *audience research events* that involved students or prospective students, and to acknowledge how that status may have pressured students either to complete or to give a *favourable* answer to the questions.

Following Breel's model, *open-ended, unstructured* qualitative interviews took place in addition to the questionnaire. Burgess describes qualitative interviews as *"conversations with a purpose"* (cited in Mason, 1996, p38) with the researcher co-producing the data with the interviewee. This approach can draw out a greater degree of authentic material from the interviewee than a more rigid procedure, and used together with a questionnaire-based survey can give depth to the research. To be a

successful interviewer it is important to be respectful to and interested in the subject, to be flexible, to take on board the subject's point of view and to be prepared to listen (Byrne, 2012, p207).

From an ethical perspective it is important to acknowledge that the position taken by the researcher affects the interview's contents, its analysis and the approach taken (ibid., p213). The interviews took place either face to face or on the telephone with written or verbal permission being granted, the transcripts being anonymised, and the original recordings being stored safely on a hard drive that has been locked away.

Chapter 4 - Pilot Study - The Singularity

4.1 Introduction

Audience collaboration in music performance is present in many contexts, from the pub sing-a-long to the call and response rituals of African and African-American cultures. As mentioned in the Literature Review there is a growing body of academic research that explores interactive audience collaboration using a variety of digital technologies. Many of the compositions and collaborative performances that have emerged have been driven by the affordances of these technologies. However very little research has been found in the literature with a focus on exploring the compositional and performance protocols that need to be developed to create successful interactive audience participation within an existing genre using pre-existing technology.

4.2 Objective

The major objective of this study is to create a dialogue between performer, audience, composer and technology by creating a pilot study composition and performance's drawing on Eco's conceptions of *open works* (Eco, 1962), which, according to Robey require of the public

"a much greater degree of collaboration and personal involvement than was ever required by the traditional art of the past"

(Eco,1989, pX1).

Inspiration for the composition's title and approach is drawn from technologist Ray Kurzweil who popularised the term in his book *The Singularity is Near* (Kurzweil, 2005). Kurzweil defines The Singularity as the moment when AI matches the level of human intelligence and notes that the future will be a dialogue with machines in which AI collaborates with humans (Kurzweil, 2005, 35-43).

The combination of this research objective and the influence of Kurzweil led to the creation of the pilot study composition entitled *The Singularity*. Any performance of *The Singularity* creates a network of pre-programmed and random AI machine-generated elements with live performances from the performer and the audience performers with each element having some form of interaction with the others.

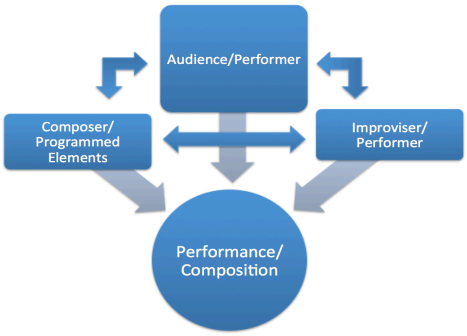


Figure 4.1 Performance Model

Using the compositional and performance structures of contemporary jazz as a model that is particularly suited to improvisational interaction,

audience-soloists use handheld digital controllers to trigger different sections of the composition as well as pitched and non-pitched sound events to create the interaction between themselves, the technology and the performer.

4.3 Composition Construction

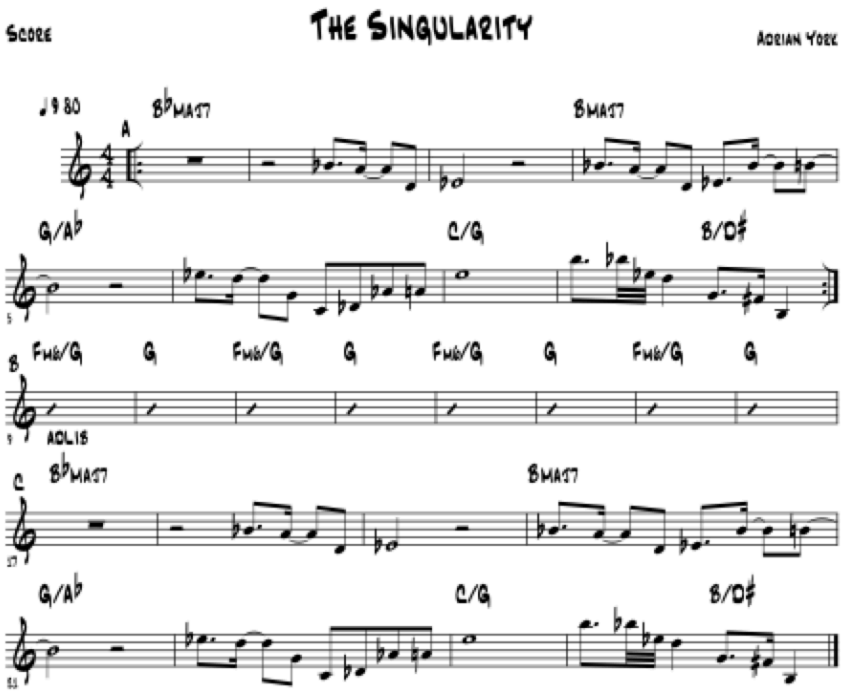


Figure 4.2 The Singularity Score

As with many jazz standards as well as songs from The Great American Songbook, *The Singularity* is constructed around an AABA compositional structure with each section being eight bars in length. The A section shifts between Bb, B and C tonalities with a passing movement through an Ab diminished chord. The B section moves

between a G Phrygian and Ionian/Lydian with the repeating final A section coming at the end of the form.

The melody is mostly based on semitone and 5th intervals and is articulated by the performer using a lead synth sound. The melody can be heard in a video at the following link https://youtu.be/WWUsikRNG38. Once the melody has been played by the performer over the AABA structure each of the four WiiMote *audience-soloists* takes it in turn to improvise. Each of these improvisations is followed by an improvised musical dialogue with the performer. After each of the *audience-soloists* have finished their improvisations, all the performers engage in a collective improvisation. The performance ends after the performer plays the melody one final time. There are a series of programmed backings for the improvisation sections selected by the audience-performer who controls the iPhone. These did not necessarily match the AABA structure and harmonic format of the melody section. This relinquishing of some control of the compositional structure to the performer is similar Eco's report of Henri Pousseur's description of his piece *Scambi*, as

> "*not so much a musical composition as a field of possibilities…Since the performer can start or finish with any one section, a considerable number of sequential permutations are made available to him"* (Eco, 1989,1-2).

4.4 Technical Infrastructure

The technical challenge raised by the performance of The Singularity (2017) was to create an infrastructure that was robust enough to

1. Withstand the stresses of live performance
2. Provide powerful enough WiFi and Bluetooth networks to create a stable platform for the controllers
3. Provide a level of accessibility that met Lee and Freeman's (2013) five criteria
4. Enable Ray Kurzweil's *dialogue with machines* (Kurzweil, 2005, 35-43)

All sounds were generated from the Digital Audio Workstation AbletonLive (Ableton, 2017) with the programme running on a MacBook Pro.

Figure 4.3 The Singularity Ableton File

Using a phone app entitled TouchOSC (Hexler, 2019) that sends and receives Open Sound Source control messages, an iPhone triggered different “scenes” in the Ableton Live Master Track with each scene being a different section of the composition. Open Sound Source control is a communication protocol for electronic music instruments optimised for modern communication networks. This process can be seen in the video at the following link https://youtu.be/qnOQqNWSmuA.

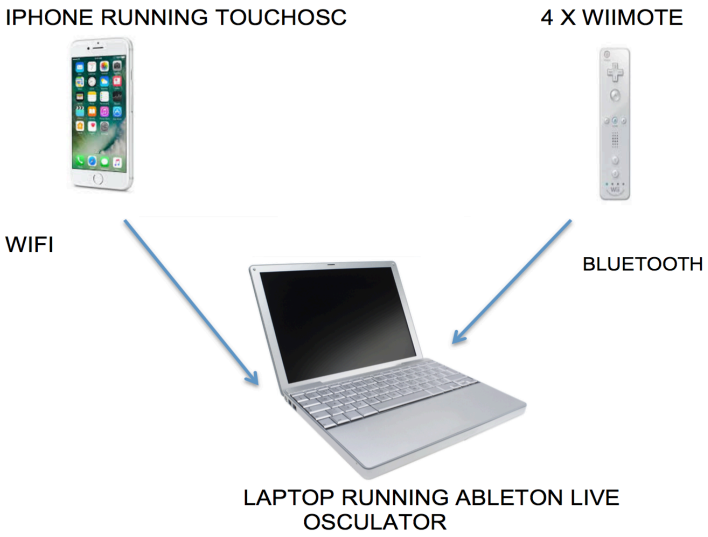


Figure 4.4 Project Network

TouchOSC connects via WiFi to an application on the MacBook called OSCulator (Osculator, 2019) that transfers the control signals from TouchOSC to Ableton Live.

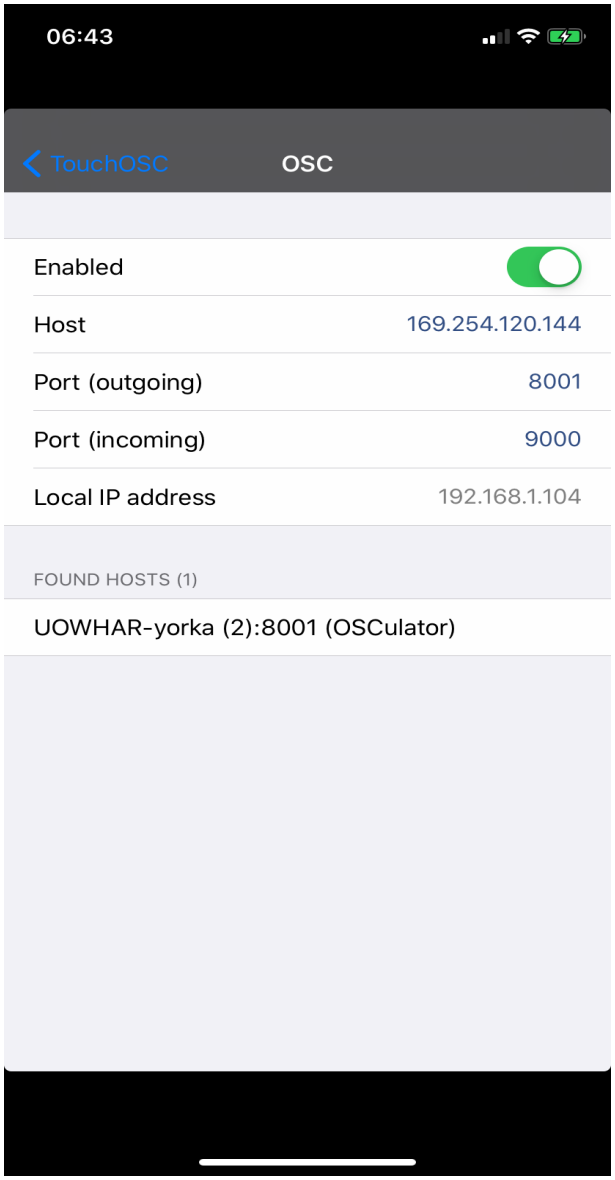


Figure 4.5 TouchOsc Connectivity

Four WiiMote controllers are used to change parameters within Ableton Live also connecting via OSCulator but using Bluetooth rather than WiFi for connectivity.

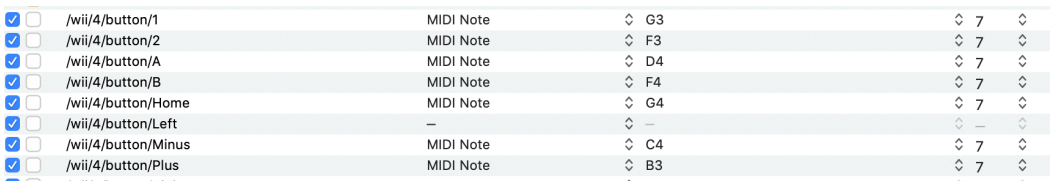


Figure 4.6 Osculator Wii 4 Settings

The sounds triggered by the WiiMote controllers along with the parameter changes can be seen in a video at the following location https://youtu.be/24a_go4JcIA.

There had been problems with the WiFi at the venue for the pilot performance of *The Singularity* and after consulting with the IT department it was decided that the best way to ensure a stable connection between the iPhone and the laptop was to generate a computer to computer network from the MacBook.

Figure 4.7 TouchOsc BeatMachine Configuration

This was a very effective solution that allowed the audience-performer using TouchOSC on the iPhone to trigger Ableton clips without there being any dropout. The global quantisation for these clips was set to 8 bars ensuring that each newly triggered clip entered at the end of an

eight-bar passage with the previous one finishing its cycle thereby creating smooth transitions between sections and sustaining the flow of eight bar sections.

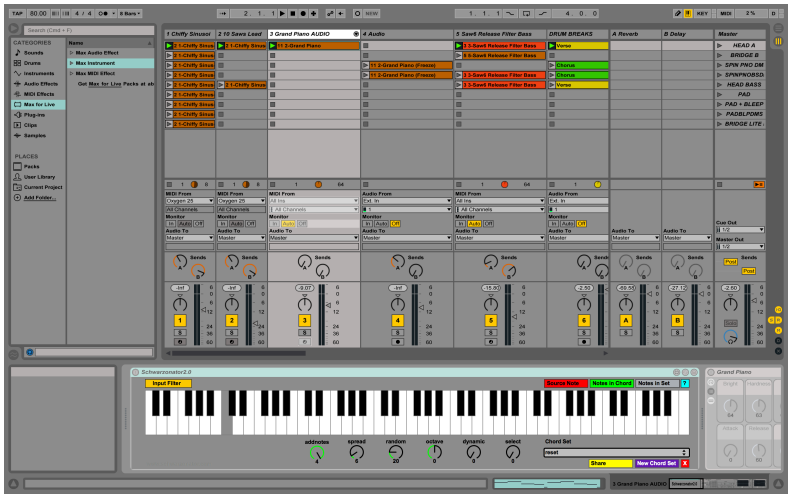


Figure 4.8 Ableton Live and Schwarzonator 2.0

Addnotes	Spread	Random	Octave	Dynamic
4	6	26	0	0

Table 1. Schwarzonator 2.0 control settings

The Max For Life Schwarzonator 2.0 plug-in was used on the piano track to generate random chord voicings built on the harmony of the composition and adding an AI element to the performance. The *addnote* function allows you to choose the density of each voicing, *spread* marks the range across the keyboard that the voicings inhabit, *random* shifts notes up and down in a random manner, *octave* shifts notes up and down and *dynamic* adds a random element to the note's velocity. The piano part with the addition of Schwarzonator can be seen at the following link at https://youtu.be/afBmPznM3IU and the original part

without the addition of Schwarzonator can be seen at

https://www.youtube.com/watch?v=VvFTiqm_FL8.

Figure 4.9 WiiMote Controllers

The four WiiMote controllers were numbered and colour-coded with each of them controlling a specific sonic element.

WiiMote 1	Controls pitch of 80-Elaspsych-Shy loop
WiiMote 2	Controls pitch of Electric Screamer Lead synthesizer
WiiMote 3	Controls dry/wet mix of delays on Slap 120 bpm loop
WiiMote 4	Triggers pitches Bb, C, D & F on Arp Pluck sample

Table 2. WiiMote Sonic Element Control – *The Singularity*

The performer used an M-Audio Oxygen 25 keyboard to perform the melody and to create improvisations using a blend of the Chiffy Sinusoi

and 10 Saws Lead synthesizer patches on Ableton Live using a USB direct connection in to the Macbook Pro laptop.

Each of the elements in the technical infrastructure for the performance of *The Singularity* functioned effectively establishing it as a good model for future research purposes.

4.5 Performance Protocols

The *performe*r functions as the musical director/conductor/MC of the performance as well as setting up and managing the equipment and software. At the start of the performance the *performer* follows the instructions listed below which involve finding five volunteer *audience-soloists* and leading them through the performance.

PERFORMANCE INSTRUCTIONS – P = PERFORMER. V = VOLUNTEER

1. GET 5 VOLUNTEERS
2. GIVE IPHONE TO V1 PLUS INSTRUCTIONS
3. GIVE WIIMOTES TO VS 2-5 PLUS INSTRUCTIONS
4. EXPLAIN TRACK LENGTH AND FORMAT
5. P TO CUE SOLO SECTIONS. EACH V TO GO IN TURN – SHORT EXPLORATION FOLLOWED BY A DIALOGUE WITH P

6. ALL TO PERFORM TOGETHER ON CUE
7. P TO FADE MASTER

Figure 4.10 Performer Instructions for *The Singularity*

Each of the *audience-soloists* were given the following set of colour-coded performance protocols matching the colour of their WiiMote and technical instructions which they were to read before the performance.

THE SINGULARITY AUDIENCE-SOLOIST INSTRUCTIONS

1. MAKE SURE POWER LIGHTS ARE ON
2. AFTER MELODY SECTION START PERFORMING ON CUE FROM PERFORMER EACH IN TURN (AP1, AP2, AP3, AP4)
3. MAKE YOUR PEFORMANCE A SHORT EXPLORATION OF THE POSSIBILITIES FOLLOWED BY A DIALOGUE WITH THE PERFORMER
4. ON CUE FROM THE CONDUCTOR PERFORM TOGETHER UNTIL THE TRACK FADES

TECHNICAL INSTRUCTIONS

AP 1 – PRESS BUTTON 1 ON THE WIIMOTE TO TRIGGER OR TO STOP THE SOUND. CURL YOUR ARM HOLDING THE WIIMOTE UP AND

DOWN TO TRANSFORM THE SOUND. THIS SHOULD INITIALLY BE DONE QUITE SLOWLY TO ALLOW FOR SONIC EXPLORATION.

AP 2 – PRESS AND HOLD BUTTON 1 ON THE WIIMOTE TO TRIGGER THE SOUND. CURL YOUR ARM HOLDING THE WIIMOTE UP AND DOWN TO TRANSFORM THE SOUND. THIS SHOULD INITIALLY BE DONE QUITE SLOWLY TO ALLOW FOR SONIC EXPLORATION.

AP 3 – PRESS BUTTON 1 ON THE WIIMOTE TO TRIGGER OR TO STOP THE SOUND. CURL YOUR ARM HOLDING THE WIIMOTE UP AND DOWN TO TRANSFORM THE SOUND. THIS SHOULD INITIALLY BE DONE QUITE SLOWLY TO ALLOW FOR SONIC EXPLORATION.

AP 4 – PRESS BUTTONS 1, 2, +, - OR A ON THE WIIMOTE TO TRIGGER THE SOUND. CURL YOUR ARM HOLDING THE WIIMOTE UP AND DOWN TO TRANSFORM THE SOUND. THIS SHOULD INITIALLY BE DONE QUITE SLOWLY TO ALLOW FOR SONIC EXPLORATION.

Figure 4.11 Audience/Performer WiiMote Instructions

The audience-performer controlling the musical structure of the performance was given the following instructions:

TOUCHOSC INSTRUCTIONS

There are 9 Purple switches. Each one triggers a cycle of music. When you trigger a switch it will play through to the end of its cycle before the next one triggers. For added performance pleasure play with the yellow slider when the bass synth is playing.

