International Journal of Performance Arts and Digital Media

ISSN: 1479-4713 (Print) 2040-0934 (Online) Journal homepage: http://www.tandfonline.com/loi/rpdm20

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To cite this article: Tom Davis (2018): Instrumental intentionality: an exploration of mediated intentionality in musical improvisation, International Journal of Performance Arts and Digital Media, DOI: 10.1080/14794713.2018.1545209

To link to this article: https://doi.org/10.1080/14794713.2018.1545209

INTERNATIONAL JOURNAL OF PERFORMANCE ARTS AND DIGITAL MEDIA
https://doi.org/10.1080/14794713.2018.1545209

Instrumental intentionality: an exploration of mediated intentionality in musical improvisation

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ABSTRACT

This paper examines the musician/instrument relationship through exploring notions of mediated intentionality. Ihde's [1990. *Technology and the Lifeworld*. Bloomington: Indiana University Press] writings are taken as a starting point for examining these human–technology relationships with a particular focus on the intentionality of the human-instrument construction. Notions of instruments as mediators of intentionality are then examined from a variety of standpoints found in improvisational practice, with a focus on different conceptions of mediation, instrumental resistance and instrumental agency. Verbeek's [2008. "Cyborg Intentionality: Rethinking the Phenomenology of Human–Technology Relations." Phenomenology and the Cognitive Sciences 7: 387–395] conception of Cyborg Intentionality is explored as one way to extend these notions within a post-phenomenological posthuman framework. To help contextualise this discussion the author presents a performance system, the *Feral Cello*, whose design has been informed by the above discussion. Verbeek's hybrid and composition notions of intentionality are used as a framework for reflection upon the performance system.

KEYWORDS

Improvisation; intentionality; resistance; musician/instrument relationship

Introduction

As an instrument builder and improviser, I am interested in improvisational practices that explicitly foreground technology as part of the performance aesthetic. I see myself as working within a group of practitioners that explore technologically mediated performance in which the agency of the technology becomes highlighted through the act of performance, as part of the performance practice. Performers in this area (for example Green (2013), Ferguson (2013), Borgo (2014), Stapleton (2008), Davis (2011); Norman, Waisvisz, and Ryan 1998), often conceptualise their relationship with the instrument as one of dialogue or resistance. Starting with a brief description of the musical improvisation context and a recap of Ihde's (1990) human–technology relations, this paper seeks to examine the performer–instrument relationship in more detail. It achieves this through exploiting the context of musical improvisation as a site of enquiry in which the performer–instrument relationship is scrutinised as an explicit

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part of the creative practice. As part of this process, varying interpretations of musical instruments are encountered ranging from a conception of instruments as fixed objects of frozen agency waiting to be activated, through to assemblages of technologies whose boundaries are more fluid. To further the understanding of these assemblages, this paper employs Verbeek's (2008) notion of Cyborg Intentionality, which extends Ihde's (1990) phenomenological modalities of relations to tools by its increased recognition of the agency of the technology within the mediating process. In Verbeek's conception, technology is not just a mediator of human intentionality, but actually takes an active role in contributing to the intentionality of the human–technology assembly.

Improvisational context

> Pat Question: How does an improviser improvise?
> Pat Answer: By developing and employing a repertoire of possibilities in order to risk the unknown. (Corbett 1995, 225)

It is not the intention of this article to give a definitive definition of improvisation but rather to provide a working understanding of the processes that are relevant to further the discussion of the performer-instrument relationship. In improvisation, particularly within a non-idiomatic or free improvisation[1] context, there is a constant strive from the performers to do something new within their performance practice. Improvisation in this context is often defined as the creation of the un-for-seen (Borgo 2005, 14) or composing in the moment, the act of live composition. This act of improvisation then, comes with an act of risk, not necessarily the risk of playing something wrong; for example, not following the notation correctly – but perhaps a deeper and more fundamental set of risks that relate to the authenticity of the improvisational process, to truly play/create the un-for-seen (Corbett 1995).

In an interview with Corbett (1995) Evan Parker outlines three risks that he sees arising as part of the improvisational process.

