Enabling Creativity:
Inclusive music interfaces and practices

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Abstract
Inclusive music practices often involve the use of music interfaces, aiming to overcome disabling barriers to music making faced by people with disabilities. In this paper, design approaches, and the question of 'openness' are discussed, as are practices with interfaces for sound and music creation in sonic arts and electronic music broadly. In addition, I examine ethnographic examples from my research with Drake Music Northern Ireland, a music charity that aims to enable people with disabilities to compose and perform their own music through music technology, to show that in inclusive music, it is through the social interactions and practices using a DMI or musical tool that design limitations can be exposed and challenged, and new adapted uses or affordances emerge.

Keywords: inclusive music, assistive music technology, critical making, enabling technology

1 Introduction

The barriers to music making that people with disabilities face can be viewed through two predominant theoretical models: the medical model and the social model (Lubet 2011). The former sees disability as arising from the physical or mental limitations of the musician, whereas the latter sees the exclusionary design of the musical instrument or interface as the disabling factor. The social model perspective naturally shifts the focus to enabling: techniques and technologies for transcending or transforming disabling barriers. In the following, I discuss musical control interfaces and digital musical instruments (DMIs) used in electronic music and inclusive music practices.

Digital disability is a phrase coined to provoke the recognition that ICT and digital technologies, commonly hailed as a panacea for people with disabilities, in practice often act to further exclude users (Goggins and Newell 2003). The Helen Hamlyn Centre for Design (Royal College of Art) and Scope Disability Charity report 'Enabling Technology' argues that whether mainstream, hacked or adapted, many devices can be made to empower people with disabilities to live and act more independently (Jewell and Atkin 2013).

I will first discuss musical interface design broadly from the perspective of the different motivations, ethos and goals that DMI designs can aspire towards. Second, I will introduce the field of inclusive music and the tools and practices that it encompasses. Third, I move into a discussion of my own ethnographic research conducted with the Drake Music Project Northern Ireland (DMNI), a music charity that facilitates workshops to enable people with disabilities and learning difficulties to compose and perform their own music, sharing examples of accessible music interfaces and situations as I have experienced them in the field. In conclusion I suggest that music interfaces and their usage in practice at DMNI reveal important parallels to other forms of music that are also inextricably linked to digital music technologies; the different meanings in their making, and the importance of the social interactions surrounding these technologies as they are actually used in practice.

2 The meanings in making

The availability of assistive music technology (AMT), accessible DMIs and mainstream adapted devices for people with disabilities continues to grow and diversify, largely because of two factors: the nature of the materiality of digital technology, and intertwined with this, the availability of cheap and powerful tools for hacking and coding unique, personal and bespoke hardware and software for music and sound creation. Recent studies into DIY, hacking, and maker culture, analyse the growing interest in individualized and personally manufactured designs and devices, emphasizing the democratization of knowledge, technology and material culture (Blikstein 2013; Tanenbaum 2013; Lindtner 2012; Lindtner et al. 2014) alternative values and ideologies, and a return to an interest in physical materials (Ratto 2011; Lindtner

2014). This is attributed to readily available technology and knowledge at low or no cost, and the "openness" of many software based technologies (Hamidi et al. 2014; Tseng 2014).

The practices of composers, hackers, and makers creating or modifying tools and instruments for various musical and sonic ends can arguably also be seen as growing, diversifying and transforming. Some seek to improve the screen-mouse-keyboard paradigm of interaction, or introduce a new one; to find innovative ways to free oneself from the restraints of laptop performance; to propose a more embodied, intelligible way of performing computer music or to subvert contemporary standardized trends in electronic music performance (Jordà 2001; Cook 2003; Kim and Seifert 2006; Miranda and Wanderly 2006; Magnusson 2010; McGlynn et al. 2012). Whilst others aim to create tools of intentionally restrictive interactive potential for performances incorporating techniques of constraint (Bowers and Archer 2005); and others still pursue experimental research aims (Gurevich et al. 2010; Marquez-Borbon et al. 2010; Donarumma 2011)

New modes of interaction and making, from the embodied and extended, to the virtual or augmented (Tanaka and Bongers 2001; Duckworth 2003), the intra-infra-contra-hyper (Bowers and Archer 2005), to the hacked and bent offer new imaginings of music tools and instruments and novel approaches to music performance (Miranda and Wanderly 2006; Goldman 2011; Green 2011).