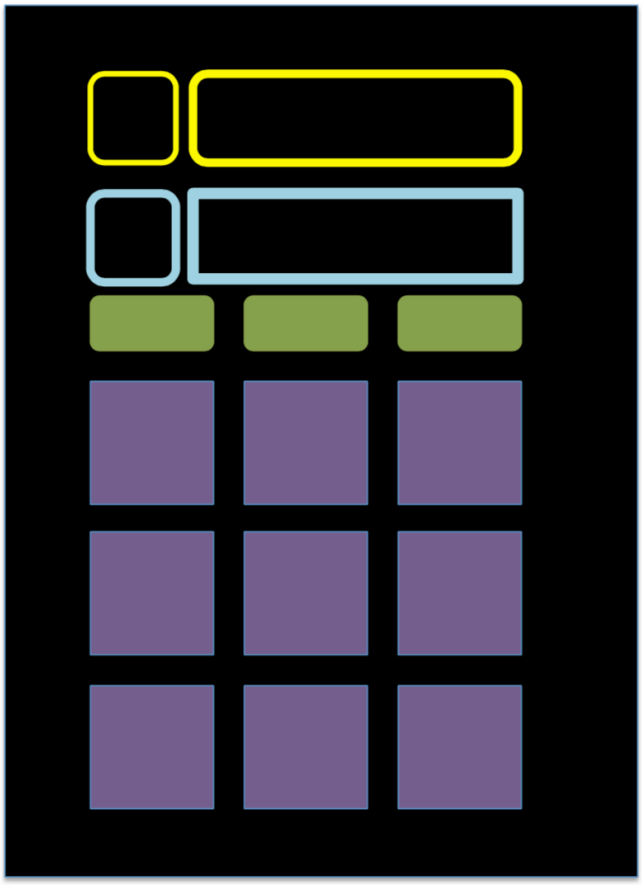


Figure 4.12 Audience-Soloist TouchOsc Instructions

4.6 Personal Subjective Analysis

Approximately 50 audience members attended the pilot performance of The Singularity at the Innovation in Music Conference in September 2017. The technical infrastructure was robust despite running 4 Wiimotes

simultaneously and the computer to computer network provided a stable WiFi framework allowing for WiiMote functionality from anywhere in the hall.

This performance met the five Lee and Freeman (2013) criteria in that

1. Participation was easily accessible
2. Gestures from the audience were turned them into a single musical composition
3. *Audience-soloists* had no reservations about participating
4. *Audience-soloists* were motivated to perform and sustained interest in their participation
5. *Audience-soloists* in some instances identify a clear relationship between their gestures and the musical outcomes

Feedback on the performance was delivered verbally both from the *audience-soloists* and from members of the audience both in the Q & A session that followed and in further discussions post-performance.

1. Both the *audience-soloists* and the audience as a whole felt that there were meaningful moments of musical dialogue between the performer and the *audience-soloists* and most obviously with the glissando Wiimote
2. There was a sense of *relief* from the whole the audience that the technology functioned as promised

3. The *audience-soloists* and the audience enjoyed the process and there was a sense of “playfulness” and “discovery” for both groups
4. The performance protocols worked effectively

However not all of the *audience-soloists* were aware of what sounds/motifs/effects they were triggering and there was a lack of familiarity with the layout and functionality of the WiiMote and this will inform the design of future research into the performance protocols. There is also a question as to whether there needs to be a greater emphasis on random AI-generated elements so that the *performer* isn’t operating within a “zone of expectation” and that with repeat performances there is always an element of surprise.

4.7 Theoretical Analysis

Actor-network theory is being used to uncover the connections between the various entities that are a part of the performances within this research and to make transparent how the networks and the power relationships embedded in them are organised.

To apply the ANT method a decision has to be made about which actant should be the starting point in the network. Because of the non-hierarchical nature of ANT research this is not always a straightforward

process with no actant having a privileged status within the network. Dankert suggests that

"The only guide to choose the starting point is the theme, central question and goal of the research. For example in a research on the implementation of a policy, the policy document could be such starting point" (Dankert, p5).

Building from the Dankert proposal, the actant that is the starting point for an analysis of the ANT pilot performance should be this PhD thesis itself as it is both the container for and generator of the research questions that have driven the creation of the two compositions at the heart of this research; but as Dankert notes *"For ANT, there is no best or worst choice"* (ibid., p5). Following Dankert the research then begins *"by exploring and unravelling this actant and the human and non-human actants that relate to it"* (ibid., p5). The performance is a *punctualised black box* containing multiple actants creating an *actant-network*, with each actant also having its own network and potentially being a part of many others. As Callon describes *"each entity summons or enlists a cascade of other entities"* (Callon, 1986, p32). In ANT terms both the process of *punctualisation* and therefore the performance have no existence until the *actants* in the network connect, with the punctualisation *masking* the network by making the connections invisible (Law, 1992, p5). The inherent instability in the network means that for each performance the network has to be remade and the connections

and associations refreshed. Applying ANT is the process of tracing the connections; the network is built out of filaments that have a *"fibrous, thread-like, wiry, stringy, ropy, capillary character"* (Latour, 1996, p3) joining together *actants* that have *agency*, described by Latour as *mediators* (Latour, 2005, p39), with stable entities that are non-transformative.

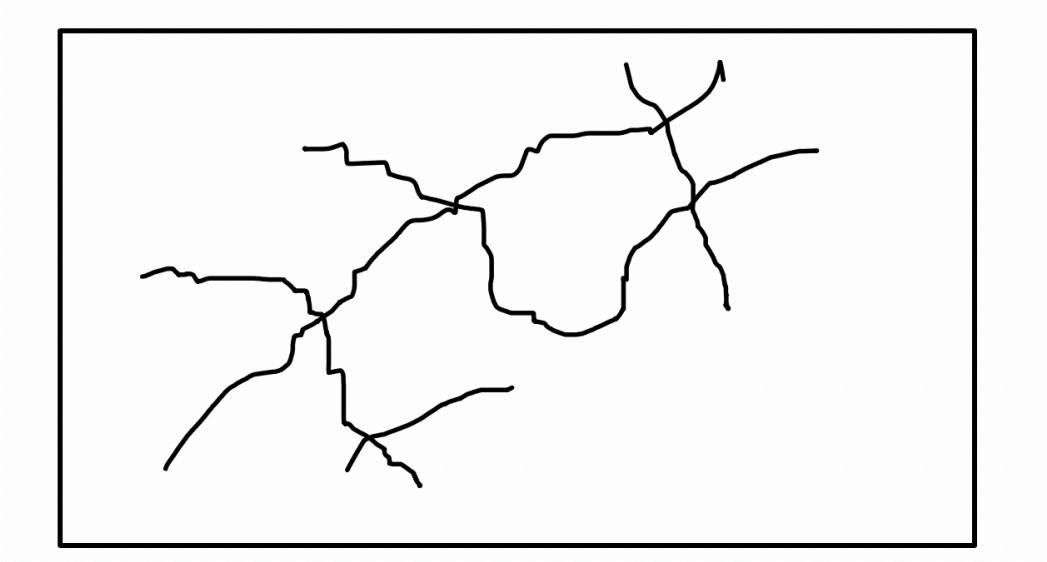


Figure 4.13 Black Box masking the network

Entities without agency can be disregarded or as Latour pithily puts it *"If your actors don't act, they will leave no trace whatsoever"* (ibid., p150), but in relation to the network he adds *"It's the work, and the movement, and the flow, and the changes that should be stressed"* (ibid., p143) or as Law explains *"interaction is all there is"* (Law, 1992, p2).

In Table 3 we can see a list of actants with agency in the performance of *The Singularity*, and non-transformative entities which engage in no interaction. However, if a non-transformative entity becomes active in

some way then it achieves agency and the black box is depunctualised. If we were to analyse a *car* from an ANT perspective, the notion of *car* would be the punctualised black box. If its battery is flat then the car entity is depunctualised with the individual actants such as the battery, starter motor et al. being revealed as the black box falls away.

Human	Theoretical	Technological
Performer (and composer)	Kurzweil's The Singularity definition	WiFi
Audience-soloists	Performance protocols	Four WiiMote controllers
Audience	Compositional protocols	Ableton Live DAW and file
iPhone audience-performer	Technical infrastructure	Macbook Pro laptop
Sound engineer	AABA compositional structure	M-Audio Oxygen 25 keyboard
	Jazz improvisation	Max For Life Schwarzonator 2.0 plug-in and file
Creative Artefact	Eco's conceptions of open works	TouchOSC
Sheet music	Small's conception of *musicking*	iPhone
Composition	The PhD thesis	OSCulator and file
	Location	Bluetooth
Organisational	Performance space	Open Sound Source
Innovation in Music Conference		Sound System

Table 3. The Singularity - Actants and non-transformative Entities (Actants in red, non-transformative Entities in blue)

The *Organisational*, *Creative Artefact* and *Location* entities are all *intermediaries* within the network that makes up the performance of *The Singularity*. They may well have had *agency* within the creation of the composition or other entities that make up the performance and therefore be classed as *actants* within those entities' own networks, but in the context of the research questions that motivate this research they are to be ignored in the process of *simplification* that allows ANT to focus on *agency* and *transformation*. For example, Kurzweil's *The Singularity* definition gives a title and a context to the composition but in no way affects either the performance or the outcome of the research questions. In the same way, the Innovation in Music Conference hosted the author's paper presentation and performance and provided the performance space and sound system, but none of these necessary elements have agency over the other *actants* and so fall out of the network. However, if the fire sprinklers were activated in the performance space and the sound system blew up and the conference organisers interrupted the performance, then these elements would be transformed into *actants* with *agency.*

The *Theoretical* entities are also static with the exception of this PhD thesis, an entity that is constantly in motion, being transformed by actants including supervisors, examiners and the author whose interactions with research papers, creative practice and research outcomes have helped shape the composition, the technological

infrastructure and the compositional and performance protocols for this performance.

The *Human* entities, the *performer*, the *audience-soloists* and the *iPhone audience-performer* all have *agency* as they are active in constructing the performance with the outcomes having a degree of uncertainty, but the rest of the audience are there as passive receptors. Five of the *Technological* entities: the WiFi network, the Macbook Pro laptop, the Bluetooth network, the Open Sound Source protocol and the Sound System are not in any way transformed or transforming and so are not part of the *actant-network.* The four WiiMote controllers, Ableton Live DAW, M-Audio Oxygen 25 keyboard, TouchOSC, iPhone, OSCulator and the Max For Life Schwarzonator 2.0 plug-in are *actants* with agency which will be further investigated later in this chapter.

Although the author of this thesis is the instigator of this research project, the composer, has written the research paper to allow for the conference performance, and has bought, rehearsed with and transported the bulk of the technology used in the performance, there is no privileged position within ANT or enhanced status of any kind for any entity within the network. However, to create the network the author becomes *The Translator-Spokesman*. In Callon's ANT analysis of the VEL (véhicule électrique) *actant-network* it is the French national electricity company EDF that *translates* other entities such as car company Renault, fuel cells and catalysts into actants within the VEL project with

EDF as *The Translator-Spokesman. Translation* is achieved by choosing *"from a spectrum of methods that ranges from seduction to pure violence by way of simple bargaining"* (Callon, 1986, pp26).

Callon develops this idea further.

> *"Translation builds an actor-world from entities. It attaches characteristics to them and establishes more or less stable relationships between them. Translation is a definition of rules, a distribution of roles and the delineation of a scenario. It speaks for others but in its own language. It is an initial definition"* (ibid., 1986, pp25-26).

Callon continues *"Each entity is thus reduced to a few properties which are compatible with the relationships established between the entities"* (ibid., p34). In the VEL *actant-network* the car company Renault is *translated* into a company-that-builds-car-bodies for the VEL project rather than the autonomous corporate entity that it was. However, *translation* cannot be taken granted as *"it does not occur without resistance"* (ibid., p26). In the case of Renault, the company decides that its role in the VEL project is not in its corporate interests and withdraws from the project which then collapses.

So who or what is *translated* for the performance of *The Singularity* and what is the potential for *resistance*?

Entity	Translated Entity
Audience	Audience-soloists
Audience member	iPhone audience-performer
WiiMote controllers	MIDI controllers
iPhone	Sequencer controller
Ableton Live DAW	*The Singularity* File
M-Audio Oxygen 25 keyboard	Melody and improvisation trigger device
TouchOSC app	MIDI controller for *The Singularity* DAW composition structure and bass sound filter controller
OSCulator	*The Singularity* File
Max for Life Schwarzonator 2.0 plug-in	*The Singularity* Piano part AI generator

Table 4. *The Singularity* - Translations

In the actor-world of *The Singularity* performance, the process of translation turns just a few audience members into *audience-soloists* and one audience member into the iPhone audience-performer who controls the structure of the whole composition through triggering different scenes within Ableton Live via the TouchOsc app on the iPhone. WiiMote games controllers become MIDI controllers and an iPhone becomes a controller for the Ableton Live DAW. The M-Audio Oxygen 25 MIDI keyboard transforms into a melody and improvisation trigger device and the TouchOSC Iphone app. takes on the function of a MIDI

controller that can vary the compositional structure of *The Singularity* within Ableton Live as well as acting as a bass sound filter controller. OSCulator has its own file for *The Singularity* allowing the WiiMotes to function as remote MIDI controllers for sounds within Ableton Live and the Max For Life Schwarzonator 2.0 plug-in also within Ableton is programmed to generate *The Singularity* piano part using stochastic processes to affect note spread, note density and voicings.
As long as both the technological and the human actants function as they are meant to, then the performance black box remains in place; but just us with the EDF example, *The Singularity* performance network is inherently unstable with *actants* being prone to resistance. The *audience-soloists* could get stage-fright and refuse to perform, the batteries in the WiiMotes could run out or Ableton Live could crash, or the iPhone audience-performer might not follow instructions in relation to the structure of the composition. All of these scenarios would compromise the performance and hence the network would collapse.

To be effective the *translation* process is linked to movement described as *displacement.* Latour lists some *displacements* that EDF used in the VEL project with entities being "*converted into inscriptions"* such as *"reports, memoranda, documents, survey results, scientific papers".* EDF also "*organises meetings, symposia, study sessions at which different parties are bodily convened*" (Latour, 2005, p27). Within *The Singularity actant-network* the composition is converted from an original manuscript draft into inscriptions such as printed sheet music, an Ableton Live file

and a chapter in this PhD as well as other publications enabling not only *The Singularity* performance *actant-network* but the networks making up this research.

This ANT analysis reveals that through the process of *translation* a few audience members are *displaced* to become *audience-soloists* with agency in the performance actant-network leaving the rest of the audience members as a forgotten cohort who leave no trace. The challenge of transforming this passive entity into activity provides a clear motivation for the further research undertaken in the next chapter where these ideas will be developed.

4.8 Evaluation of Learning

This performance of *The Singularity* was designed as a pilot project to test out the theoretical underpinning, technological infrastructure, compositional and performance protocols, and the basic premise of this research. As well as the feedback from the audience and *audience-soloists* the following conclusions have been drawn which will feed into the second artefact.

Firstly, a modal harmonic approach should be applied throughout the whole composition whilst other elements such as rhythm, instrumentation and dynamics might change, so that any melodic elements triggered by the *audience-soloists* can function across the harmonic structure of the

whole piece. There were issues with the harmonic complexity of *The Singularity* and some of the pitches triggered by the Wii controllers created unwanted dissonance.

Secondly, sounds triggered by the *audience-soloists* should have gentle attack envelopes or be of no fixed meter to avoid rhythmic incompatibility. The emerging technology of distributed synchronised playback on handheld devices (SynkroTakt, 2016) may be a way to solve rhythmic problems but until the technology is available for use this proposal is still speculative rather than proven. Using musical textures that are less dense than those in *The Singularity* will create greater sonic clarity allowing the *audience-soloists* to identify their contributions with greater certainty.

The ANT analysis has identified the lack of agency amongst most audience members in the performance of *The Singularity.* To enable a simple scaling up of the numbers of interactive performers, it would be worth investigating audience members triggering *distributed sound* on their mobile phones (CoSiMa, 2017). For a smaller increase in audience agency, the potential for OSCulator to run more Wiimotes than were used in this performance of *The Singularity* could also be evaluated. The ANT analysis has also highlighted a concern around the level of agency given to the iPhone audience-performer, with this actant's power relationship with the rest of the network having the potential to create a level of *resistance* that could lead to its collapse.

The *audience-soloists* should be given a brief soundcheck to explore the parameters and functionality of their controllers as well as the sonic possibilities. This would meet criteria i), iii) and iv) from Lee and Freeman's (2013) set of criteria to enable a successful audience participatory experience.

To create a more *distributed* performance, the stability of the computer to computer WiFi and Bluetooth networks and their range offers opportunities for distributing the Wiimotes, mobile phones and any other controllers throughout the performance space as well as the potential for using more controllers on the network.

This evaluation of learning from the pilot performance of *The Singularity* provided a solid foundation for the further research in this thesis.

Chapter 5 - Deeper Love

5.1 Introduction

The composition *Deeper Love* was composed specifically for this research as a creative vehicle to implement the findings that emerged out of the performance of *The Singularity.* The ANT analysis of the performance identified the untranslated lack of agency of the audience *actant* within *The Singularity* performance network. To address this issue as well as providing a way to integrate *Interactive Musical Participation* into my artistic practice as a jazz musician, several *novel* elements were developed for the performances of *Deeper Love*. The first of these was the creation of the *Deeper Love Soundpad App* (in collaboration with Dr Rob Toulson - available from the Apple App Store at https://apps.apple.com/us/app/deeper-love-soundpad/id1441139504).

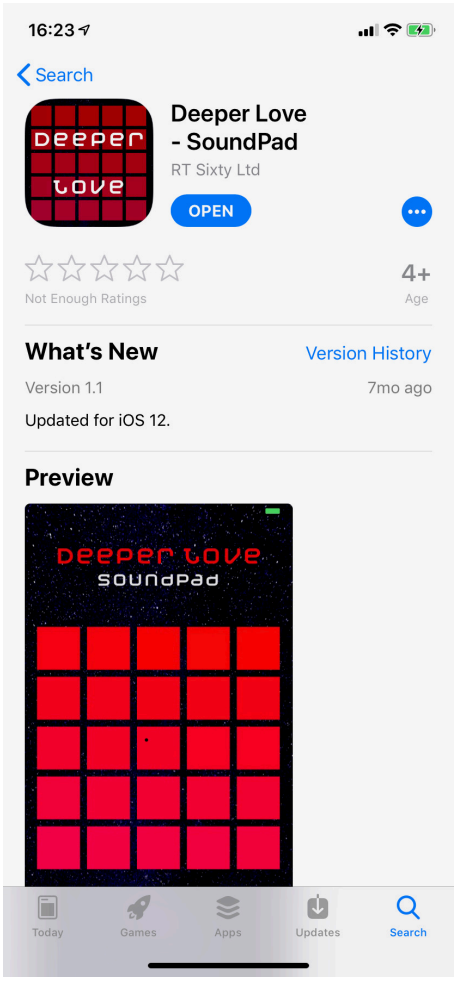


Figure 5.1 Deeper Love Soundpad App Store Page

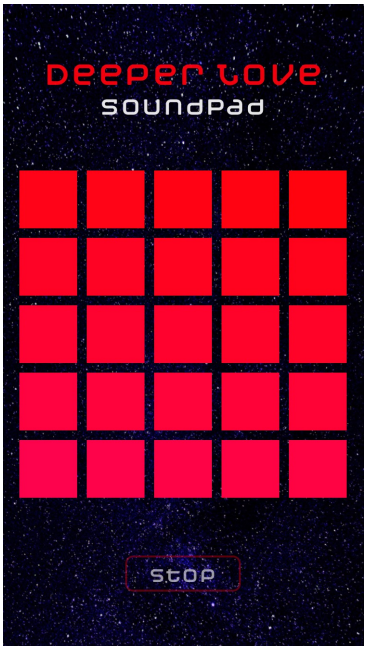


Figure 5.2 Deeper Love Soundpad

The app enables all members of the audience who have access to an iPhone or iPad to be active participants in a musical performance. This is achieved by the *audience-performers* triggering pre-prepared audio samples by touching the virtual buttons on the 5 x 5 *Soundpad* grid. These samples can be heard on a video located at https://youtu.be/O9AyO4Y_zqo.