> Risk One – never get out there; can't find the wilderness. The Risk of Stagnation.
> Risk Two – never come back; lost in the wilderness. The Risk of Insanity.
> Risk Three – go full circle (and take audience with). The Risk of Completion.
> Evan Parker. (as quoted in Corbett 1995, 223)

These risks emphasise the need of the improviser to enter into the unknown, to get beyond their own mannerisms, beyond repeating a catalogue of what they can do, or as Borgo puts it 'to find ways of improvising that release us from our habits' (Borgo 2005, 21). Improvisers employ a number of techniques to facilitate this process but tend to fall into one of two camps in their relationships to their instrument: Those that limit themselves to the traditional 'instruments of culture' (Corbett 1995, 230) and push against these boundaries through the use of extended playing techniques to make anew and redefine the resistive boundaries of the instrument; and those that seek to 'deface, deconstruct and/or reconstruct' (Corbett 1995, 230) the instrument to give a sense of playing with something new each time. These different approaches to improvisation suggest different ways of conceiving the relationship between performer and instrument. The next section will explore the different ways in which instruments can be conceived as mediators of performer intentionality.

Mediated intentionality

As Verbeek (2015) notes, recent literature in the field of Philosophy of Technology has suggested that humans and technologies should not be interpreted as two separate entities between which interaction happens; but rather, that technologies and humans should be understood as co-constituting entities that shape each other. As these human–technology relations are situated within the world, it can be surmised that the technologies have a role in the mediation of our experience with the world. Building on a Phenomenological understanding of intentionality, such that our thoughts and beliefs are 'characteristic of being of or about something in the world' (McIntyre and Smith 1989, 147), Verbeek follows that human experience has an 'intentional structure' and argues that it is possible for this intentionality to be mediated through technological artefacts (Verbeek 2008, 387). Verbeek's conception of mediated intentionality builds on previous work by Don Ihde and although these notions have already been further developed by others, for example (Magnusson 2009), it is worth shortly introducing Ihde here to provide a consistent grounding for further discussion.

In *Technology and Lifeworld* (1990) Ihde opens his discussion of a Phenomenology of Technics by examining the 'various ways in which I-as-body interact with my environment by means of technologies' (Ihde 1990, 72). Through this examination of the different ways in which technologies can mediate our experience, Ihde sets out three categories of mediation: Embodied; they become an extension of the human body: Hermeneutic; they become representations of reality with which we react & Alterity; they become terminations of our experience (Verbeek 2008, 289). Ihde represents the three categories with the following notation, in which the arrow represents the direction of human intentionality.

> Embodied relations: (human – technology) → world
> Hermeneutic relations: I → (Technology – world)
> Alterity relations: I → Technology – (–world) (may or may not interact with the world).
> (Ihde 1990, 107)

These relations can be summarised as an interpretation of technology as a transparent object through which we interact with the world; technology as an object that represents an element of the world which must be interpreted or read, and technology as an object that we are interacting with and that we ascribe agency to. Although these relations are presented here as distinct categories, it is important to note that Ihde's human–technology relations should not be interpreted as fixed states, but rather, they describe a continuum of possible states. Following this, it is possible for any single interaction with technology to go through multiple states along this continuum.

Musical instruments as passive mediators

Ihde directly addresses the notion of musical instruments as technological mediators in his writing. Most often (1990 and 2007), he employs his embodied relation to categorise the performer–instrument relationship.

> It should be obvious that a very large use of musical instrumentation falls clearly into the embodiment pattern. The player picks up the instrument (having learned to embody it) and expressively produces the desired music:

> Player –> instrument –> Sound.
> In Embodiment cases, the soundmaking instrument will be partially symbiotically embodied. (Player-instrument) —> sound. (Ihde 1990, 95)

In Ihde's conception, for an embodied experience to be achieved, the technical difficulties of performing with the instrument have to be overcome through the development and employment of instrumental technique. If this is achieved, the performance can be said to have an air of effortless playing, where the distance between the musician's intention and the desired music collapses so that the instrument becomes a transparent vehicle for musical expression. The instrument, in this case, could be understood as a passive, transparent mediator of musical intention and musical desire. The instrument can be thought of as something purely instrumental, a means to an end, a tool for task completion. This conception of the performer–instrument relationship is what Evens terms 'old immediacy theory' (Evens 2005, 130). Evens provides the perceived 'effortless' playing of the virtuoso pianist Rubinstein as an example:

> It is true that Rubinstein projected an air of utter effortlessness in his playing; he sat over the keyboard executing the most technically challenging manoeuvres with relaxed aplomb, a serene, even childlike look on his face, delighting in the music exactly as does a member of the audience. He seemed to be watching his fingers dance over the keys as though they weren't even his, charmed and surprised by the beautiful music emanating from the instrument before him. (Evens 2005, 130)

This understanding of instrumental technique is similar to how Ihde categorises the performer–instrument relationship in *Technologies–Musics–Embodiments* (2007):

> A deeper analysis would go on to show that in the learning process, the shapes of experience change: first, struggles with playing the flute yield sounds, but they are not refined, gracile, 'musical'. But as skill is acquired, the flute is 'mastered' in that it withdraws or becomes more and more transparent and the player is able to produce the sounds we hear as flute-music. (Ihde 2007, 11)

Both these descriptions describe the technical mastery of the instrumentalist overcoming any physical difficulties of playing the instrument. In this construction, one could argue that when the instrumental technique is highly developed the musical instrument itself disappears so that there is no distance between the musical thoughts of the musician and the sound that they can produce. In this understanding, the instrument can be thought of as a direct conveyor of the performer's intentionality.

Notions of instrumental resistance

In contrast to 'old immediacy theory', Evens also articulates an alternative understanding of the performer-instrument relationship, one that recognises the existence and importance of a persistent instrumental resistance even in well-trained players.

> the instrument does not mediate, does not stand between the musician and the music. Neither does the instrument disappear, for it remains integral to the music, offering itself to the musician. (Evens 2005, 159)

In this instance, the instrumental technique is not employed in the mastery of the instrument, to overcome its resistances, but rather 'to place the instrument's resistance in greater contact with the musician' (Evens 2005, 160). The development of an instrumental

technique acts as a facilitator, bringing the resistances of the instrument and the performer closer together, encouraging the 'most efficient meeting [of the performer] with the instrument's resistances' (Evens 2005, 159).

Evens describes instrumental resistance as the physical 'pushing back' of the instrument against the performer, the friction where the 'hard surfaces of the instrument meet the soft flesh of the musician' (Evens 2005, 159). As such, the resistance in this instance is primarily from the physical interaction between the instrument and the performer, one that is necessary for the performer to play, as, without resistance, the instrument falls from the performers grasp. The aim of the performer then is to use the instrumental technique to align themselves to the instrumental resistances, not so they overcome them, but so they can get the most out of them.

In *Contexts of/as Resistance*, Sally-Jane Norman (2013) presents different ways of conceiving of musical instruments and their associated resistances. Norman starts by defining musical instruments in Schafferian terms 'as systems allowing the production of a variety of sound objects while conveying a sense of causal constancy' (Schaeffer 1966, 51 in Norman 2013, 276). Norman gives an example of a Stradivarius violin as an embodiment of a kind of 'frozen agency' of both the craftsmanship used to create it but also the virtuoso performance that it enables. Norman states that in the context of a meaningful performance, 'defiance of normative affordances and patterns of use, generating friction and resistance, is integral to creative endeavour' (Norman 2013, 281). Norman outlines two ways in which these resistances can be exemplified: either through a virtuoso technique that 'exceeds familiar instrumental possibilities', which is similar to Even's conception above. Or alternatively, as manifest in 'the disruption or hijacking of instruments and/or their familiar uses, in contexts where human and non-human actors are equal contributors' (Norman 2013, 282). This later interpretation, a resistive, disruptive understanding of instrumentality is one that is often embraced by improvisers, particularly those within a non-idiomatic or free improvisation genre.