Matt Ratto (2011) builds upon the possibilities offered by open source software and hardware, as well as developing technologies such as 3D printing, and explores how making can supplement and extend critical reflection on the relations between digital technology and society. He defines his experiments as 'critical making': a mode of materially productive engagement that is intended to bridge the gap between physical and conceptual exploration (Ratto 2011). His research can be likened to the way in which practices surrounding DMI design, creation and performance challenge traditional musical ontological questions such as: what counts as a musical instrument (or even a musician); what constitutes a musical performance; and what is musical communication?

Turning now to look at interfaces in inclusive music, I hope to show how the idea of 'critical making' and challenging the traditional definitions of what counts as a musical instrument, a performance, a musician is of vital importance in inclusive music.

3 Inclusive musical control interfaces

The hardware and software practices discussed above are examples of the ways in which electronic musicians and composers can potentially create new tools, patches or instruments for individual works, or configure software or adapt mainstream hardware in unique ways specific to each instance of performance. This is possible due to the advent of electronic instruments, particularly controllers and digital musical instruments (DMIs), which have made instrument design itself available to composers and technologists as a form of musical communication (Goldman 2011). In a similar vain, bespoke AMT can be created, aiming to overcome specific barriers for individual musicians or user groups, or to be widely accessible tools for music and sound creation.

Inclusive DMI designer Brendan McCloskey (2014) identifies four terms used to describe design ethos in accessible design: 'accessible'; 'assistive'; 'universal' and 'inclusive'. Noting that the distinctions between these terms often overlap and blur, a device is deemed: *assistive* or *accessible* if it addresses a specific physical and/or cognitive impairment, and *universal* or *inclusive* if it enhances usability through an appreciation of a wide spectrum of capabilities amongst the population (McCloskey 2014: 46).

In a report entitled *Engagement with Technology and Special Educational and Disabled Music Settings*, Farrimond et al. (2011) give a comprehensive summation of music technologies used in these settings. The report refers to pioneer of electronic music Robert Moog's (1988: 214–220) definition of contemporary music technology, identifying "three diverse determinants of musical instrument design and musical instrument structure. The first is the sound generator; the second is the interface between the musician and the sound generator; the third is the... visual reality of the instrument". Farrimond et al. (ibid: 13) argue that this modular system allows each element to be modified, adapted or replaced depending on the individual needs of a musician.

For musicians who face barriers to participation a modular system can offer significant benefits over traditional, un-modifiable instruments (ibid). They identify five major musical interface types: distance and motion tracking technology; touch screen technology; tangible interfaces; wind controllers and biometrics (ibid: 26-29). Farrimond et al. (2011) also discuss the

variety of barriers, additional to the subjective barriers faced by musicians that exist between the potential of music technology to meet the needs of musicians with disabilities or special education needs such as the training of facilitators; and obtaining consistent resources and funding (ibid: 29).

As Farrimond et al. (2011: 13) illustrate, contemporary music technology that follows Moog's (1988) definition of a modular system is more suited to musicians with disabilities because different interface types can be appropriately utilized in response to individual musician's specific barriers to access and participation. In addition, the more 'open' a DMI or digital device is (as opposed to 'closed' or un-modifiable) the more it can be adapted for a specific user's needs or purpose. In other words, open (adaptable or open source) technologies can be hacked or modified to overcome disabling barriers to music making for people with disabilities.

A recent study into accessible design titled *Enabling Technology* (Jewell and Atkin 2013), identifies that open source hardware, such as Arduino and Raspberry Pi, and 'curated ecosystems', such as iOS and Android, also afford enormous versatility and customization needed by people with disabilities. However, I would add to this that even 'closed' designs can be modified, so rather than defining a technology as open or closed, analyzing a device's level of 'openness' may be more useful. Through my fieldwork at Drake Music Northern Ireland (DMNI), I have seen that although a hardware interfaces can be hacked to suit a specific individual, a more immediate and spontaneous solution emerges through linking tools together in arrays, attempting to create for a musician the opportunity to discover the most appropriate control interface for their own specific capabilities. Sound generators that have inaccessible interfaces can be adapted with controllers or sensors to overcome a specific barrier to its utilisation. In all cases it is the trained facilitator implementing the hack, or adapting a tool for the musicians, so an important question to ask when considering openness is: open to whom? A precondition for the person hacking or adapting a tool is a certain level expertise; thus, a universally open technology is hard to conceive.

Yet, no matter how open or accessible a technology is said to be, whether it actually has an enabling effect and the ways in which it can be creatively used to enable participation is understood through observing and participating in practice. In the following section the focus is turned to practices with inclusive musical control interfaces.

4 Inclusive musicking with digital tools

I am currently engaged in a year-long ethnographic study of DMNI, which I am undertaking through participating in DMNI activities and workshops; self-learning the functionalities and affordances of each piece of equipment used in the workshops; and semi-structured interviews and focus group discussions aimed at forming an understanding of the experiences and views of the workshops and the use of digital technology from different people involved in DMNI.