The process of *Interactive Musical Participation mobilises* the audience members who are *transformed* from being *passive receivers* of information into *audience-performers* able to engage in *sonic dialogue* with each other and with the other performers. In the case of the *Deeper Love Soundpad App* it provides a technological solution that allows for the creation of a structured case study to address the first of the research questions motivating this thesis – 1) What is the experience of audience members engaging in *Interactive Musical Participation* within contemporary jazz? As well as the obvious scaling up of participation that the *Deeper Love Soundpad App* creates, from an ANT theoretical perspective it also converts potentially the whole audience into an *actant* with agency through a process of *translation*, with the author of this thesis becoming *The Translator-Spokesman* who convinces them to play along and enter the *actant-network.*.

A*udience-performers* using the *Deeper Love Soundpad App* only have a limited degree of *agency* because of the samples being pre-composed, but they do have control over how much of the sample is triggered, its volume, the order in which the samples are triggered, the metric

positioning of each sample trigger point, and they have also the ability to retrigger samples and create sample combinations to form new textures. The design of the app was specifically chosen to enable the thesis research questions to be evaluated in the context of creative practice.

This performance process is not dissimilar to the agency given to the performer in Luciano Berio's *Sequence I for Solo Flute* (1958), one of the pieces identified by Eco to demonstrate his conception of *open works* (Eco, 1962, 1989). According to Eco, the composer

> *"presents the performer a text which predetermines the sequence and intensity of the sounds to be played. But the performer is free to choose how long to hold a note inside the fixed framework imposed upon him"* (Eco, 1989, p1).

There is an interesting comparison between the Berio soloist, who is given a musical text to perform with freedom to interpret note durations, and the *Deeper Love audience-performers* triggering a fixed framework of pre-composed samples and able to control their metric position, volume, order and duration. If anything, it is the *Deeper Love audience-performer* who has the greater degree of *agency* with emerging digital technologies extending the prior practice as identified by Eco.

The samples created for the *Deeper Love Soundpad App* work within the harmonic methodology of modal jazz improvisation (Russell, 1959; Mehegan, 1959; Nettles and Graf, 1997; Mulholland and Hojnacki, 2013),

in that each of the pitched elements works in the modal harmonic framework of the composition.

The *Deeper Love Soundpad App* builds on the research carried out by Lee and Freeman (2013) with their networked musical instrument application for mobile phone called *echobo.* As with *echobo*, the *Deeper Love Soundpad App* with its combination of audience performance and sound transmission sits in a *hybrid* rank within Freeman's taxonomic system of participatory performance modes (Freeman, 2005 b, 757-760). Unlike *echobo* the *Deeper Love Soundpad App* is not networked and there is no *master musician* controlling the harmonic structure of the composition with chord choices being built from the eight note scales available to the audience on their version of the *echobo* app. The outcome of this is that the *stochastic* element of the *echobo* performance should be much less pronounced with the *Deeper Love Soundpad App* because the *Deeper Love audience-performers* have the opportunity to explore the samples without them being changed by a *master musician,* a process that proved frustrating for the participants in the *echobo* research.

> *"Many participants commented that they felt that the master musician limited their musical expressivity by 'taking away' keys too often"* (Lee and Freeman, 2013, p454).

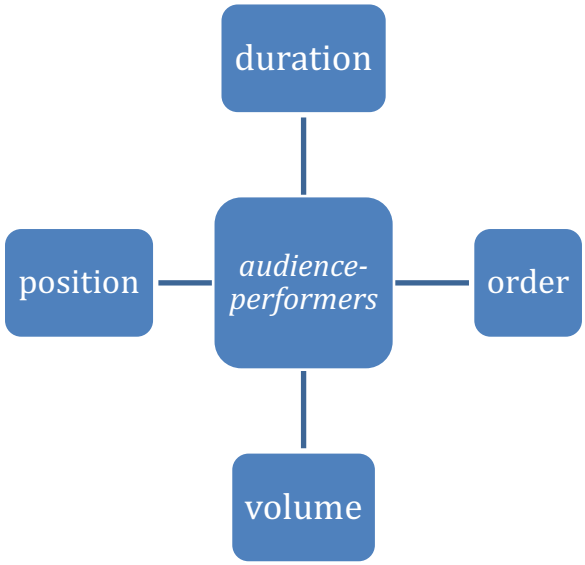


Figure 5.3 *Deeper Love Audience-Performer Agency*

Another *novel* element in the *Deeper Love* performance is the development of sampled improvised lines for the *Deeper Love audience-soloists* using the *WiiMote* controllers. The melodic structure of these samples is also constructed using the modal harmonic and improvisational methodologies of contemporary jazz. This element addresses the second of the *research objectives* within this thesis – *To investigate a variety of software and hardware interface technologies and the training that will be needed to use them, to enable Interactive Musical Participation within the contemporary jazz idiom.*

The *audience-soloists* have a degree of agency over how much of the sample is triggered, the order in which the samples are triggered, the metric positioning of each trigger point and the potential for retriggering and sample combination to form completely new melodic, rhythmic and textural material. With the ability to create both motivic development and

also rhythmic displacement, *audience-soloists* have the capacity to apply several of the improvisational techniques of the *non-interactive* instrumentalist or vocal jazz soloist.

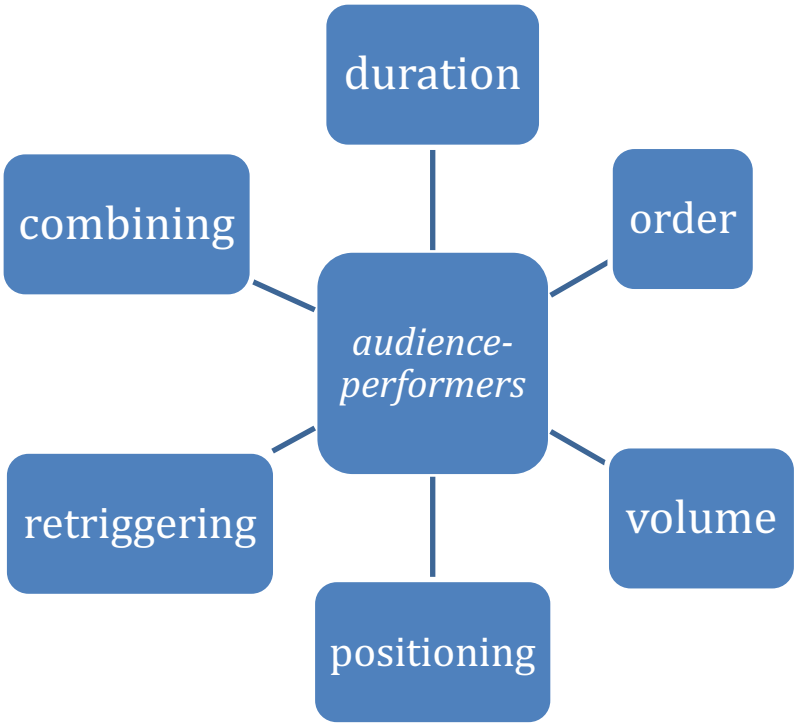


Figure 5.4 *Deeper Love Audience-Soloist Agency*

The *Deeper Love* performances are designed to investigate whether these *novel* developments in this research can relocate this artistic practice in *Interactive Musical Participation* from the context of an academic conference to something more real-world such as a concert or club, with an audience interacting via the *WiiMote* controllers and the *Deeper Love Soundpad App.* It also seeks to explore the experiences of the participants in the performance and to make critical judgements on the quality of the interactivity, to analyse the usability and scalability of

the technological solutions being used, to develop the performance protocols that underpin this practice, and to evaluate whether the compositional and improvisational methodologies were appropriate and successfully applied. The results taken from the performances will also provide data that will be applicable to further research in this area.

5.2 Objective

Building from Cook's principle for designing computer music that researchers should *"Make a piece, not an instrument or controller"* Cook (2001 & 2009) and Rosenkransa's (2010) proposal that *interactivity* is measured by the *frequency of engagement* within a *mediated communication*, the objective of the *Deeper Love* performances is to test out the criteria for a successful audience participatory experience as proposed by Lee and Freeman (Lee and Freeman, 2013, p450)

i) to make participation easy (accessibility)

ii) to collect gestures from the audience and turn them into a single musical composition (musical security)

iii) to drive audiences to start participation without reservation (initiation)

iv) to motivate people to participate and sustain the interest (attraction)

v) to provide a clear relationship between their gestures and outcome in music (transparency)

and the eight principles previously proposed in this research for the design of the technological infrastructure for this project as:

i) informal

ii) interesting

iii) immediate

iv) accessible

v) natural

vi) necessary

vii) affordable

viii) scalable

Carrying out the research performances for *Deeper Love* in the context of club and concert performances creates the opportunity for data collection in something approaching a *real-world* performance setting compared with the constraints of an academic conference. The analysis of this data will lead to the creation of *performance protocols*, a framework for *compositional design*, and suggestions for a technical infrastructure that will give the outcomes of this research the potential to be carried forward into the mainstream of popular music performance.

There are two separate *visions* driving this research:

i) that at large concerts or music festivals, audiences of many thousands could be transformed into *audience-performers*, moving from a state of *alterity* to being part of a new homogenous entity with the performer; that instead of using their phones for shining lights, filming or taking photographs, audience members will become *sonic collaborators* in the performance creating an *ontogenic* composition in a process of *distributed creativity* (Sawyer and DeZutter, 2009).

ii) that at jazz concerts at clubs and festivals as well as becoming *audience-performers* as detailed above, that volunteer audience members can engage in improvisation and *sonic dialogue* with each other and with the other performers.

5.3 Composition Construction

The compositional construction of *Deeper Love* is partially developed from conclusions drawn from the evaluation of learning from the pilot performances of *The Singularity.* As with *The Singularity* the chosen metre is 4/4 but for *Deeper Love* a hip-hop swung 16ths feel is utilised at a tempo of 82 beats per minute. One of the potential outcomes of this research is to move *Interactive Musical Participation* from being a research-based practice to becoming part of mainstream popular music performance practice. Hip-hop was an influence on 89% of songs in the

USA Top 100 charts in 2018 (Hit Songs Deconstructed, 2019) so working within a sub-genre such as hip-hop/jazz rather than something more esoteric creates a link to the mainstream of popular culture. Presenting the research in a musical context not too far removed from the mainstream of popular music may be a factor in gaining acceptance for *Interactive Musical Participation.*

The heuristic analysis drawn from the performances of *The Singularity* indicated that the harmonic complexity of the composition created unwanted dissonances when some of the pitches triggered by the *audience-soloists* using the Wii controllers clashed with the chords. By using modal harmony, one of the archetypal methodologies of modern jazz harmony (Russell 1959; Mehegan 1959; Nettles and Graf 1997; Mulholland and Hojnacki 2013), for the pitches selected for the *Deeper Love Soundpad App* as well as for the melodic and harmonic material in the composition, no problems were created with the chord-scale relationships which were able to function without any issues of dissonance across the harmonic structure of the whole piece.

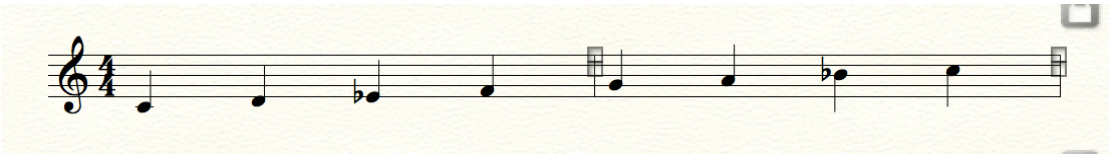


Figure 5.5 ***Dorian mode in the Key of C***

The scale chosen for *Deeper Love* is the Dorian mode, a minor scale with a major 6th and a flattened 7th. The scale has attracted academic attention because it was used as the compositional foundation of Miles Davis' 1959 tune *So What*: *"The structure of 'So What'... has become the canonical*

example of a modal composition" (Monson, !998, p150), and it is one of the few jazz compositions to have crossed over to the pop charts with Ronny Jordan's 1992 hip-hop influenced version (The Guardian, 2014). *So What* was a track on the Miles Davis album *Kind of Blue* described as *"the premier album of its era, jazz or otherwise"* (Kahn, 2000, p16).

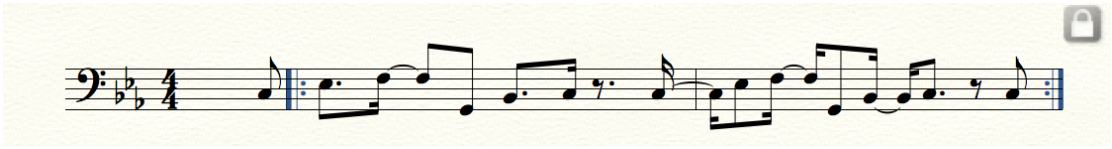


Figure 5.6 *Deeper Love Double Bass Ostinato*

Deeper Love is built around a two-bar double bass ostinato figure which is constructed around two three-note motifs. The first motif consists of the tonic (C) followed by the minor 3rd (Eb) and then the perfect 4th (F). The second motif uses the same intervallic relationships but builds from the fifth degree of the scale of C Dorian (G) moving to Bb and then returning to C. The two motifs then repeat with the repetition being rhythmically displaced. The ostinato figure features all the notes from a C minor pentatonic scale (C Eb F G Bb), all notes but one from C blues scale (C Eb F [F#] G Bb) as well as having five notes out of the seven from the C Dorian scale (C [D] Eb F G [A] Bb). This ambivalence from a chord-scale perspective allows for improvisation using all three of these scales.

Figure 5.7 ***Deeper Love Structure in Ableton Live***

i)	Introduction	8 bars
ii)	Head	8 bars
iii)	Vibes solo (*audience-soloist*)	open duration
iv)	Synthesizer solo (*audience-soloist*)	open duration
v)	Audience Participation 1(*audience-performers)*	open duration
vi)	Introduction	8 bars
vii)	Head	8 bars
viii)	Audience Participation 2 (*audience-performers)*	open duration

Table 5. ***Deeper Love*** **Structure**

The introduction of *Deeper Love* is eight bars long (see *fig. 5.7* and *Table 5* for composition structure) with the bass motif being played four times, accompanied by a generic drum hip-hop beat, electric piano chords using quartal voicings in the mode of C Dorian, and a descending string line similarly using quartal voicings in C Dorian. This feel continues for another eight bars for the *head* (main melodic material-see *fig. 5.8*) of the

composition but with the addition of a vocal melody that doubles the bass ostinato part.

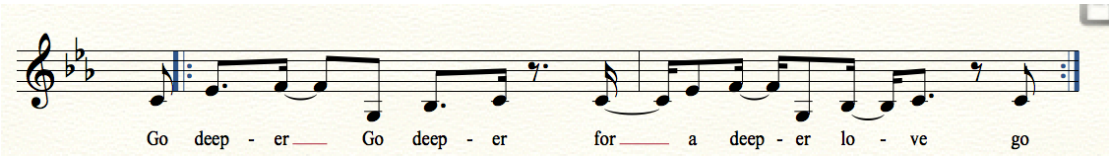


Figure 5.8 *Deeper Love Vocal Melody*

The third section of *Deeper Love* features the first *solo* from one of the two *audience-soloists.* As in the performances of *The Singularity* they are tasked with pressing buttons on a *WiiMote* controller to trigger *sonic events.* The first soloist has a series of pre-composed samples of vibraphone motifs and improvised lines in the Dorian mode to use as improvisational source material. There are seven samples in all and the sample set went through several iterations in a heuristic process of development.

On reflection it seemed clear that having a slow attack would lead to less "interesting" performances, one of the key criteria for this research. The challenge was to develop samples that could

- be triggered at any point in the bar and still lead to a satisfying musical conclusion
- allow the audience-soloist to improvise with the samples through a process of discovery, playing, retriggering and joining different sample elements together
- create an informal, immediate, accessible and natural experience

for the audience-soloist thus addressing more of the key criteria for this research

The outcome that seemed to be most effective was to use trills, scale and pattern-based motifs and lines that *floated over* the rhythm affording a freeform approach to *metric displacement* (Love, 2012) rather than being locked into a strict metrical structure. This approach obviated the need to address any issues of latency management because the accuracy of the trigger-point was not relevant. The accompaniment for this section kept the same bass and drum feel with a simplified Dorian mode electric piano part creating a less sonically dense texture than in The Singularity thus ensuring that the audience-soloists can identify their contributions with clarity.

WiiMote 3	Triggers arpeggiated synthesizer patterns using the Dual Osc 2 Pure Lead sound
WiiMote 4	Triggers pre-prepared improvised vibraphone motif and phrase samples

Table 6. WiiMote Sonic Element Control - *Deeper Love*

The fourth section is designed to work as the sonic bed for synthesizer patterns using the Dual Osc 2 Pure Lead sound (see *Table 6*). These are triggered by the second of the two *audience-soloists.* The bass and percussion accompaniment remain the same as for the previous section but the electric piano drops out creating even greater sonic clarity for the improvisors.

The fifth audience participation section creates a clear contrast with the previous compositional elements being the moment when the rest of the audience are activated as audience-performer participants in the performance by triggering the audio samples from the Deeper Love Soundpad App on their iPhones. The rhythm is held together by a repetitive shaker loop with harmony and texture partially being provided by a thirty-bar loop featuring Dorian scale textures using an Ableton Live sample called *Aquatic Cloud.* Each of the Aquatic Cloud Ableton samples is a single-pitched waterphone sample with the thirty-bar looped part being an improvised response to the challenge of creating a suitable soundscape for the Deeper Love Soundpad App samples. The other textural element is a 31 bar and one beat length loop with an Ableton sample entitled *Backwards Metal* featuring bell samples with a lengthy reverb or backwards reverb tail. This was another improvised part using the Dorian mode. Having the two textural elements looping around different bar lengths implies a *polymetric* approach (Rubbra, 1953, p41) and creates textural variety as the loops do not cycle together. At this point the Deeper Love Soundpad App samples are played by the audience-performers touching the buttons on the 5 x 5 Soundpad grid. There are twenty vocal samples all of which are either single notes or licks. The other five samples are made up of three more ambient soundscapes, a whispered *Deeper Love* and a whispered *aaaah.* All the pitched samples use the Dorian mode.

The following two sections are reprises of the introduction and vocal head. *Deeper Love* ends with a repeat of the audience participation segment of the composition with the programmed loops gradually fading out leaving the sounds from the audience's iPhones as the final moment of the composition.

Deeper Love is an archetypal modal jazz composition with a structure constructed around a *head, solos, head* model; however, the interactive elements create the novel structural conception of the audience bringing the performance to a close in a novel performance context of *audience takeover*.