Whilst there is a large body of practitioners that leave the instrument alone, but develop a virtuoso musicianship of extended techniques (Derek Bailey being a notable example (Corbett 1995, 230)), Norman's second manifestation of resistance as the 'disruption and hijacking of instruments and/or their familiar uses' is one that is actively employed by a growing range of improvisers. This approach, which has a lineage back to the 60s, is one that has been actively employed more recently by those seeking to extend their performance practice with the use of technology. Musicians drawing on areas of practice such as circuit bending or DIY culture might be actively constructing or deconstructing their instruments as part of the performance. Instruments, in this case, are rarely fixed single objects for activation; rather, they tend to be constructed or de-constructed from many disparate elements. In such performances, these instrumental technologies are often foregrounded as part of the performance practice. This in turn, is suggestive of a different conception of the performer-instrument relationship than that of a frozen agency waiting to be activated.

Instrumental intentionality

In *The Meaning of Indeterminacy: Noise as Performance* (2014), Klett and Gerber document a culture of Noise Music that rejects notions of 'virtuosic instrumentation and stylistic

process' and a concern from Noise Artists that instrumental mastery leads to improvisatory stagnation (Klett and Gerber 2014, 7). Some Noise Artists feel that some instrumentalists have so much performance knowledge that they have 'exhausted the instrument' (Klett and Gerber 2014, 7). Klett and Gerber state that in contrast to this, the aesthetic of Noise Music, which champions the resultant quality of sound over instrumental technique, enables musicians to re-explore their instruments in new ways. With many Noise Artists creating work in which the 'instrument' consists of complex systems of multiple devices, and with notions of indeterminacy central to the genre, many artists see the instrument as a collaborator in the creative process (Klett and Gerber 2014, 8).

A notion of collaboration with an instrument, the playing with real or attributed agencies (Norman 2013) is prevalent in a growing body of improvisational practice. To highlight a few examples: Stapleton's (2008) Dialogic Instrument series explores notions of resistances and mastery in performance contents through instrument design. These are contextualised through an exploitation of Buber's notion of dialogue 'where the goal of dialogue is not homogeneity or the resolution of difference, but instead a form of convivencia (a tense but productive co-existence)' (Stapleton 2008). Or similar discussions explored in Ferguson's (2013) notion of 'imagined agency' and his question of 'to what extent does a musician perform the technology or does the technology perform the musician?' (Ferguson 2013, 141). Such conceptions of human/instrument relations not only recognise the redistribution of agency amongst human and non-human actors but start to question the notion of fixed boundaries between instrument and performers. Taking this idea further, Borgo borrows the term 'configuring' from Actor Network Theory (Latour 2005) to describe a 'mutually constitutive process through which users, technologies, and environments are dynamically engaged in refashioning one another in a feedback loop' (Borgo and Kaiser 2010, 1–2). These 'mutually constitutive processes' are very similar to how Evens characterises the relationship between musicians and their instruments, not as something akin to the relationship between a master and a slave but, rather, as a more fluid intermingling of liquid surfaces.

> Again, there is a meeting of sonic surfaces, wherein the instrument extends itself to meet the player's touch while the player, through practice and technique and with tools, merges her nervous system with the body of the instrument. Instrument and player intermingle at their liquid surfaces, each dissolves its own boundaries, reorganizes itself, to effect more engrossing contact with the other and with the sonic result. (Evens 2005, 83)

In this conception, the instrument is not transparent, it does not disappear in use, the performer is not trying to master it; they are collaborating with it; adjusting and shaping themselves in relation to it. This wider conception of musical instrumentality relates to concepts of mutable boundaries between performer and instrument. As Norman puts it '[r]ather than being given over to users as finite objects or systems, they [musical instruments] result from the coincidence, constant negotiation, and co-evolution of volition and materials in a given place and time' (Norman 2013, 281). This suggests a broader definition of what an instrument is, one that is determined by a use function that is poly- and multi-stable in its construction. I argue that this more post-phenomenological understanding of the instrument performer relationship can be furthered through employing Verbeek's notion of Cyborg Intentionality.