My research methodology is participant observation, so the study began formally in February 2014 when I joined a sixteen-week training course to become a DMNI access music tutor. Around ten other Belfast based musicians were also inducted at the same time. As the training progressed, I began to shadow and assist workshops, eventually co-facilitating inclusive music workshops in different contexts, gaining first-hand experience of inclusive musicking with DMNI's plethora of equipment. On many levels I felt like an inexperienced trainee, which enabled me to fully immerse myself in the experience of learning to be a DMNI access music tutor. Throughout the duration of my research I have often been challenged to improvise and spontaneously find different ways of communication, musical collaboration and adapting technology for non-conventional usages.

I have chosen two instances of creative use of accessible DMIs and mainstream technology in inclusive music workshop settings, introducing some of the techniques and technologies utilised in inclusive music.

4.1 Enabling Creativity

From the first session of the training course onwards, DMNI CEO Dr. Michelle McCormack always emphasised that the important point in inclusive music is not the technology being used, but rather how you bring out creativity in another. Defending simple technological solutions, such as MIDI switches and pad based controllers, Michelle stressed to the group of trainees that although now there is an abundance of new technologies and devices for music and (accessible music), especially those created in universities, in practice they often don't last and do not achieve sustained use. The various reasons she gave are well documented in academic research, such as:

issues surrounding lack of intelligibility (Jordà 2001; Wessel and Wright 2002; Cook 2004) and lack of time and resources for users to gain a level of mastery (Farrimond et al. 2011; Gehlhaar 2014)

My own experiences in the field, through participation and close observance of workshops, have corroborated what Michelle has continually emphasised to the trainee access music tutors. Furthermore, I have seen that through the social interaction between musician and facilitator and the creative, improvised solutions with musical control interfaces that arise as a result, musicians with disabilities are enabled to participate and engage in the musical process.

4.2 Workshops

Workshops are delivered once a week in social care facilities, schools and at the DMNI studios (based in Belfast and Newry). The groups are comprised of adults or children (sometimes mixed groups) with a range of both physical disabilities and learning difficulties, depending on the client or care provider DMNI is working with. The format of the workshops discussed here followed the structure of most DMNI short-term workshops. This generally consists of five phases: 1. Rapport and relationships are formed between access music tutors and the participants. 2. A song or soundscape is composed through discussion and experimenting with ideas 3. The song is structured and mixed through discussion and critical listening 4. The composition is then arranged for performance 5. Once the composition and performance arrangements are complete, a performance may be organised to present the work to a public audience, including the participant's parents and carers.

4.3 Ultrasonic timpani

For musicians with quadriplegic cerebral palsy who experience sensory-motor dysfunction, the major barrier to participation is limb motor control (McCloskey 2014: 44). Movements take time, and keeping a motion or action steady and consistent, two essential requirements for playing a tradition musical instrument, is not easily possible. McCloskey (ibid: 11) argues that some MIDI instruments may be inclusive or accessible in nature, but most are not optimised for musicians with quadriplegic cerebral palsy who have a limited degree of upper limb motor capability.

In one afternoon workshop with an ensemble comprised of three just such musicians and two supporting facilitators (including myself), after a period of drawing out some ideas from the participants, it was decided by the group that a timpani part would suit the piece that was currently being composed. As a large marching band drum set has its home in the DMNI Belfast studio, the facilitators decided to record the musicians playing rhythms on the drum with a regular drumstick. I had to hold the drum in the air, bringing it to arm level for the musicians, a condenser mic was set up for recording into DAW software. However, after a few attempts it was clear that one of the musicians was not happy with his recording efforts. The following solution that Facilitator A (my cohort) had thought of and had wanted to test, with impressive results. Facilitator A took an iPad to the musician; they together recorded one drum hit into *Garageband*'s (https://www.apple.com/uk/mac/garageband/) sampler so he could play a rhythm with a sample, rather than on the actual drum. The musician's hand motion was not controlled enough to discretely use the iPad touch screen interface. Facilitator A improvised a solution, adapting the iPad with a *Soundbeam* (http://www.soundbeam.co.uk/) sensor via an *iRig* (http://www.ikmultimedia.com/products/irig/) Audio-MIDI interface adapter. *Soundbeam* is an ultrasonic sensor that transforms sonar responses into data that can control MIDI events. Through echolocation, a hand or object breaking the beam of the sensor at different points sends different values of data. There is no physical interface, no knobs, sliders or pads, so for a musician who finds working with physical objects a difficulty, the *Soundbeam* enables control of discrete note events. The musician was now able to play the timpani sample with concentrated effort. He recorded a track that he was satisfied with.