5.4 Technical Infrastructure

The technical infrastructure for the performances of *Deeper Love* builds on the framework that was utilised for the pilot project *The Singularity* with sequenced material being played back via the Digital Audio Workstation Ableton Live (Ableton, 2017) running on a MacBook Pro. However, in a difference to the performances of *The Singularity* there was no *audience-performer* controlling an iPhone running TouchOSC (Hexler, 2019) to trigger different sections of the composition. On reflection this didn't seem like an interactive performance element that could be *scaled up*, a key objective of this research. In the *Evaluation of Learning* subsection of Chapter Five it was noted that to create a simple *scaling up* of the numbers

of interactive performers, audience members could use distributed sound on their mobile phones (CoSiMa, 2017), and so this is the primary novel element in the interactive technical infrastructure of *Deeper Love.* In the performances of *The Singularity* there were four *audience-soloists* performing on WiiMotes triggering sounds on Ableton Live via OSCulator. It would be technically possible to have more *audience-soloists* running WiiMotes than in *The Singularity* but each additional WiiMote puts more stress on the Bluetooth network leading to potential instability and it still doesn't achieve the much greater potential for *scaling up* that the iPhone running a sound app such as the *Deeper Love Soundpad App* offers.

The electric piano, acoustic bass, drums and percussion, strings and vocal parts for *Deeper Love* were all recorded as audio files or as midi files and then converted to audio files using the Digital Audio Workstation Logic Pro X (Apple Inc., 2019).

Figure 5.9 *Deeper Love Audio Files in Logic Pro X*

Next they were exported as .aif files.

Figure 5.10 *Deeper Love Audio Vocal Files in Logic Pro X*

Additional vocal files were recorded in Logic Pro X for use in the *Deeper Love Soundpad App* as were the vibraphone samples for the WiiMote Wii4.

Figure 5.11 *Deeper Love Ableton Live Session*

The audio .aif files were then imported into Ableton Live as *clips* into the various *tracks* and then eight *scenes* were created to form the *Master*

song structure (see *fig. 17*). Two tracks were set up for the two WiiMote *audience-soloists.* The first marked *Vibes Wii4* is running the Ableton *Sampler* and hosting the samples created within Logic Pro X. The second called *arpeg beep Wii3* contains a synthesizer patch entitled *Dual Osc 2 Pure Lead* and an arpeggiator with a *Classic UpDown 8th* setting.

Figure 5.12 *Deeper Love* Ableton Live Arpeg Beep Wii3 Synthesizer and Arpeggiator

The Logic Pro X vocal samples as well as the Ableton ambient samples for the *Deeper Love Soundpad* were trialled within Ableton Live to see how they worked with the backing track for the *Audience Participation scenes.*

Figure 5.13 *Deeper Love* Ableton Live Samples for the *Deeper Love Soundpad App*

An Ableton Push 2 controller was used within the performances to control the *Master Track* of Ableton Live which made the selection of the *Master Tracks* much easier in a performance context with the buttons on

the Push 2 being larger and more accessible for triggering than clicking directly on the track in Ableton Live.

Figure 5.14 *Deeper Love* Performance Rig: Push 2, laptop, WiiMote, Roland RD-700

As in *The Singularity* the WiiMote controllers were connected via Bluetooth to the laptop, connecting to Ableton Live via OSCulator (Osculator, 2019).

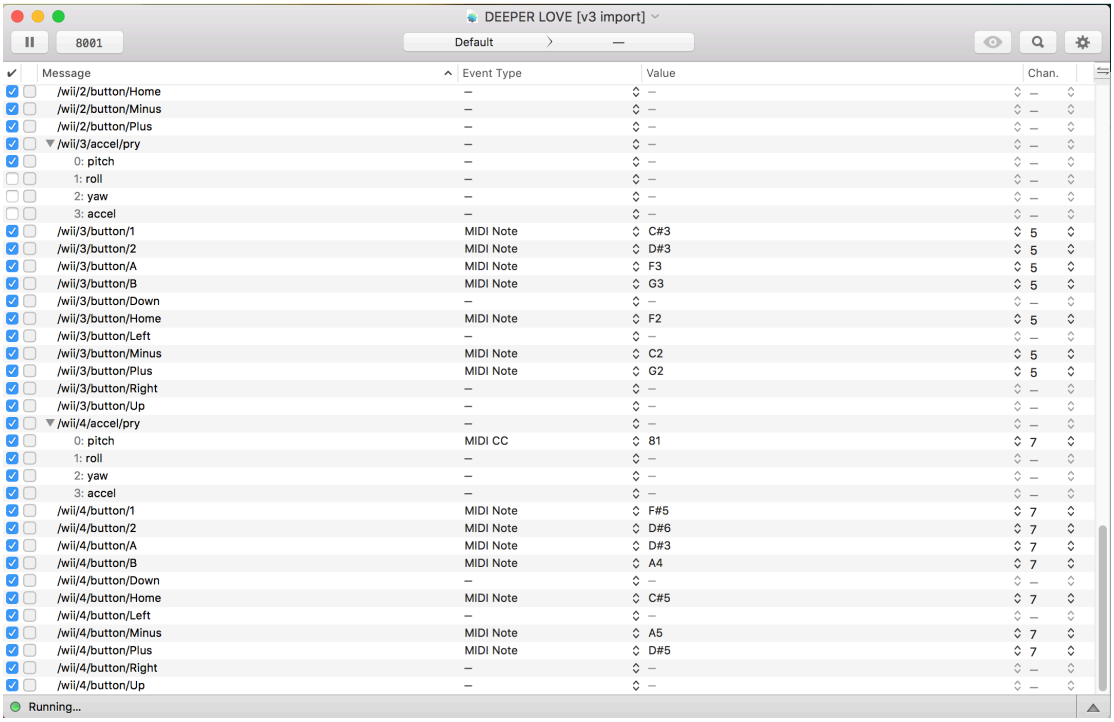


Figure 5.15 *Deeper Love* WiiMote OSCulator Settings

The *Deeper Love Soundpad App* (see *fig.5.2*) was developed in conjunction with Dr. Rob Toulson, Professor of Creative Industries: Commercial Music at the Westminster School of Media, Arts and Design, University of Westminster. Dr. Toulson had previously created the code (see Appendix 3) and the layout of the app for a research project that saw the development of an interactive album app (Paterson et al., 2017, 193-209). The initial concept and the sample content were developed by the author of this thesis with the intention of creating an app that mirrored the basic functionality of the Novation Launchpad used in the pilot study. Using an already existing piece of coding was congruent with one of Cook's previously stated principles for designing computer music controllers (2001 & 2009) to *"Make a piece, not an instrument or controller"*. The process of modifying Toulson's *variplay* app interface

was relatively straightforward from a technical perspective with the only adaptation being that there would only be a single audio trigger per button. There was also an issue around the *normalizing* of the audio to a maximum level without having the samples distort in the iPhone's speakers. This was resolved using a heuristic methodology until a satisfactory outcome was achieved. The app is only downloadable from the Apple App Store with the decision taken not to develop an Android version at this point in the research for reasons of time management.

A novel development from the performances of *The Singularity* was the addition of live musicians for some of the performances of *Deeper Love*.

Figure 5.16 *Deeper Love* Performance at Area 51, University of Westminster

The *Deeper Love* pilot in September of 2018 at the Crosstown Traffic conference in Huddersfield had no additional musicians. For the first of the three performances at the *Area 51* performance space, University of

Westminster in December 2018 and February and March 2019, a saxophonist, a percussionist, electric bass player and electric guitarist were added with no electric bass player for the final event. There is a video available of this performance available for streaming on YouTube at https://youtu.be/oRYjKNtZvlA. The performances at the *East Grinstead Jazz Club*, and the *Toulouse Lautrec* jazz club in Kennington just featured the author of this thesis, the *audience-performers* and the *audience-soloists.*

Figure 5.17 *Deeper Love* Performance 2 at Area 51, University of Westminster

For the performances where the additional musicians were used, sound reinforcement was supplied through the in-house backline, PA, mixing and monitoring systems. A novel addition to industry standard sound

reinforcement at the final Area 51 performance was the placing of two radio microphones in the audience area, building on techniques developed by Die Neukoms (Visser and Vogtenhuber, 2015). This extra reinforcement allowed the *audience-performers* to amplify the sound coming from their iPhone speakers in the audience participation segment of *Deeper Love.* The audio levels and balances of the *Aquatic Cloud, Backwards Metal* and shaker loops that are the sequenced backing for the audience participation segment had to be carefully managed to allow the iPhones to be heard and not swamped by the PA system.

5.5 Performance Protocols

As with *The Singularity* the lead performer for *Deeper Love* functions as the musical director/conductor/MC of the performance, leading the onstage musicians, *audience-performers* and *audience-soloists* as well as setting up and managing the equipment and software. At the start of the performance the performer follows the instructions listed below which involve finding two volunteer audience-soloists, encouraging the audience to download and to use the *Deeper Love Soundpad App* and explaining the app's functionality and the performance process.

PERFORMANCE INSTRUCTIONS

P = PERFORMER. AS = AUDIENCE SOLOISTS

1. ASK THE AUDIENCE TO DOWNLOAD THE *DEEPER LOVE SOUNDPAD APP* AND EXPLAINING THE APP'S FUNCTIONALITY AND THE PERFORMANCE PROCESS
2. FIND 2 VOLUNTEER AUDIENCE-SOLOISTS
3. GIVE WIIMOTES TO AUDIENCE-SOLOISTS PLUS VERBAL INSTRUCTIONS ON WIIMOTE FUNCTION
4. EXPLAIN COMPOSITION STRUCTURE TO AUDIENCE-SOLOISTS AND AUDIENCE-PERFORMERS
5. P TO TRIGGER THE ABLETON SCENES AND CUE SOLO SECTIONS. EACH AUDIENCE-SOLOIST TO GO IN TURN – SHORT EXPLORATION FOLLOWED BY A MUSICAL DIALOGUE WITH P. FOLLOWED BY AUDIENCE PERFORMERS.
6. DURING THE SECOND AUDIENCE PARTICIPATION SEGMENT P TO CUE SOUND ENGINEER TO FADE MASTER FADER
7. P TO CUE MUSICIANS, AUDIENCE-PERFORMERS AND AUDIENCE-SOLOISTS TO STOP PLAYING.

Figure 5.18 Performer Instructions for *Deeper Love*

Contrasting with the performance of *The Singularity* for which each of the *audience-soloists* were given a set of colour-coded performance protocols and technical instructions to read before the performance, all the *Deeper Love* instructions were delivered verbally thus meeting three

of the eight principles (*informal, immediate and natural*) that the technological infrastructure for this project was based on.

The *audience-performers* were asked to download the *Deeper Love Soundpad App* at the beginning of the event with posters in the performance space displaying the app's name to make the process straightforward. Following this the *audience-performers* were asked to open up the app, turn the volume up on their iPhones and were then told about triggering the sounds from the 5x5 grid. It was also suggested that they should move around during the audience participation segment and on the final Area 51 performance to use the radio microphones positioned in the performance space so adding additional amplification support for the sound coming out of their iPhone speakers.

5.6 Analysis

Quantative data has been gathered through the use of several instruments including group-administered self-completion questionnaires, with qualitative open-ended interviews expanding on the quantative results. All the studies were cross-sectional in nature with the individuals sampled for the questionnaire being self-selecting from the attendees at the four *Deeper Love audience research events*. The collection of information from performers and audience follows a mixed-method approach integrating both qualitative and quantitative data from a pragmatic perspective. Using a mixed-method approach can deliver a

deeper understanding of the central research issues than either qualitative or quantitative methods on their own (Creswell, 2002).

The *Deeper Love Launch Event* was held on 10th December 2018 in the *Area 51* performance space at the University of Westminster. The performance had been publicised through the university with an open invitation to staff and students to what was a free of charge and non-ticketed event. There were approximately thirty standing attendees with at 70:30 female to male gender split, most of whom were of student age and with five older attendees drawn from members of the university staff. Nearly all of the audience owned iPhones running IOS 12 or later and were able to move around the room and participate. Whilst some interesting results emerged from this event, other research performances were scheduled so that the data could be tested in a variety of contexts.

Figure 5.19 *Deeper Love* Performance 2 - East Grinstead Jazz Club

The second performance was held on 18th December 2018 at the *East Grinstead Jazz Club*, a typical example of a regional British jazz club, with a *house band* in which the author of this research performs, visiting guest soloists and a host/singer. There were forty-three audience members seated at tables and therefore unable to move around freely during the performance, with an equal gender split and an average age of 60. Only nine members of the audience filled in questionnaires as notably most of them did not own recent iPhones or have a model that runs IOS12, the minimum operating system to run the *Deeper Love Soundpad App*. Some expressed resentment that the app wasn't available for the Android operating system. Comments such as *"Why isn't it on Android?"* were received on several occasions from audience members.

Toulouse Lautrec jazz club in Kennington, London was the venue for the third performance which took place on 19th December 2018 in front of fifteen audience members of mixed gender and an average age of approximately fifty-five. The audience was seated at tables for this performance and the audience members were again unable to move around the room. At this performance only three people submitted the questionnaire and there were issues with finding enough audience members who had access to iPhones. There may be some correlation between age and percentage of iPhone ownership but that issue is not related directly to this thesis.

On the 23rd February back in *Area 51* at the University of Westminster another performance was held in front of an audience of applicants to the university and their guests. It was not run as an *audience research event* but as a technical experiment responding to a handwritten comment on one of the questionnaires from the first performance. The comment read: *"volume for the parts would help create more sense of agency and cohesion"*, and it referred to the volume of the samples being triggered from the app. Two radio microphones were positioned in the audience section of *Area 51* to reinforce the sound level from the iPhones and to allow *audience-performers* to move as close to the amplification as they wished. This sound reinforcement made a noticeable difference to the level of the sounds being played from the iPhone. Comments relating to the use of the extra amplification from the sound technicians at the event included *"That worked really well"* and *"Yeah, that was really cool"*.

The final *audience research event* took place on 20th March 2019 again at *Area 51* to an audience of university applicants and their guests. As with the previous *Area 51* event the audience was standing and able to move around freely. The same sound reinforcement for the iPhones was used as on the 23rd February performance. The audience of twenty-four members had a 50:50 gender split and was mostly comprised of sixteen and seventeen-year-olds with some middle-aged parents in attendance. This audience with its high level of young people had an iPhone usage of 71%.

The responses to the questionnaire completed by the *audience-performers* at the four *Deeper Love audience research events* have been turned into percentages with data having been collected from fifty-five individuals in all with high response rates from all participants. The data has also been summed to give an overview of the findings. Even with the results from the four *audience research events* combined this is still a relatively small data set to draw conclusions from and as so should be approached with some caution. However, with some comparisons between the summed responses and those from each *audience research event* it should be possible to see some trends emerging. A seven-point Likert scale has been used to report on the responses with 1 representing *Strongly disagree and 7 Strongly agree*. The full data set of responses, the summing and percentages can be seen in Appendix 2 with the summed percentages being listed in *Table 7.*

I felt a sense of agency during the performance

1	2	3	4	5	6	7		
2%	0%	3%	7%	20%	24%	44%	Total respondents	54

Strongly disagree — Strongly agree

My participation made a contribution to the work

1	2	3	4	5	6	7		
4%	5%	9%	20%	17%	17%	28%	Total respondents	54

Strongly disagree — Strongly agree

I did not feel that other audience participants made a contribution to the work

1	2	3	4	5	6	7		
22%	22%	15%	20%	8%	9%	4%	Total respondents	54

Strongly disagree — Strongly agree

I felt that the interactive moments in the work were meaningful

1	2	3	4	5	6	7		
4%	6%	7%	17%	23%	24%	19%	Total respondents	53

Strongly disagree — Strongly agree

I enjoyed being able to make a contribution to the work

1	2	3	4	5	6	7		
0%	0%	2%	11%	28%	22%	37%	Total respondents	55

Strongly disagree — Strongly agree

I felt that participation via the technology was easy to access

1	2	3	4	5	6	7		
7%	2%	4%	5%	24%	19%	39%	Total respondents	54

Strongly disagree — Strongly agree

I felt a bond with the other participants

1	2	3	4	5	6	7		
4%	11%	13%	17%	19%	18%	18%	Total respondents	54

Strongly disagree — Strongly agree

I felt a relationship with the performers

1	2	3	4	5	6	7		
2%	5%	13%	16%	15%	27%	22%	Total respondents	55

Strongly disagree — Strongly agree

Table 7. Audience Questionnaire Summed and Calculated as Percentages

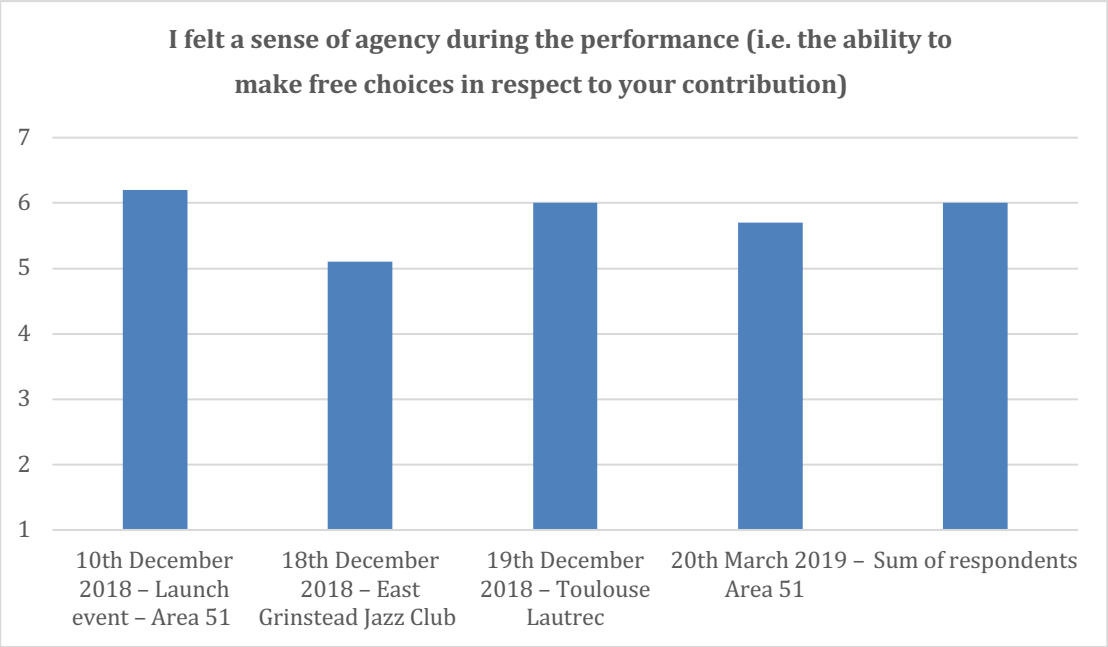


Figure 5.20 First Likert Item Results Expressed as a Mean

In response to the first Likert item *"I felt a sense of agency during the performance (i.e. the ability to make free choices in respect to your contribution)"*, 88.88% of those surveyed were on the positive end of the scale with the rest being either neutral or on the negative side. The findings were consistently weighted positively across all four of the *audience research events* with only 3 out of the 54 total respondents choosing a negative option. At both the Area 51 launch event and at the Toulouse Lautrec event there were no negative choices at all. These responses indicate that a large majority of the *audience-performers* did feel a sense of agency during the performance.