Cyborg intentionality

Verbeek in *Cyborg intentionality: Rethinking the phenomenology of human–technology relations*, describes Ihde's formulations of technological relations as a form of mediated intentionality, that 'occurs when intentionality takes place 'through' technological artifacts' (Verbeek 2008, 387). Verbeek argues that Ihde's embodied and hermeneutic relations blackbox the specific relations that can exist between humans and technology or technologies and the world. He is concerned in particular with Ihde's definition of embodied and hermeneutic relationships as these are more specifically about intentionality as they relate to perceptions of the world. Verbeek is interested in interrogating more deeply the relations between the humans and technology or technology and the world. These are the interactions that are represented by the dashes in Ihde's terminology; for example (Human–Technology) → World.

As Verbeek writes in *Introduction to Mediation theory* (2015):

> We should not see interaction as interaction between two fixed objects. The humans and technologies are not 'two poles' between which there is an interaction; rather, they are the result of this interaction. (Verbeek 2015, 28)

In Verbeek's terms '[t]echnologies help shape human experiences and practices. Rather than being external to human beings, they help define what it means to be human. Technologies help us develop our knowledge of the world, our moral actions and decisions, and even our metaphysical and religious frameworks' (Verbeek 2015, 30). He relates these understandings of our relationships with technology to the notion of the cyborg as it is defined by authors such as Haraway (1991) and Hayles (1999). Theorists, who do not support an intellectual position that maintains strong ontological boundaries between technology and humans; but, rather, a blurring of these ontological boundaries that itself supports constructions of 'the self' that are more fluid and can incorporate technological artefacts. Drawing on this notion of the cyborg Verbeek seeks to extend Ihde's notion of mediated internationalities to those of cyborg internationalities in which the intentionality 'is partly constituted by the technology' (Verbeek 2008, 390). Through this reconceptualisation Verbeek introduces two new categories: hybrid intentionality; 'in which the human and the technological are merged into a new entity, rather than interrelated' and composite intentionality; 'situations in which not only human beings have intentionality, but also the technological artefacts they are using' (Verbeek 2008, 390).

Taking Ihde's understanding of the relationship above as a starting point:

> Ihde's embodied relation (human - technology) —> world, becomes the hybrid/cyborg relation (human/technology) — > world, and the hermeneutic relation of
> human —> (technology -world), becomes a composite relation of
> human —> (technology—> world).

Hybrid intentionality

Verbeek's notion of hybrid intentionality suggests that there is a true merging of instrument and human to create a 'new entity', a cyborg – in which the association 'physically alters the human'(Verbeek 2008, 391). Such a conception challenges notions of self and redefines the boundaries of the human so that they become indistinct as we become

part of a larger complex system. In a hybrid intentionality, the human and technologies form a new experiencing entity – rather than in the embodied relation where the 'distinction can still be made between the human and the technological 'share' in the mediated experience' (Verbeek 2008, 291). Rather than a technology being used, the technology is incorporated into the self and the human and technology can be thought of as becoming one intentional object (McIntyre and Smith 1989). Technologies *used*, like telescopes and hearing aids, help to constitute us as different human beings, whereas technologies *incorporated*, constitute a new, hybrid being – which could, in principle, also use technologies which help to constitute us as different 'transhumans' (Verbeek 2008, 392).

Taking Ihde's understanding of the relationship above as a starting point,

> Ihde's embodied relation of
> (player - instrument) —> sound
> can be reinterpreted, following Verbeek, as
> (player/instrument) — > sound.

Verbeek's notion of cyborg intentionality has a direct relationship with the language that Evens uses to formulate his understanding of a performer/instrument relationship. The merging of nervous systems, the intermingling of liquid surfaces, all suggest a co-joined, co-defined player instrument relationship where the player and the instrument become one entity with fluid boundaries. Such a definition implies that player instrument relationship is also enactive in the sense that the boundaries of the player/instrument become blurred and fluid whilst they are re-configured in action.

Composite intentionality

In Verbeek's notion of composite intentionality, both the technology and human have intentionality: 'the intentionalities of technological artefacts themselves play a central role, in co-operation with the intentionalities of the human beings using these artefacts' (Verbeek 2008, 392). Following Ihde and taking his examples from technologies that extend perception, Verbeek states that 'Technological intentionality' here needs to be understood as the specific ways in which specific technologies can be directed at specific aspects of reality'. Verbeek cites Ihde's example of the tape recorder 'flattening out' the recording by making the background levels seem louder than they are perceived by humans. This is an example of how a recording of a soundscape affects our perception of it; that is, the technology affects the way we perceive the world. '[O]ne could say the composition of human intentionality and technological intentionality is directed at making accessible ways in which technologies 'experience' the world' (Verbeek 2008, 393).