This is one example chosen from many to illustrate a trained access music tutor's spontaneous problem solving efforts towards overcoming an individual's specific barrier to participation in the composition process. In this instance a musician was enabled to play his own timpani line and participate as the other musicians had. After witnessing this the other two musicians decided to abandon their initial acoustic recordings and play the sampled timpani through the iPad sampler too.

An acoustic instrument can be made more accessible for musicians with different abilities by sampling and playing it through an iPad touchscreen interface. In turn, the iPad can

be adapted with the *iRig* and *Soundbeam* to include an even broader spectrum of users. This example of a facilitator adapting tools to overcome a disabling barrier illustrates how inclusivity and accessibility is not solely determined in the design and making. Most importantly, it is in social interactions and creative practices through which technologies are utilised, assemblages of devices are created and spontaneously adapted to overcome disabling barriers.

4.4 Opening the door to participation

The *Skoog* (http://www.skoogmusic.com/) is another accessible DMI, which comprises a 'soft, squeezable object', variably sensitive to touch, responding to a light touch or the total compression of its malleable interface. The object is multi-touch sensitive with five colour-coded responsive zones. Each zone can have a particular note or sampled sound allocated to it and multiple parameters are variable from within accompanying software. Using physical modelling developed within *Max/MSP* (www.cycling74.com), it is possible to dynamically manipulate the various instrument sounds though 'pressing, squeezing, rubbing, stroking, tilting or manipulating the Skoog' (Farrimond et al., 2011: 28).

Psychologist and musician Dr. Ben Schögler, co-inventor of the *Skoog* delivered a training session for the DMNI trainee access music tutors, part of a daylong session focussing on different interfaces used in the DMNI context. He recounted one experience to us, which I summarise here.

Ben told us the story of a boy with Asperger's syndrome who was working with a community musician and Skoog practitioner, Lewis Forbes. They had met through a group music making session with the *Skoog*. This particular boy was the only one from the group who wouldn't engage in the workshop. He was consumed in playing with a door handle away from the group. The care workers there said that he always did that, explaining it as 'just repetitive behaviour'. Lewis had refused to accept this; he felt that it was this boy's way of having some control over his environment. Lewis took the *Skoog* to the boy at the door and recorded the door handle's sound and mapped the sample onto the *Skoog's* physical interface. The sound of the boy playing with the door handle was transformed into an instrument. When Lewis started playing with the sound of the door handle on the *Skoog*, it caught the boy's attention. Through interacting with Lewis, the Skoog and the sampled sound of the door handle, participation was enabled. This example echoes the 'Ultrasonic timpani' and was chosen as emblematic of the potential of DMIs for inclusion. It also exemplifies the way in which the affordances of the technologies can only be utilised through the creative and spontaneous interactions between facilitator and musicians working together.

5 Conclusions

The music interfaces and their usage in practice as I have experienced in my very specific research with DMNI reveal important general parallels to other forms of music also inextricably linked to digital music technologies.

Electronic musicians use DMIs and musical control interfaces in subversions of the mainstream (Sicko 2010; Danielsen 2010; Demers 2010; Butler 2006, 2014). Sonic arts challenges the boundaries of what constitutes music, sound and research through the utilization of comparable technology and attempts a turn away from traditional composition conventions and music theory (Emmerson 1986; Smalley 1997; Bowers 2002; Wessel and Wright 2002; Prior 2008). Through inclusive music practices using mainstream and inclusive musical control interfaces, exclusionary designs are exposed and solutions to removing disabling barriers are explored. At the same time, common assumptions of what musicians with disabilities can actually achieve are challenged and traditional notions of disability are deconstructed (Lyons 2006; Cappelen and Andersson 2012; Jewell and Atkin 2013; McCloskey 2014). These technically closely related but stylistically and ideologically divergent examples show how neutral and heterogeneous digital music technologies are, exemplifying some of the broad and variegated applications that are possible.

These attempts at subversion, resistance and deconstruction are enacted in practices of design and making, and of composition and performance. Ratto (2011) defines critical making as a mode of materially productive engagement intended to bridge the gap between physical and conceptual exploration. In the context of inclusive music, the questions of who this productive engagement is open to, who is excluded and why, must be asked. Nevertheless, it is through the social interactions and practices using a DMI or musical tool that design goals and ethos are actually tested. It is in practice that design limitations can be exposed and challenged, and new adapted uses or affordances emerge.

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