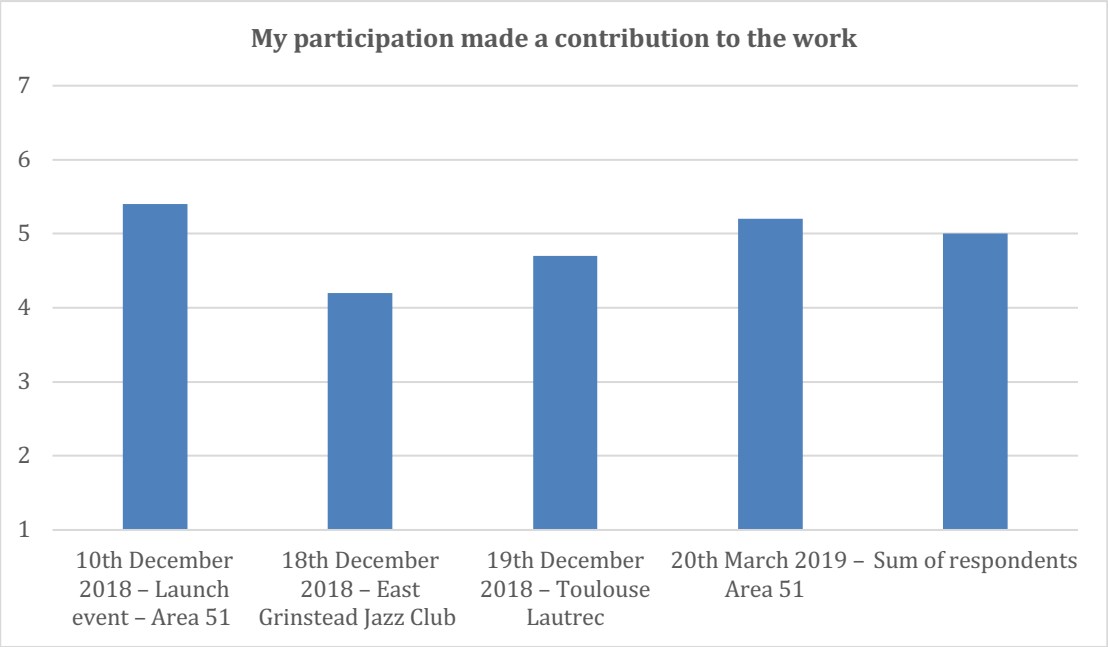


Figure 5.21 Second Likert Item Results Expressed as a Mean

The second Likert item *"My participation made a contribution to the work"* was less definitive with 61.09% of those surveyed being on the positive end of the scale but with 20.37% choosing the neutral option and 18.5% on the negative side. This shift towards the neutral is partly explained by the results coming from the 2 smaller sample sets with 2 out of the 3 Toulouse Lautrec responders opting for this option as did 37.50% of the 8 East Grinstead responders. There may have been an issue with the older participants at these two events not finding the technical elements of the participation particularly easy to manage and this is borne out to a certain extent by the data relating to the sixth Likert item that relates to ease of access to the technology.

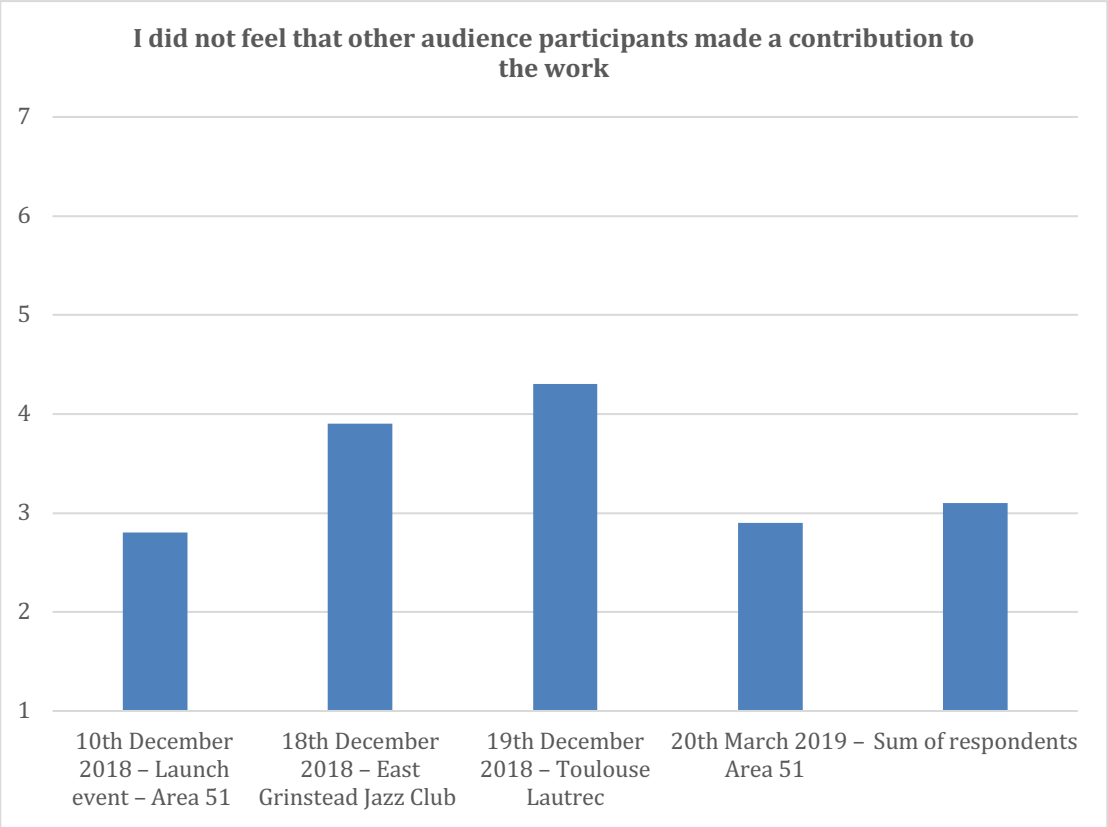


Figure 5.22 Third Likert Item Results Expressed as a Mean

The third Likert item *"I did not feel that other audience participants made a contribution to the work"* was in a similar area of percentage to the second with 59.25% on the negative side for what was a negative question, with 20.37% again choosing the neutral option and 9 out of 54 respondents on the positive side of the negative question. The Toulouse Lautrec and East Grinstead participants again bucked the trend with 66.66% of the Toulouse Lautrec and 75% of the East Grinstead responders on the neutral or negative side of the question. Some participants mentioned that they found this question confusing which may have created some false answers.

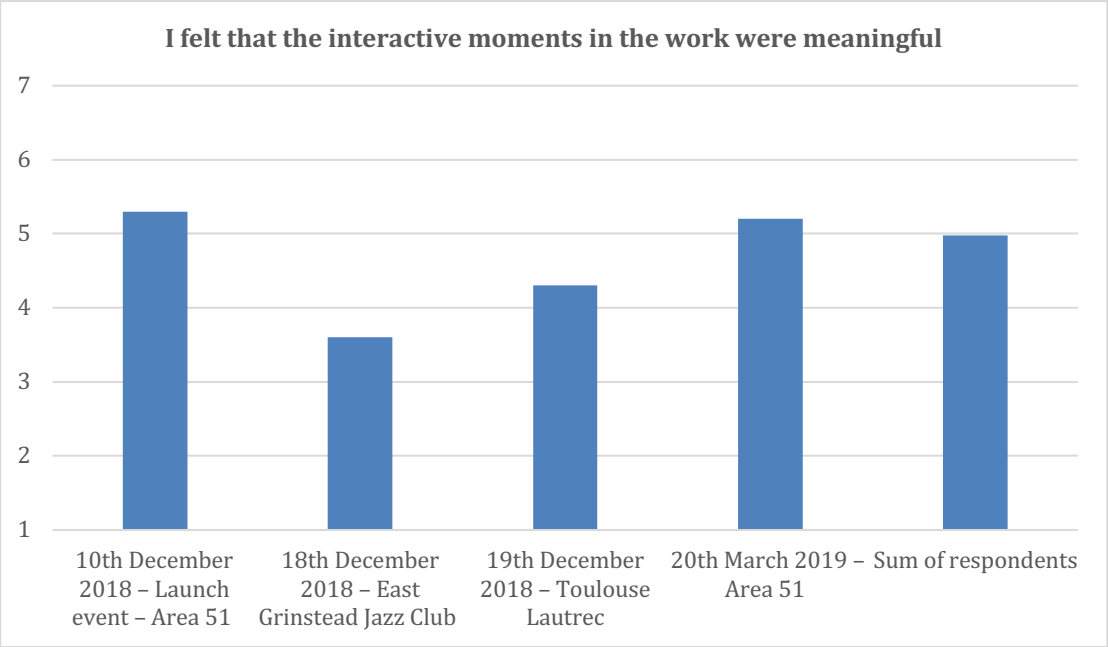


Figure 5.23 Fourth Likert Item Results Expressed as a Mean

In response to the fourth Likert item almost two thirds (66.02%) of the 53 respondents reacted positively to the statement *"I felt that the interactive moments in the work were meaningful"*. That percentage rises to 76.90% for the first and 75% for the second of the two University of Westminster Area 51 *audience research events.* A possible explanation for this might be that the younger audiences at the Area 51 events were more receptive to the research than the participants for the Toulouse Lautrec event where 66.66% made the neutral choice, and at East Grinstead where 37.50% made the neutral choice with the same percentage of participants on the negative side of the scale.

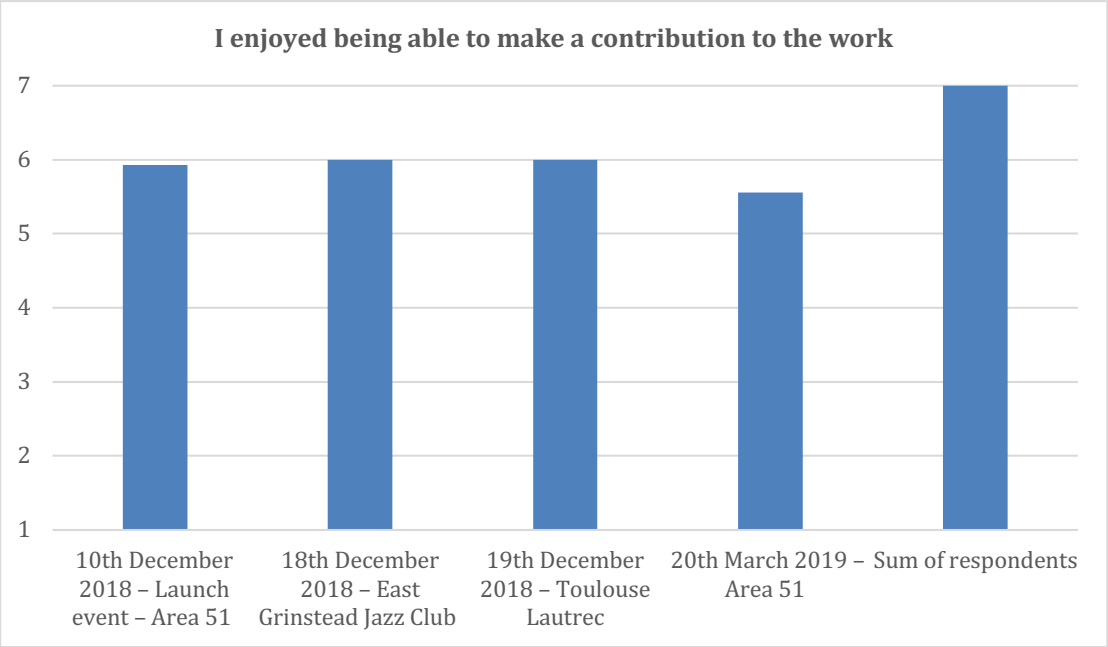


Figure 5.24 Fifth Likert Item Results Expressed as a Mean

The overall response to the fifth Likert item *"I enjoyed being able to make a contribution to the work"* was very positive across all four of the venues with 85.44% of the summed respondents on the positive side of the scale. Perhaps surprisingly given the previous results, 66.16% of the Toulouse Lautrec participants and 57.14% from East Grinstead *strongly agreed* with the proposition with only 1.81% of the summed total being on the negative side. The fourth and fifth Likert items are particularly central to this research and so the results extrapolated from this data bode well for future research in this area. However, it is important to bear in mind any possible bias in these responses as well as understanding that caution must be applied because of the relatively small sample size.

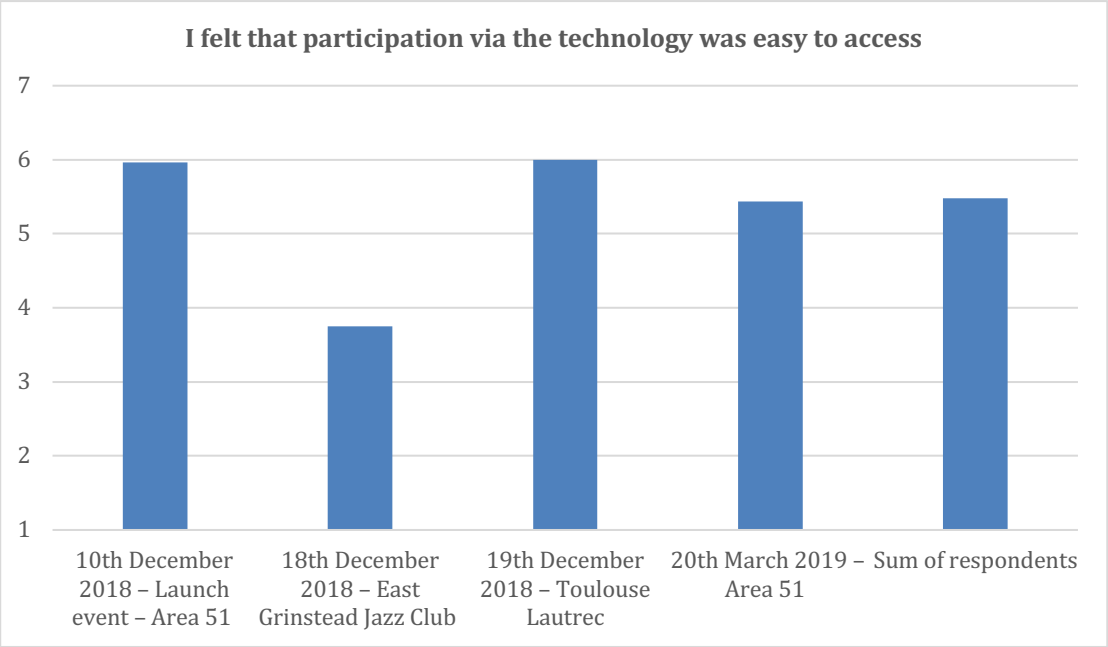


Figure 5.25 Sixth Likert Item Results Expressed as a Mean

Of the 54 respondents to the sixth Likert item *"I felt that participation via the technology was easy to access"*, 81.46% of the summed participants were on the positive side of the scale however 50% of the East Grinstead audience were either neutral or on the negative side of the proposition suggesting that despite enjoying the process, many of them were unable to access the *Deeper Love Soundpad App* because of their lack of an iPhone running OS12 or later. In future research making the app *platform agnostic* by creating code and building the app for both the IOS and Android platforms may be a way of addressing the lack of ease of technological access reported by many of the East Grinstead respondents.

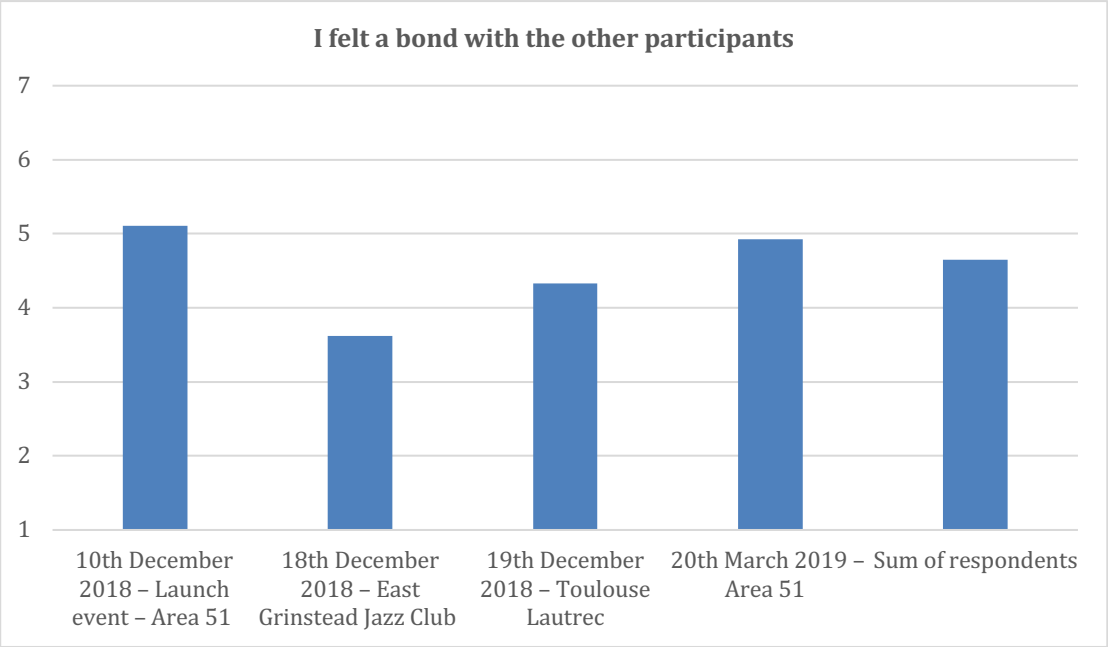


Figure 5.26 Seventh Likert Item Results Expressed as a Mean

There was a less positive summed response to the seventh Likert item *"I felt a bond with the other participants"* with 55.53% of the *audience-performers* being on the positive side of the scale. It was the East Grinstead respondents who again provided a different perspective with 62.5% on the negative side of the scale. This outcome may stem from the fact that the East Grinstead *audience-performers* were seated and unable to move around the room; but with all the Toulouse Lautrec participants who were also seated being either neutral or on the positive side of the spectrum it would take further research to verify this conclusion.