> In this instance, the hermeneutic relation of
> player —> (instrument – sound),
> can be reinterpret, following Verbeek, as
> player—> instrument—> sound.

This conception of the player/instrument relationship fits well with that of a resistive instrument that exhibits levels of its own agency and intentionality. This relates well to the dialogue instruments of Stapleton (2008) and the 'Imagined Agency' of Ferguson (2013). Perhaps the stance that best illustrates this position is outlined in the following extended quotation from Evan Parker regarding his relationship with his saxophone:

> You couple yourself to that instrument and it teaches you as much as you tell it what to do. So, you're sensitive to … how it's responding to your efforts to control it. By hearing it, the way it's feeding back to you, you learn to control it better. So, it's a very dynamic and very sensitive process. And the instrument at the same time seems to be giving you additional information. So [there are] things that you have under your control, but every so often something will go wrong. You'll lose control. In that moment, you are given an opportunity to learn something else that the instrument can do. Then gradually the nature of the instrument and its will—it sounds a bit mystical—in relation to its destiny—it sounds Steinerian! [laughs] But let's say the saxophone has a destiny, has a will, and it has a set of intentions in its relationship with you, and you start to find it difficult to distinguish yourself and your intentions from the instrument's intentions, or let's say I've found it difficult to do that. (Parker in Borgo 2014)

For Parker, the saxophone isn't something to be mastered. Rather it is an object to enter into a relationship with, something you 'couple yourself to'. Also, Parker has a sense that the instrument has its own intentionality and that a performance becomes a negotiation between this instrumental intentionality and the performers intentionality.

The feral cello

To further illustrate the conception of the relationship with a musical instrument as a Composite Intentionality I would like to outline an example of where an exploration of these concerns has informed my own creative practice. The *Feral Cello* is a performance system that I have been developing solo since Jan 2016, and most recently (since Oct 2016) in collaboration with composer and performer Laura Reid (2017). This system has been utilised in a number of performance contexts, most notably NIME 2017, SMC 2017 and NoiseCore 2017 where it was used to perform the piece *Gemmeleg*, composed by Reid (2017) (Figure 1).

The *Feral Cello* could be described as belonging to the family of actuated instruments (Overholt 2011) and is also similar to IRCAM's smart instruments (SMART), both of which have the ability to redefine the acoustic response of the instrument through employing transducers situated on the body of an acoustic instrument. The *Feral Cello* is a normal acoustic cello with a bridge-based acoustic pickup and a transducer (Visaton) attached to the front of the instrument. The signal at the pickup (Gage 2018) is sent to a laptop running Max (cycling'74 2017) software where a variety of digital signal processers are applied to the sound and passed back through the acoustic body of the cello. In this way, the sound world created by the cello can be altered in real time; either in subtle ways, such as altering the acoustic response of the cello, or more explicitly, through enhancing and extending the sounds possible for the cello to make. Although it is possible to make the cello feedback through the pickup transducer system, in the collaboration with Reid most of the time this feedback loop is a controlled so that the resulting sound is mainly the clean cello plus the cello related electronics. The choice of the character of the signal processing applied is controlled by a machine learning algorithm programmed to recognise musical gestures recorded by the cellist. This is implemented through the use of the zsa.descriptors[2] (Malt and Jourdan 2009) library to carry out audio feature analysis on features such as spectral centroid, spectral flux, spectral brightness and spectral rolloff of the incoming sound. This data is then fed into IRCAM's gesture follower [gf] object which employs Hidden Markov Models for real-time gesture analysis (Bevilacqua et al. 2009). The Max patch also implements signal processing employing

Figure 1. *Gemmeleg* being performed on the Feral Cello SMC, Helsinki 2017.

techniques such as; delays, spectral freezing, granular synthesis and filtering. These effects are applied to the original source sound and fed back through the body of the cello through the transducer (Figure 2).