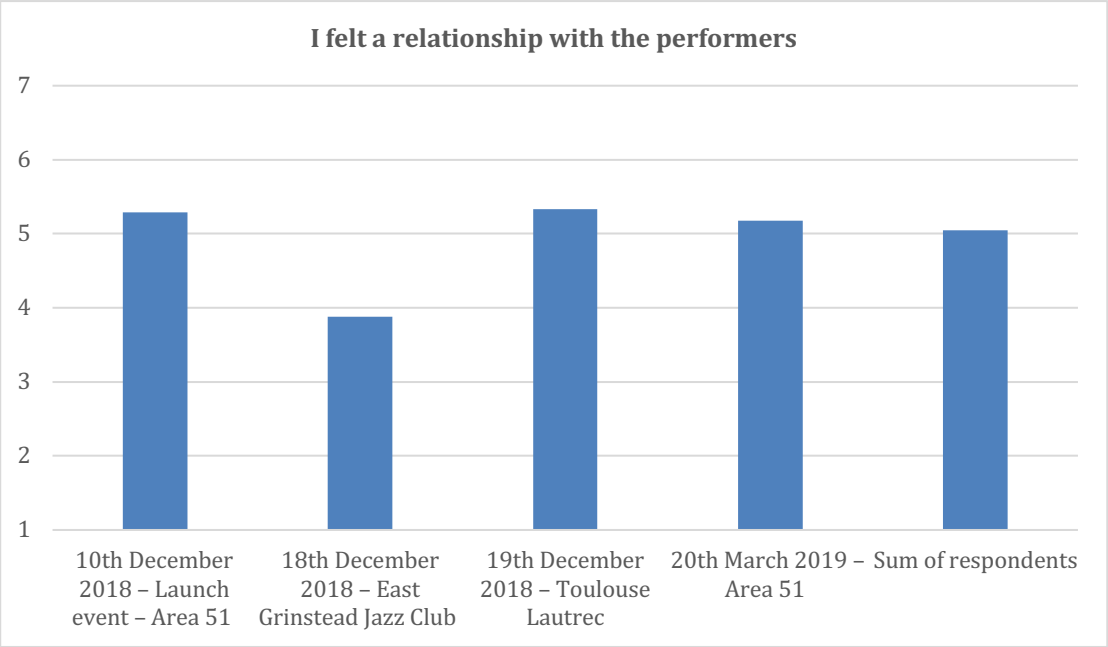


Figure 5.27 Eighth Likert Item Results Expressed as Mean

In the final Likert item *"I felt a relationship with the performers"* 63.55% of the summed responses were on the positive side of the scale with 20.02% responding negatively. There is an interesting comparison with the 53.55% of the East Grinstead respondents who also selected the negative side of the scale. With the Toulouse Lautrec results being based on only three returned questionnaires it is hard to draw many conclusions from those results in isolation; however, with the larger East Grinstead sample there seems to be a correlation between the higher level of negative scale results and the lack of mobility in the room, the age of the respondents and the lower iPhone to Android ratio displayed by those participants.

Three qualitative open-ended interviews were undertaken with *audience-soloists* (AS) from the first Area 51 *audience research event,* the East Grinstead and the Toulouse Lautrec events. The first was carried out

face to face and the second two by phone. Six broad themes emerged from the analysis. The first related to how straightforward it was for the *audience-soloists* to access the participatory process via the technology. One AS interviewee said

> "*Yeah I felt it was very intuitive. I could see the potential for breaking down a lot of barriers to people that haven't trained as musicians straight away… There's a lot of potential there*."

Another interviewee, when asked, said

> "*Yeah. Yeah. Very to the point where after a couple of moments I was hoping for more. I mean … the controllers have basic functions. And I was already thinking ahead to. Oh it's that way. I want more of things because it's so easy to use*".

The second theme hovered around the issue of agency in terms of the *audience-soloists'* contribution, as one interviewee put it,

> "*You know you gave me the space to kind of explore that myself and kind of yeah explore and then you would respond. Giving me the freedom to explore.*"

Another interviewee, when asked, said "*It's just playing. You're just like playing with a simple instrument isn't it?*", and a third "*for the most part I was in full control*".

The next comment is centred on the theme of feeling *blended* into the performance with the interviewee commenting

"*The musicians were all aware of my presence. They were all making eye contact and giving me hints and clues on when to go in when to come out. It was very much part of the performance*."

Following on from the previous topic the question of whether there had been a *sonic dialogue* between the musicians emerged.

One *audience-soloist* said

"*it felt (as) if someone had explained the concept beforehand. And then I'd done it. I wouldn't have guessed that it was as inclusive as it was. I mean it really felt, yeah just very very very natural. Yeah*."

Another mentioned

"*Yes. When I realised what I was doing okay. Yeah. There was call and answer and there were people listening to each other and duplicating the sounds even in the audience there was people doing certain things. One side of the hall and the other side of the hall you'd hear somewhere else. Oh I'll do the same thing and call and response*."

Talking about the issue of whether the *audience-soloists* felt *bonded* with the other participants, comments included

"*Yeah. very much so. I guess it was almost like that kind of hive mentality that you know people realise there's something going on. And they can affect change to get you know like a group awareness. Yeah.*"

Another interviewee said

"*Inclusive. It felt like It pulled people together. I think it made everything quite inclusive. But once things got going it was very much a group dynamic*."

As to whether the interactive moments in the work were *meaningful* musically one interviewee argued that

"*It was like a demo of what could be. Like. It felt like it should be, it could branch out into something more and at that point I it would start feeling when it was almost like just a little taste of what could be but if it was done at a bigger scale with crowds and stuff like that… If you gave too many options it just might just break down into something that's not very nice.*"

One interviewee identified a potential future direction for the research.

"*I imagine it'd be good for lessons maybe not just on the gig scene, in schools and primary schools, participating in the different ways and interacting with people. I think there is quite a lot of uses for it,*

The idea of the controller to know how you move it around.

Gestures could have been implemented in, I think that would have created some kind of almost dance element to it."

Following a mixed-method approach for collecting data that integrates both qualitative and quantitative results has created a research platform that has provided important insights into the experiences of the *audience-performers* and *audience-soloists.* In summary these results

provide a solid basis for addressing the *research questions* as well as creating fruitful pathways for further investigations.

5.7 Theoretical Analysis

An ANT analysis of any of the *Deeper Love* performances is going to contain many of the same actants and network connections that made up the *actant-network* for the performance of *The Singularity*, however the *Evaluation of Learning* in Chapter 4.8 highlighted both the need to *scale up* audience participation and the potential for *resistance* from the iPhone audience-performer.

The starting point for an analysis of any of the *Deeper Love* performances can again be this PhD thesis, though it could just as easily be the *Deeper Love* score or sheet music (Dankert, p5), and the performance similarly becomes a *punctualised black box* with actants creating an *actant-network*. A list of actants with agency and non-transformative entities in the performances of *Deeper Love* (*Table 7*) highlights the differences with the pilot composition/performance.

Human	Theoretical	Technological
Performer (and composer)	Performance protocols	Deeper Love Soundpad
Audience-soloists	Compositional protocols	Two WiiMote controllers
Audience-performers	Technical infrastructure	Ableton Live DAW and file
Audience	Modal harmony	OSCulator and file
Musicians	Jazz improvisation	M-Audio Oxygen 25 keyboard
Sound engineer	Eco's conceptions of *open works*	Ableton Push
Creative Artefact	Small's conception of *musicking*	iPhone
Sheet music	The PhD thesis	WiFi
Composition		Macbook Pro laptop
	Location	Bluetooth
Organisational	Performance space	Sound System
Jazz club/University		

Table 8. Deeper Love - Actants and non-transformative Entities (Actants in red, non-transformative Entities in blue)

The iPhone audience-performer actant in *The Singularity* network has been replaced by the *audience-performers*, a *translated* subsection of the audience. The *audience-performers* trigger a new technological actant, the *Deeper Love Soundpad*, which functions as an *immutable mobile*, translating the audience into *audience-performers* through its offer of exploration in the brave new world of *Interactive Musical Participation*. This new actant displays a much higher level of interactive engagement reflected in more network connections, with there being less possibility of *resistance* than with the iPhone audience-performer.

Similarly, the addition of an Ableton Push controller affords the Performer rather than the iPhone audience-performer the ability to change *scenes* within Ableton Live and hence the structure of the composition within the performance.

A cartographic rendering of the filaments and nodes making up the network (see *fig. 5.28*) creates a clearer representation of the activity, connections and translations within.

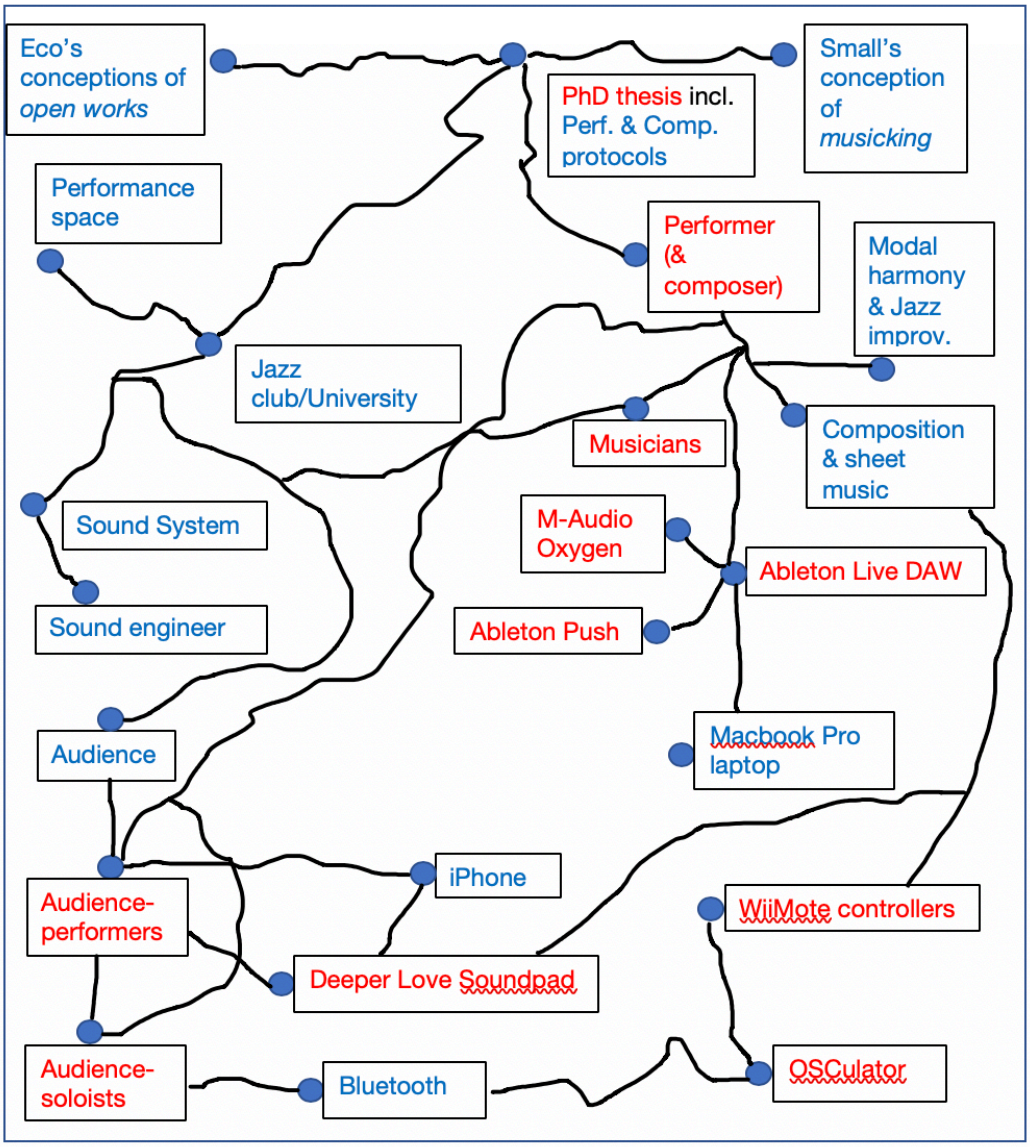


Figure 5.28. Deeper Love – Actant-network

As in *The Singularity's* actant-network, the *Organisational*, *Creative Artefact* and *Location* entities are *intermediaries* within the *Deeper Love* network but still have the possibility of *agency* within their own hidden and *simplified* networks. For instance, The East Grinstead Jazz Club (EGJC) exhibits *agency* and *movement* by turning the upstairs room at The Dorset Arms public house into a jazz club in a process of *translation*. However, within the *Deeper Love* performance network although the EGJC displayed agency in relation to putting the event on in a process of *displacement* (Latour, 2005, p27), there was no further movement that in any way identifies the jazz club as a *mediator* rather than an *intermediary* (ibid., p39).

In the actant-world of *The Singularity* the iPhone is also an *intermediary*, a vessel that contains the TouchOSC app but with no autonomy in the network. In the *Deeper Love* performance network, the iPhone becomes a *mediator* because it is translated into a musical instrument and distributed sound source with its own speaker being used. It has obvious connections to the *Deeper Love Soundpad* and the *audience-performers* and further connections to the composition, the audience, the performer and then on to the rest of the network. However, because there is no *a priori* ordering within the network the iPhone and its closest connections are no more privileged than any of the other actants, despite its importance in enabling the scaling up of interactivity. Because ANT is a theory based on providing a snapshot of activity every actant has to function without *resistance* for the network to flow.

5.8 Evaluation of Learning

In reviewing the literature there was no evidence of research that addressed the integration of *Interactive Musical Participation* into the music genre of contemporary jazz. This research was designed to address that gap in knowledge through the investigation of two *research questions* and three *research objectives.*

The initial phase involved the process of trialling the technical infrastructure, compositional and performance protocols for this research using a music composition entitled *The Singularity* as a *research instrument.* The outcomes from this study and the ANT analysis included a solid technical foundation for the project, the development of compositional and performance protocols that have been carried forward into the main study. Four key findings also emerged that were taken forward:

1) To allow for a simple scaling up of the numbers of interactive performers, *audience-performers* could use *distributed sound* on their mobile phones
2) That a modal harmonic approach for compositional purposes creates a controlled harmonic framework for both *audience-performers* and *audience-soloists* to perform within
3) That sounds triggered by the *audience-soloists* should have gentle attack envelopes or be of no fixed meter to avoid rhythmic incompatibility

4) That having an *audience-performer* control the structure of the composition via TouchOSC on the iPhone creates a greater potential for *resistance* from an ANT perspective

These findings helped to shape the creation of the second *research instrument,* a composition entitled *Deeper Love.* It was composed in the *Dorian mode* to create a unified harmonic framework for all the melodic, chordal and *triggered* sonic material*.* As stated earlier in this chapter an iPhone app called the *Deeper Love Soundpad App* was developed to enable a scaling up of the numbers of *audience-performers.*
Deeper Love was first performed at the Crosstown Traffic Conference in Huddersfield on September 7th 2018. For this pilot performance the app was not yet fully developed and so the app samples were triggered manually by *audience-performers* on a Novation Launchpad S digital controller (video available at https://youtu.be/ZD6yiBJd7hM). However, the Huddersfield performance which was well-received established the viability of the compositional and technical concept (video available at https://youtu.be/6T03nNZWJDQ) leading to the four *audience research events* covered earlier in this chapter.

Two research instruments, a questionnaire and a series of interviews, created a series of findings which can be tested against the principles, criteria, *research questions* and *research objectives* that informed the design of this research.

The technological infrastructure for this project was based on eight principles. It needed to be: i) *informal* ii) *interesting* iii) *immediate* iv) *accessible* v) *natural* vi) *necessary* vii) *affordable* and viii) *scalable.* Principles iii), iv) and v) are met by the responses to the questionnaire Likert item *"I felt that participation via the technology was easy to access"* to which 81.46% of the summed participants were on the positive side of the scale. The *scalability* and *free of charge* nature of the *Deeper Love Soundpad App* address principles vii) and viii), and the evidence for principles i) and ii) comes from the *informal* nature of the event itself, far away from the classical music concerts described in Small (1998) and by the engagement of the *audience-performers* and *audience-soloists* throughout the event and comments such as *"There's a lot of potential there"*. In regards to vi), developing an affordable and accessible technological infrastructure for *Interactive Musical Participation* within jazz is embedded in the core of this research and taken from an identified gap in research as evidenced in the Literature Review in Chapter Two.

Revisiting the Lee and Freeman (2013) set of criteria to enable a successful audience participatory experience it can be seen that as with *The Singularity*

1. Participation was easily accessible
2. Gestures from the audience were turned into a single musical composition
3. *Audience-soloists* had no reservations about participating

4. *Audience-soloists* were motivated to perform and sustained interest in their participation

5. *Audience-soloists* in some instances identify a clear relationship between their gestures and the musical outcomes

The first *research question, "*What is the experience of audience members engaging in *Interactive Musical Participation* within contemporary jazz?", has been met by the results and analysis in this chapter, and the second, "What are the opportunities for incorporating *Interactive Musical Participation* within contemporary jazz?" have been dealt with in this and the previous chapters with a *speculative future* being proposed in the final chapter of this thesis.

The three *research objectives* are all related to the design or evaluation of *Interactive Musical Participation* within contemporary jazz and have been addressed by the research presented in this thesis.

Although the current study is based upon a small number of participants and despite its exploratory nature, the findings and the ANT analysis contribute to knowledge by adding to the growing body of literature on *Interactive Musical Participation*, and by providing novel contributions to the *performance practice* of popular music.

Chapter 6 – Discussions and Conclusions

6.1 Overview

"*Music was, and still is, a tremendously privileged site for the analysis and revelation of new forms in our society*" (Attali,1985, p133).

With live performance shifting into the online world it may be that the performative interactivity that technology affords is a herald of things to come and that this research, which was undertaken to evaluate the potential for *Interactive Musical Participation* in the field of contemporary jazz through the design and performance of a series of live musical artefacts, will become a trailblazer for online interactive performance. In this research performance and compositional protocols and a technological infrastructure were developed through various iterations to allow a *mobilised* audience to perform using games controllers and an iPhone app. This methodology created a *collaborative improvisatory space* for both the *audience* and the *performers* with findings and analysis being drawn from results taken from interview and questionnaire-based research instruments.

6.2 Original Contributions to Knowledge

The research findings presented in this thesis, discussed in detail in Chapter Five, were generated from the investigation of two *research questions* and three *research objectives* all related to the design or evaluation of *Interactive Musical Participation* within the contemporary jazz idiom. The study generated a number of novel findings, compositional and performance protocols, and technological solutions.

Although the Literature Review has created a much richer and more detailed survey of the field of *Interactive Musical Participation* than has been available up until this point, the overarching novel element of this research has been the development and application of *interactive performance technology* to allow *Interactive Musical Participation* within jazz, an existing genre which has its own defined compositional and improvisational structures as well as performance protocols. This research has been informed by the innovative application of *Actor Network Theory* to the musical performances that are at the heart of this research to uncover the power relationships and the potential for *resistance* within the network through creating a snapshot of the connections between the human and non-human actants that constitute the performance network.

The first of the two research questions – *What is the experience of audience members engaging in Interactive Musical Participation within contemporary jazz?* – was addressed through the creation of two

research instruments, a questionnaire and a series of interviews the results from which are presented in Chapter Five of this thesis. Taken together the findings created valuable new data adding to the growing body of literature on *Interactive Musical Participation.* This data should assist in the design of *Interactive Musical Participation* projects across all the genres of popular music.

The performances of the pilot study, *The Singularity*, and *Deeper Love*, the main research vehicle, were a direct response to the second research question – *What are the opportunities for incorporating Interactive Musical Participation within contemporary jazz?* As previously stated the integration of *Interactive Musical Participation* with an existing popular music genre and the development of protocols and technologies to enable that process was particularly significant creating a large space for further research. Within the more proscribed field of jazz the novel conception of *audience-performers* and *audience-soloists* as two new performer categories may be of importance if *Interactive Musical Participation* develops into a more generally accepted element of performance practice within jazz or any other popular music genre.

The three *research objectives* also generated findings with implications for future research. A novel and important outcome of the first *research objective – To investigate how modern technologies can be utilised to engage audiences with improvisation in contemporary jazz performance* – was the development of the *Deeper Love Soundpad App* which

addresses issues of *scalability* and *audience agency* in *Interactive Musical Participation*. The *Soundpad* concept promises a future where every smartphone owner can become a *mobilised* performer integrated into one or more compositions within a performance.

The second *research objective – To investigate a variety of software and hardware interface technologies and the training that will be needed to use them, to enable Interactive Musical Participation within the contemporary jazz idiom* – was addressed by the creation of a novel, easily accessible and low-cost technological infrastructure as well as the performance protocols for *Interactive Musical Participation* as previously described in Chapters Four and Five. The use of the WiiMotes as a trigger for improvised motifs was another original contribution to knowledge and gave the *audience-soloists* a considerable degree of agency in their experience of *Interactive Musical Participation.*

The third *research objective* in this study set out *to investigate how standard compositional and improvisational structures and performance protocols within the contemporary jazz idiom will need to be altered to enable Interactive Musical Participation.* In an original contribution to knowledge the results of the research showed that standard jazz compositional and improvisational structures as well as performance protocols can work in the context of *Interactive Musical Participation.* The only caveat to this is that harmonic and rhythmic considerations need to be managed carefully as was the case in the construction of the

Deeper Love research composition. In another novel development a new performance context of *audience takeover* emerges at the end section of *Deeper Love* when it is the *audience-performers* playing the *Deeper Love Soundpad App* rather than the live musicians or sequenced material that creates an underscore to close off the composition. It is at this moment that the transformative process of turning the audience into the performer is complete, in what has been an exploration of the Deleuzian-Guattarian approach to creative arts research leading to an *ontogenic* outcome.

6.3 Impact and Implications

The results from this research imply that the process of *Interactive Musical Participation* can be effectively integrated with a popular music genre such as jazz. No major changes need to be made to performance protocols although there are issues with both the harmonic makeup of compositions and the rhythmic elements of any triggered material that need to be carefully managed. An affordable, scalable and accessible technological framework has been developed which has been tested in real-world *gig* conditions and found to be reliable and robust thus opening up the field to other practitioners across popular music.

This research has attracted some interest and achieved some public engagement. Papers and performances were delivered at several academic conferences, live performances happened at two jazz clubs

and at the University of Westminster, conference papers and a book chapter were published and online portals presented news stories about the research.

The pilot composition entitled *The Singularity* was presented both at the *Innovation in Music* conference at the University of Westminster in London, 2017 as a paper and performance and at the CREAM Summer PhD Symposium at the University of Westminster in July 2018. The performances established the viability of the research path as well as providing valuable data for the subsequent work. The *Innovation in Music* conference paper was written up as a chapter for the *Innovation in Music* book published by Routledge in 2019. A paper was given in September of 2018 at the *Crosstown Traffic* conference in Huddersfield as well as a pilot performance of the primary vehicle for this research entitled *Deeper Love.* Building on the audience feedback and heuristic analysis of this performance full research performances took place in December 2018 and March 2019 at the *Area 51* performance space at the University of Westminster, at the *East Grinstead Jazz Club*, and the *Toulouse Lautrec* jazz club in Kennington, London.

The research has been featured on the University of Westminster's website (available at https://www.westminster.ac.uk/news-and-events/news/2018/adrian-york-showcases-groundbreaking-research-performance-involving-audience-with-technology) and there was an article about the first *Area 51* performance at the University of

Westminster on the Music Education UK website (available at http://musiceducationuk.com/category/magazine/features/).

Looking to the future the research will be featured and extended in live performances from a new ensemble entitled *Global Tribe.* The group will showcase *Interactive Musical Participation* at music festivals and in concert performances and will act as a vehicle for carrying forward the findings from this thesis. It is hoped that the novel *interactive* elements of the research will increase its impact in both the academic and non-academic world.

6.4 Future Research

Further investigation and experimentation into the way *Interactive Music Participation* can be integrated within popular music genres and other areas of interactive performance is strongly recommended. Future research might be broadly divided into four areas:

i) Technical improvements and developments

ii) New compositional concepts

iii) New performance contexts

iv) Collaborations

6.4.1 Technical improvements and developments

A number of ideas for developing the *Soundpad App* have emerged during the research process.

i) Having the buttons on the app play back different samples for each song

ii) Being able to turn the sound of the app on and off remotely via a data automation system

iii) Sending new samples to the app at each interactive moment via a device automation system (Hagins and Hawkinson, 2013) or using remote virtualisation technology (Zhao et al., 2013)

iv) Being able to trigger more than one button on the app at once

v) Having the app display instructional messages

These improvements should increase the practicality of using the app through the duration of a complete performance as well as aiding the artist in controlling the interactive performance soundscape.

Further experimentation needs to take place in the area of reinforcement for the sounds triggered by the *Soundpad App* using smartphones. Part of this would entail assessing the utilisation of the *Soundpad App* at a larger concert, festival or stadium gig to see if it is more effective in those environments with a mass, full-house audience than in a club or small concert context. This area of research could see the realisation of Mcluhan's proposal that the mass audience becomes a "*creative participating force*" (McLuhan, 1967).

6.4.2 New Compositional Concepts

Future studies could be undertaken to develop novel compositional concepts using *Interactive Musical Participation.* Building on Levin (2001), CoSiMa (2017) Lee and Freeman (2013), *audience-performers* within a performance context could be mobilised to be the prime source of sound generation with other performers improvising around and responding to these audience-generated soundscapes.

6.4.3 New Performance Contexts

Some investigation would be warranted to explore the feasibility of using technologies such as the *Soundpad App* or the WiiMote for triggering pre-prepared samples in the field of Music Therapy or other therapeutic interventions that involve music, sound production or performance. Extending the research of Hunt et al. (2004) the therapeutic application of *Interactive Musical Participation* could be analysed to see if it allows all performance participants to operate on a *level playing field*.
With the emergence of social distancing and the global shutdown of live music it may be possible to create *interactive mixes* that will allow a new performer category, the *listener-performer*, to trigger sounds from a *Soundpad App* and perform with the track at home.

6.4.4 Collaborations

Future collaborations with performance organisations that already work with interactivity such as *Punchdrunk* and *Secret Cinema* will be explored to investigate if this research can help such organisations improve their immersive and interactive experiences. There is also potential for examining the potential for collaborations with artists in a variety of fields ranging from music and drama to performance and installation art.

6.5 Conclusion

Small's premise that *"Music is not a thing at all, but an activity, something that people do"* (Small, 1998, p2) has been extended to expand the notion of participation into an *interactive* musical involvement that is both *natural* and *necessary* (Hasse, 2017), and that exemplifies Nyman's definition of experimental music as a location that emphasises "*an unprecedented fluidity of composer/performer/listener roles*" (Nyman, 2009, p23). The concept of participation being a *liberation* (Rzewski, F. and Verken, M. 1969, p94) as theorised by Musica Elettronica Viva in the 1960s, transforms the audience into *active agents* (Brand et al., 2012, p635) reinvented as *audience-performers*, who, in an *ontogenic* process of *distributed creativity* (Sawyer, R.K. and DeZutter, S., 2009), create a new homogenous entity in an improvisatory environment that has the possibility of audience influence firmly

embedded (Bailey,1993, p44). However in this research the *audience-performers*, in a similar model to the compositions identified by Eco as *open works* (Eco, 1962) (Eco, 1989, p19), are improvising by manipulating data provided by the author using *"melodies, scales and arpeggios"* associated with the chord sequence (Bailey,1993, p48), rather than self-generating their musical responses. Taking a Deleuzian-Guattarian approach to creative research in which the *intra-action* of theory and practice is *immanent* to creativity, these *"melodies, scales and arpeggios*" which are the pillars of *chord-scale theory* (Russell, 1959; Mehegan, 1959; Nettles and Graf, 1997; Mulholland and Hojnacki, 2013) can be seen as stable Deleuzian-Guattarian *molar* lines with the performances, improvisations and new performance and compositional protocols being the more contingent *molecular* lines.

This process delivers the *controlled* levels of *interactivity* and *immersive* experience identified in the *narrative tree* model used in performances of Zoe Svendson's play *World Factory* (Svendsen, 2015) which was a key influence on this research. It offers up the prospect of moving beyond the Debordian *spectacle* (Debord,1967) to allow the audience to reappropriate *"the production of subjectivity"* (Guattari,1992, p81) in an act of creative *self-sufficiency* (Maciunas, 1965), and to be motivated to move from being *passive voyeurs* to *active participants* (Rancière, 2009*,* p53) thus creating "*new modes of human relations*" (Borriaud,1998 b, p168) and to "*experience the miracle"* (Rzewski and Verken, 1969, p94).

From an *actor-network theory* viewpoint the complex web of relationships between human and technological *actants* that characterises *Interactive Musical Participation* have been *depunctualised* and made explicit through the process itself. As the audience becomes the performer the *ANT Black Box* falls away to reveal its secrets (Latour, 2005; Callon,1986; Law,1992). This thesis was completed in the time of the COVID-19 pandemic, an event that has led to the shutdown of live entertainment. In this context the networks that sustained live performance have collapsed; the venues and institutions that hosted live shows are shut, audiences, artists and support staff are having to manage both anxiety about infection and social distancing, and the fragile economic infrastructure of the entertainment industry has been exposed. The outcome of this situation is that many of the actor-network connections of the presented in this thesis can no longer be made. However, new models of performance are emerging including a “drive-in” gig in Aarhus, Denmark with audio being transmitted into the cars via FM radio (NME, 2020).

This research offers novel *interactive* options for transforming performance in this new era. From an ANT perspective it may be that interactive engagement with a performance as a *mediator*, creating a more engaged audience experience, will replace the proximal *intermediary* experience within the actor-network that has been the norm.

It is *digital natives* playing their own smartphones (Oh and Wang, 2011; Late Shift, 2016; CoSiMa, 2017), the ubiquitous computer in our pocket, who will engage most constructively with this *transformative praxis* (Väkevä 2010, p59) in which the mobilisation of audience *agency* becomes *"a practical necessity rather than a theoretical construct"* (Fischer-Lichte, 2008). It is *digital natives* for whom interactivity is second nature that will drive forward the practice of *Interactive Musical Participation* beyond the realms of this thesis and the practice of this researcher, transforming musical performance by becoming digital collaborators.

Appendix 1 – Deeper Love Audience Questionnaire

Post-performance quantitive audience research material.

Please highlight the appropriate number to indicate your feelings about the following statements:

I felt a sense of agency during the performance (i.e. the ability to make free choices in respect to your contribution)

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

My participation made a contribution to the work

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

I did not feel that other audience participants made a contribution to the work

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

I felt that the interactive moments in the work were meaningful

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

I enjoyed being able to make a contribution to the work

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

I felt that participation via the technology was easy to access

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

I felt a bond with the other participants

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

I felt a relationship with the performers

Strongly disagree 1 - 2 - 3 - 4 - 5 - 6 - 7 Strongly agree

If you are willing to be interviewed for more detailed feedback on the performance, please include your

Name……..and

Email address……

Appendix 2 – Deeper Love Audience Questionnaire Results

PHD QUESTIONNAIRE ANALYSIS

I felt a sense of agency during the performance (i.e. the ability to make free choices in respect to your contribution)

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	
10th December 2018 – *Launch event - Area 51*		0	0	0	2	5	5	15		27
		0.00%	0.00%	0.00%	7.40%	18.51%	18.51%	55.55%		
18th December 2018 - *East Grinstead Jazz Club*		1	0	0	1	1	4	1		8
		12.50%	0.00%	0.00%	12.50%	12.50%	50.00%	12.50%		
19th December 2018 - *Toulouse Lautrec*		0	0	0	0	1	1	1		3
		0.00%	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%		
20th March 2019 - *Area 51*		0	0	2	1	4	3	7		17
		0.00%	0.00%	11.76%	5.88%	23.52%	17.64%	41.17%		
	Respondents	1	0	2	4	11	13	24	Total respondents	54
	Respondents %	1.85%	0.00%	3.70%	7.40%	20.37%	24.07%	44.44%		

My participation made a contribution to the work

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	Respondents
10th December 2018 – *Launch event - Area 51*		0	3	1	4	4	3	11		26
		0.00%	11.53%	3.84%	15.38%	15.38%	11.53%	42.30%		
18th December 2018 - *East Grinstead Jazz Club*		1	0	1	3	1	1	1		8
		12.50%	0.00%	12.50%	37.50%	12.50%	12.50%	12.50%		
19th December 2018 - *Toulouse Lautrec*		0	0	0	2	0	1	0		3
		0.00%	0.00%	0.00%	66.66%	0.00%	33.33%	0.00%		
20th March 2019 - *Area 51*		1	0	3	2	4	4	3		17
		5.88%	0.00%	17.64%	11.76%	23.52%	23.52%	17.64%		
	Respondents	2	3	5	11	9	9	15	Total respondents	54
	Respondents %	3.70%	5.55%	9.25%	20.37%	16.66%	16.66%	27.77%		

I did not feel that other audience participants made a contribution to the work

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	Respondents
10th December 2018 – *Launch event - Area 51*		7	8	3	4	2	2	1		27
		25.92%	29.62%	11.11%	14.81%	7.40%	7.40%	3.70%		
18th December 2018 - *East Grinstead Jazz Club*		0	2	0	4	1	1	0		8
		0.00%	25.00%	0.00%	50.00%	12.50%	12.50%	0.00%		
19th December 2018 - *Toulouse Lautrec*		0	0	1	1	0	1	0		3
		0.00%	0.00%	33.33%	33.33%	0.00%	33.33%	0.00%		
20th March 2019 - *Area 51*		5	2	4	2	1	1	1		16
		31.25%	12.50%	25.00%	12.50%	6.25%	6.25%	6.25%		
	Respondents	12	12	8	11	4	5	2	Total respondents	54
	Respondents %	22.22%	22.22%	14.81%	20.37%	7.40%	9.25%	3.70%		

I felt that the interactive moments in the work were meaningful

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	Respondents
10th December 2018 – *Launch event - Area 51*		0	2	1	3	6	8	6		26
		0.00%	7.69%	3.84%	11.53%	23.07%	30.76%	23.07%		
18th December 2018 - *East Grinstead Jazz Club*		1	1	1	3	1	1	0		8
		12.50%	12.50%	12.50%	37.50%	12.50%	12.50%	0.00%		
19th December 2018 - *Toulouse Lautrec*		0	0	0	2	1	0	0		3
		0.00%	0.00%	0.00%	66.66%	33.33%	0.00%	0.00%		
20th March 2019 - *Area 51*		1	0	2	1	4	4	4		16
		6.25%	0.00%	12.50%	6.25%	25.00%	25.00%	25.00%		
	Respondents	2	3	4	9	12	13	10	Total respondents	53
	Respondents %	3.77%	5.66%	7.54%	16.98%	22.64%	24.52%	18.86%		

I enjoyed being able to make a contribution to the work

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	Respondents
10th December 2018 – *Launch event - Area 51*		0	0	0	2	9	7	11		29
		0.00%	0.00%	0.00%	6.89%	31.03%	24.13%	37.93%		
18th December 2018 - *East Grinstead Jazz Club*		0	0	1	0	1	1	4		7
		0.00%	0.00%	14.28%	0.00%	14.28%	14.28%	57.14%		
19th December 2018 - *Toulouse Lautrec*		0	0	0	1	0	0	2		3
		0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	66.66%		
20th March 2019 - *Area 51*		0	0	0	3	5	4	4		16
		0.00%	0.00%	0.00%	18.75%	31.25%	25.00%	25.00%		
	Respondents	0	0	1	6	15	12	20	Total respondents	55
	Respondents %	0.00%	0.00%	1.81%	10.90%	27.27%	21.81%	36.36%		

I felt that participation via the technology was easy to access

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	Respondents
10th December 2018 – *Launch event - Area 51*		0	0	1	1	8	5	12		27
		0.00%	0.00%	3.70%	3.70%	29.62%	18.51%	44.44%		
18th December 2018 - *East Grinstead Jazz Club*		2	1	0	1	2	2	0		8
		25.00%	12.50%	0.00%	12.50%	25.00%	25.00%	0.00%		
19th December 2018 - *Toulouse Lautrec*		0	0	0	1	0	0	2		3
		0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	66.66%		
20th March 2019 - *Area 51*		2	0	1	0	3	3	7		16
		12.50%	0.00%	6.25%	0.00%	18.75%	18.75%	43.75%		
	Respondents	4	1	2	3	13	10	21	Total respondents	54
	Respondents %	7.40%	1.85%	3.70%	5.55%	24.07%	18.51%	38.88%		

I felt a bond with the other participants

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	Respondents
10th December 2018 – *Launch event - Area 51*		0	2	4	4	4	5	8		27
		0.00%	7.40%	14.80%	14.80%	14.80%	18.51%	29.62%		
18th December 2018 - *East Grinstead Jazz Club*		1	3	1	0	0	2	1		8
		12.50%	37.50%	12.50%	0.00%	0.00%	25.00%	12.50%		
19th December 2018 - *Toulouse Lautrec*		0	0	0	2	1	0	0		3
		0.00%	0.00%	0.00%	66.66%	33.33%	0.00%	0.00%		
20th March 2019 - *Area 51*		1	1	2	3	5	3	1		16
		6.25%	6.25%	12.50%	18.75%	31.25%	18.75%	6.25%		
	Respondents	2	6	7	9	10	10	10	Total respondents	54
	Respondents %	3.70%	11.11%	12.96%	16.66%	18.51%	18.51%	18.51%		

I felt a relationship with the performers

	Strongly disagree	1	2	3	4	5	6	7	Strongly agree	Respondents
10th December 2018 – *Launch event - Area 51*		0	0	5	3	5	6	8		27
		0.00%	0.00%	18.51%	11.11%	18.51%	22.22%	29.62%		
18th December 2018 - *East Grinstead Jazz Club*		1	2	2	0	1	2	1		9
		11.11%	22.22%	22.22%	0.00%	11.11%	22.22%	11.11%		
19th December 2018 - *Toulouse Lautrec*		0	0	0	1	0	2	0		3
		0.00%	0.00%	0.00%	33.33%	0.00%	66.66%	0.00%		
20th March 2019 - *Area 51*		0	1	0	5	2	5	3		16
		0.00%	6.25%	0.00%	31.25%	12.50%	31.25%	18.75%		
	Respondents	1	3	7	9	8	15	12	Total respondents	55
	Respondents %	1.85%	5.45%	12.72%	16.36%	14.54%	27.27%	21.81%		

Appendix 3 – Deeper Love XCode code

```
//
//  ViewController.h
//  SoundPad
//
//  Created by Rob Toulson on 16/10/2018.
//  Copyright © 2018 RT Sixty Ltd. All rights reserved.
//

#import <UIKit/UIKit.h>
#import "AVFoundation/AVFoundation.h"

@interface ViewController : UIViewController{
        AVAudioPlayer *audioPlayerAudio1;
        AVAudioPlayer *audioPlayerAudio2;
}



@end
//  ViewController.m
//  SoundPad
//
//  Created by Rob Toulson on 16/10/2018.
//  Copyright © 2018 RT Sixty Ltd. All rights reserved.
//

#import "ViewController.h"

@interface ViewController (){
    UIButton *gridCell[26];
    UIButton *stopBtn;
}

@end

float r[26];
```

```
float g[26];
float b[26];
float a[26];

int cellWidth=60;
int cellHeight=60;
int d=10;
int nx=5;
int ny=5;

int nplay=0;



@implementation ViewController

- (void)viewDidLoad {
    [super viewDidLoad];
    // Do any additional setup after loading the view, typically from a nib.

    NSLog(@"!Sound Pad!");

    // list fonts
    for (NSString* family in [UIFont familyNames])
     {
     NSLog(@"%@", family);
     for (NSString* name in [UIFont fontNamesForFamilyName: family])
     {
     NSLog(@"  %@", name);
     }
     }


    [[AVAudioSession sharedInstance] setCategory: AVAudioSessionCategoryPlayAndRecord  error: nil];
    [[AVAudioSession sharedInstance] overrideOutputAudioPort:AVAudioSessionPortOverrideSpeaker
error:nil];
    //AVAudioSession.sharedInstance().overrideOutputAudioPort(AVAudioSessionPortOverride.Speaker, error:
&error);
```

```
    CGRect screenBounds = [[UIScreen mainScreen] bounds];
    int screenX=screenBounds.size.width;
    int screenY=screenBounds.size.height;
    int centerX=screenX/2;
    int centerY=screenY/2;

    //*****************************************************************************
    // background image with 3D motion effect
    UIImageView *bgImage = [[UIImageView alloc] initWithFrame:CGRectMake(-100, -100, screenX+200,
screenY+200)];
    //[bgImage setAutoresizingMask:UIViewAutoresizingFlexibleHeight|UIViewAutoresizingFlexibleWidth];
    [bgImage setTranslatesAutoresizingMaskIntoConstraints:NO];
    bgImage.contentMode = UIViewContentModeScaleAspectFit;
    [bgImage setImage:[UIImage imageNamed:@"background_main_stars.png"]];
    [self.view addSubview:bgImage];
    //[bgImage setAlpha:0.5];
    [self.view insertSubview:bgImage atIndex:0];

    UIInterpolatingMotionEffect *motionEffect;
    motionEffect = [[UIInterpolatingMotionEffect alloc] initWithKeyPath:@"center.x"
                                                    type:UIInterpolatingMotionEffectTypeTiltAlongHorizontalAxis];
    motionEffect.minimumRelativeValue = @(-25);
    motionEffect.maximumRelativeValue = @(25);
    [bgImage addMotionEffect:motionEffect];
    motionEffect = [[UIInterpolatingMotionEffect alloc] initWithKeyPath:@"center.y"
                                                    type:UIInterpolatingMotionEffectTypeTiltAlongVerticalAxis];
    motionEffect.minimumRelativeValue = @(-25);
    motionEffect.maximumRelativeValue = @(25);
    [bgImage addMotionEffect:motionEffect];

    //*****************************************************************************
    //*****************************************************************************
    // foreground title
    UILabel *title = [[UILabel alloc]initWithFrame:CGRectMake(centerX-160, 50, 320, 40)];
    title.textColor = [UIColor colorWithRed:1 green:0.0 blue:0.05 alpha:0.95];
    title.backgroundColor=[UIColor clearColor];
```

```
[title setFont:[UIFont fontWithName:@"Moby" size:32]];
title.textAlignment = NSTextAlignmentCenter;
title.text= @"Deeper Love";
[self.view addSubview:title];
// foreground subtitle
UILabel *subtitle = [[UILabel alloc]initWithFrame:CGRectMake(centerX-150, 90, 300, 30)];
subtitle.textColor = [UIColor colorWithRed:1 green:1 blue:1 alpha:0.9];
subtitle.backgroundColor=[UIColor clearColor];
[subtitle setFont:[UIFont fontWithName:@"Moby" size:24]];
subtitle.textAlignment = NSTextAlignmentCenter;
subtitle.text= @"SoundPad";
[self.view addSubview:subtitle];
//*****************************************************************************
//*****************************************************************************
// button matrix
float rgb_inc=0.01;
r[1]=0.99;
g[1]=0.01;
b[1]=0.3;
a[1]=1;

int i;
int row,col;
row=0;col=0;
float Y0=centerY+2.0*cellHeight;
float X0=centerX-2.5*(cellWidth+d)+d/2;

// create colour array
for (i=2;i<=25;i++){
    b[i]=b[i-1]-rgb_inc;
    g[i]=g[i-1];
    r[i]=r[i-1]+rgb_inc;
    a[i]=a[i-1];
    //NSLog(@"Index %i RGBA %.2f %.2f %.2f %.2f",i,r[i],g[i],b[i],a[i]);
}

// create buttons with colours
```

```
    for (i=1;i<=25;i++){
        gridCell[i]=[[UIButton alloc] initWithFrame: CGRectMake(X0+(cellWidth+d)*col,Y0-
(cellHeight+d)*row,cellWidth,cellHeight)];
        gridCell[i].backgroundColor = [UIColor colorWithRed:r[i] green:g[i] blue:b[i] alpha:a[i]];
        gridCell[i].tag = i;
        [gridCell[i] setShowsTouchWhenHighlighted:YES];
        [gridCell[i] addTarget:self action:@selector(gridCellPressed:)
forControlEvents:UIControlEventTouchUpInside];
        [self.view addSubview:gridCell[i]];
        col=col+1;
        if (col>4){
            row++;
            col=0;
        }
    }
    //*************************************************************************
    // stop button
    stopBtn=[[UIButton alloc] initWithFrame: CGRectMake(centerX-cellWidth,Y0+cellHeight*2,
cellWidth*2,cellHeight/1.6)];
    stopBtn.backgroundColor = [UIColor colorWithRed:1 green:1 blue:1 alpha:0];
    [stopBtn setFont:[UIFont fontWithName:@"Moby" size:20]];
    [stopBtn setTitle:@"stop" forState: UIControlStateNormal];
    [stopBtn setShowsTouchWhenHighlighted:YES];
    [stopBtn addTarget:self action:@selector(stopBtnPressed:)
forControlEvents:UIControlEventTouchUpInside];
    [[stopBtn layer] setCornerRadius:8.0f];
    [[stopBtn layer] setMasksToBounds:YES];
    [[stopBtn layer] setBorderWidth:2.0f];
    stopBtn.layer.borderColor = [UIColor colorWithRed:1 green:0 blue:0.05 alpha:0.6].CGColor;
    stopBtn.alpha=0.6;
    [self.view addSubview:stopBtn];
}



- (void)gridCellPressed:(id)sender{


    long btn=[sender tag];
```

```
    NSError *error;
    NSString *audioFileName;
    NSURL *audioFile;

    nplay++;

    // load audio file for button
    if (btn<10){
        audioFileName=[NSString stringWithFormat:@"Audio0%lu",btn];
    }
    else{
        audioFileName=[NSString stringWithFormat:@"Audio%lu",btn];
    }
    audioFile = [[NSBundle mainBundle] URLForResource:audioFileName withExtension:@"mp3"];
    NSLog(@"Grid Action: %lu File %@",btn,audioFileName);

    // two audio players, allowing fade out of current while loading new
    if (nplay==1){
        [audioPlayerAudio2 setVolume:0 fadeDuration:(NSTimeInterval)1];
        audioPlayerAudio1 = [[AVAudioPlayer alloc] initWithContentsOfURL:audioFile error:&error];
        [audioPlayerAudio1 play];
        audioPlayerAudio1.volume=1;
    }else if (nplay==2){
        [audioPlayerAudio1 setVolume:0 fadeDuration:(NSTimeInterval)1];
        audioPlayerAudio2 = [[AVAudioPlayer alloc] initWithContentsOfURL:audioFile error:&error];
        [audioPlayerAudio2 play];
        audioPlayerAudio2.volume=1;
        nplay=0;
    }
}

- (void)stopBtnPressed:(id)sender{
    [audioPlayerAudio1 setVolume:0 fadeDuration:(NSTimeInterval)0.5];
    [audioPlayerAudio2 setVolume:0 fadeDuration:(NSTimeInterval)0.5];
}

@end
```

Appendix 4 – Audience-Soloist interviews

INTERVIEW 1

IS1 - INTERVIEW SUBJECT 1 AY- INTERVIEWER
[00:00:00]
IS1 - How long is it going to take?

AY- Just a few minutes.

IS1 - Yeah that's cool. I'm just going to the second gig.

AY- [00:00:07] Yeah. Great. So firstly could you just say I've gotta ask you these questions at the beginning. Could you just say what your name is?

IS1 - Yes yes. ……

AY- and do you give me permission to record this phone call?

IS1 - [00:00:21] Absolutely.

AY- Great

IS1 - [00:00:23] So, have you taken part in any kind of interactive music performance before?

IS1 - No.

AY- Did you have any reservations about it initially?

IS1 - [00:00:37] mmm… On a personal level I guess yes because I just came from doing something I'm quite comfortable. Which is playing with you guys. And then kind of a step into the unknown. As a volunteer so I don't know if that counts as a reservation the reservation. Yeah.

AY- [00:00:57] Yeah of course. That's fine.

AY- So did you feel that your participation was easy to access via the technology?

IS1 - [00:01:07] Yeah, I felt it was very intuitive.

AY- [00:01:10] And did you feel that you had the ability to make some free choices in terms of your contribution.

IS1 - [00:01:18] Yep yep.

AY- [00:01:20] Can you expand on that?

IS1 - Yeah. Yeah. Well

[00:01:26] I guess parts of with the Wii controllers is part of the thing of you know realizing that some of some of the controls if you held it down for longer rather than just a single kind of hit ,you know some of the change some of the sounds might not change but some of them would change and some would change in different ways. And then obviously you would you would respond different. You know you gave me the space to kind of explore that myself and kind of yeah explore and then you would respond. Giving me the freedom to explore.

AY- [00:02:01] Thank you. Thank you. Did you feel you were blended into the performance?

IS1 - [00:02:06] Yeah absolutely. Yeah. No, no just. I mean it helps.

[00:02:14] Like, like I said in the previous answer you know the fact that you are you are kind of waiting.

[00:02:22] You know you're kind of waiting, I discovered this you know all this changes if you hold it down a bit longer or you know so. So yeah I felt really blended.

AY- [00:02:32] Okay. Did you feel that there was a sonic dialogue going on?

IS1 - [00:02:37] Absolutely. Absolutely.

AY- How did that how did that feel?

IS1 - [00:02:46] I mean it felt, it felt if someone had explained the concept beforehand. And then I'd done it.

[00:02:55] I wouldn't have guessed that it was as inclusive as it was.

[00:02:58] I mean it really felt Yeah just very, very, very natural. Yeah.

AY- [00:03:06] But would you say that those, those sort of interactive moments were meaningful musically?

IS1 - [00:03:12] Absolutely. Absolutely.

AY- And did you enjoy being able to make a contribution to the work in this way?

IS1 - [00:03:21] Yeah yeah it was.

[00:03:24] I mean the thing that went through my mind was you know it's cool for me as a geeky musician but the idea it seems to break down a lot. I could see the potential for breaking down a lot of barriers to people that haven't trained as musicians straight away.

AY- [00:03:42] thank you. And did you feel kind of bonded with the other participants at all?

IS1 - [00:03:54] No. I mean apart from the bonding of the shared experience. I mean not massively so because we kind of did separate turns with you. Yeah. So I guess in that sense not, not so much.

AY- [00:04:10] Well you were you performing with me, so did you feel a bond?

IS1 - [00:04:13] I see I'm sorry I misunderstood you. Yes. In that case yes. Yeah, very much so

AY- [00:04:18] Okay. And, and the other performers the people who came on or the people in the room did you feel a kind of relationship with them too?

IS1 - 00:04:28] Yeah. Once you've done it out to everybody and the whole room was doing it. That was I was I mean. I guess it was almost like that kind of hive mentality that you know people realise there's something going on. And they can affect change to get you know like a group awareness. Yeah.

AY- [00:04:50] Yeah. So do you feel the group actually could create something that was you know of its own?

IS1 - [00:04:59] Yeah. Yeah

great.

[00:05:05] There's a lot of potential there.

AY- Brilliant. Listen thank you very much for your time. I really appreciate it.

INTERVIEW 2

IS2 - INTERVIEW SUBJECT 2 AY- INTERVIEWER

AY [00:00:00] Do you give permission for me to record this phone call?

IS2 Yeah that's fine.

AY Perfect. Thank you. It shouldn't take more than about five minutes. So have you taken part in any kind of interactive music performance before?

IS2 [00:00:29] What when you say interactive, you mean with instruments or just singing and clapping and stuff?

AY [00:00:34] Well things think things that involved sort of electronic devices.

IS2 No I haven't.

AY [00:00:41] No. Okay. When. When the idea was put to you. Did you have any reservations about it initially?

IS2 No.

AY No.Okay. Did, did you feel that the participation via the technology was easy to access?

IS2 Yes

AY Any of the questions you want to kind of add a little bit extra to

[00:01:04] That's fine rather than just no and yes. Okay. During the performance did you feel that you had the ability to make free choices in respect of your contribution?

IS2 [00:01:18] Yes. It was good yeah

AY Okay. You wanna talk a little bit more about that.

IS2Well it’s because. It's just playing. You're just like playing with a simple instrument isn't it.

AY [00:01:31] Yeah. I mean that's what I'm asking you.

IS2 [00:01:33] So that's what it felt like to me. Yeah yeah.

AY [00:01:35] Okay. And um did you feel that you were blended into the performance?

[00:01:43] I suppose yes yes yes.

AY Okay.

[00:01:46] And do you feel that the interactive moments were, were meaningful musically?

IS2 [00:01:56] Yes and no, I don't really have any strong feelings about that.

AY [00:01:59] Well did they seem to make sense to you musically.

IS2 [00:02:03] Oh yes I would say yes. It made me think that I was doing okay.

AY [00:02:08] Um so was that. Was it a sort of active process that you were involved in you having to think about what it was rather than a sort of random?

IS2 [00:02:18] Yes, definitely.

AY [00:02:21] Okay. Did you feel there was any kind of sonic dialogue going on between you and me for instance once it got going.

IS2 [00:02:30] Yes. When I realised what I was doing okay.

AY And how did that feel?

IS2 That was good.

AY Okay.

IS2 It was different.

AY [00:02:39] Yeah. And did you enjoy being able to make a contribution to the work?

IS2 [00:02:44] Oh yeah.

AY [00:02:46] Great. And did you feel the bond with the other participants too?

IS2 Definitely. Yeah.

AY Okay. And the relationship with the performers the performers?

IS2 [00:02:58] I suppose so. Yeah.

AY Yeah. Okay.

[00:03:02] Well those are my questions. Do you have anything else you'd like to sort of say about the experience and the event?

IS2 [00:03:09] I suppose I was expecting a bit more in terms of like you could have done more like involve more people it would have been more fun that way as well. And for longer if you know what I mean.

AY [00:03:20] Yeah. I mean there was a time constraint I had to work within. And, and also I was hoping that more people would have had iPhones. But this is part of the research process.

IS2 [00:03:34] Oh of course. That was right.

INTERVIEW 3

IS3 - INTERVIEW SUBJECT 3
AY- INTERVIEWER

AY [00:00:05] Thursday the thirty-first of January.

[00:00:08] Could you give me your name please.

IS3 - Yes ……

AY Thank you very much. So have you ever taken part in any kind of interactive music performance before?

IS3 - [00:00:24] um.

[00:00:26] not for study purposes I did used to run a choir before I came to university. I used to work in a primary school.

AY Yeah.

IS3 - And we did a kind of activity that was based on quite, where they weren't just singing they had to do percussion and things like that. Nothing.

[00:00:50] What's the word. Nothing. It was like a new idea. It's just. Okay.

AY That's fine.

That's fine. So when you volunteered

[00:00:59] did you have any reservations about it at all initially?

IS3 - [00:01:05] Just the act of going up on stage really.

AY Yeah right.

IS3 - Just singling myself out.

AY Yeah.

[00:01:13] So that was that made you. Did that make you feel nervous?

[00:01:16] What did make you feel?

IS3 - A bit apprehensive and nervous. Nothing too much.

[00:01:22]
AY was that to do with the process or just the fact you were going on stage?

IS3 - Probably.

AY Yeah. Okay. Did you feel that the participation via the technology was easy to access? Was it straightforward?

IS3 - [00:01:41] Yeah. Yeah. Very to the point where after a couple of moments

[00:01:49] I was hoping for more. I was hoping for. I mean were the controllers have basic functions. And I was already thinking ahead to.Oh it's that way. I want more of things.

[00:02:02] because it's so easy to use.

AY [00:02:07] And did you feel a sense of agency during the performance that what I mean by that. Did you feel you were able to control your own contribution?

IS3 - [00:02:16] Yeah. Yeah. Once again like I say

[00:02:22] For me I felt like that could be more variation in what things I was what sounds I was creating but for the most part I was in full control.

AY [00:02:35] Did you feel blended into the performance. Did you feel part of the performance?

IS3 - Yes.

[00:02:40] The musicians were all aware of my presence. They were all making eye contact and giving me hints and clues on when to go in when to come out. It was very much part of the performance

AY [00:02:54] Did you feel that the interactive moments in the work were meaningful musically?

IS3 - Not sure that they were. Hard question because it

[00:03:15] In a way yes. But once again. It was almost like it was on a, it was like a demo of what could be. Like. It felt like it should be, it could branch out into something more and at that point I it would start feeling when it was almost like just a little taste of what could be. So it was touching on it but I think maybe. More interaction more options. More variation would have helped.

AY And
[00:03:49] But you're coming from a background of music performance. Do you think that might have affected your view and it would.

IS3 - Yeah very much so

[00:04:00] Yeah yeah yeah. I think

[00:04:08] Being in this situation with everybody in the room being from some sort of musical background. There's a bit more thought going into what could be done but if it was done at a bigger scale with crowds and stuff like that. If you gave too many options it just. Might just break down into. Into something that's not very
[00:04:34] nice.

AY And did you think there was any kind of sonic dialogue to

[00:04:42] between the performers?

IS3 - Yeah. There was call and answer and there were people listening to each other and duplicating the sounds even in the audience there was people doing certain things. One side of the hall and the other side of the hall you'd hear somewhere else. Oh I'll do the same thing and call and response.

AY [00:05:00] And how did that feel.

IS3 - Inclusive. It felt like
[00:05:11] Once there was that initial moment of ‘well what we're doing here’. People were beginning to enjoy it.
[00:05:17] I think that the act of the call and response and copying people's ideas are somewhat prescient. Something really allowed to stand out. It pulled people together. I think it made everything quite inclusive.

AY [00:05:31] So you said the word enjoy. People were enjoying it. Did you enjoy making a contribution?

IS3 – Definitely.

AY Did you. Did you feel a bond with the other participants?

IS3 - Yeah. Yeah I mean at first it felt like - Oh I'm up on the stage. But once things got going it was very much. A group
[00:05:52] dynamic. From that moment on once you got over

[00:05:55] the diving in part

AY and did so you felt a relationship with the performers or the audience or both?

IS3 – Both, both were.

AY [00:06:04] Great. Anything you'd like to say about the experience?

IS3 - I enjoyed the experience. I thought it was different. I could see [00:06:15] where people might want to take it. I imagine it'd be good for audience participation. But not just I imagine it'd be good for lessons maybe not, not just on the gig scene, in schools and primary schools participating in the different ways and interacting with people. I think there is quite a lot of uses for it, but. I do feel like, specifically the controls we had on stage. There was
[00:06:51] The idea of the controller to know how you move it around. Gestures could have been implemented in I think that would have created some kind of almost dance element to it.

AY Yeah, I mean actually in previous iterations of the of the [00:07:09] performance we did have that. but what was interesting we found that actually some audiences found too many possibilities difficult to manage and that for people who weren't used to working, who weren't musicians that triggering sounds is in itself quite a big deal. So. I think it depends on who you're pitching it at. Yeah thanks that's brilliant.

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