Prior to the performance, the cellist trains the system with pre-determined audio cues. During the performance, the recognition of the cues is used to switch between different sound processing of the cello. As the pickup receives a combination of the acoustic cello sound and the electronically altered sound, and there are inherent differences between the performance of the gestures and the stored gestures, there is an instability in the way that the machine learning algorithm responds to the performer's input. This translates into a performance system that has a level of unpredictability for the performer. In essence, the cello alters its output (acoustic and electronic) in response to the performer's playing style, but not in a way that is totally predictable by the player. As such, this project explicitly examines the notions of human–machine composite intentionality as described by Verbeek.

This performance system has been consciously designed to resist the notion of instrumental mastery. The constant reconfiguring of the instrument through changes to its acoustic response pushes the performer to renegotiate their relationship to the instrument live in the performance. The performer can never 'get comfortable' with the instrument and as such the performer doesn't slip into an embodied mode of interaction in which the instrument becomes transparent; rather, the switching of the acoustic and electronic output of the cello highlights the material resistances of the instrument to the performer such that they are always real and present to the performer in the moment of performance. Reid has found the system challenging to perform with. Stating that in performing with the system 'chaos is something that I have had to come to terms with' (Davis and Reid 2018), that it 'is a little bit of a beast that may not be tamed' (Davis and Reid 2018) and that in performance situations the

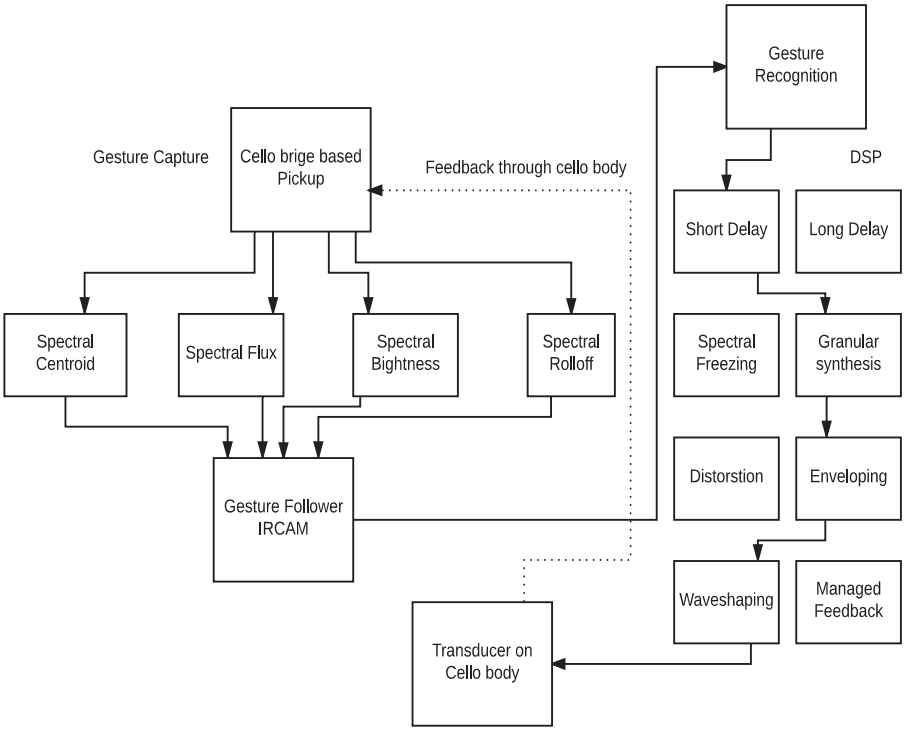

Figure 2. Block Diagram of software hardware relationships within the Feral Cello.

indeterministic nature of the system can 'make you feel quite vulnerable' (Davis and Reid 2018). One way for Reid to deal with this was to write a piece, *Gemmeleg* (hide and seek in Danish), which employs a semi-structured improvisational arrangement to allow the performer to perform with the system within some prescribed boundaries provided by a score. As Reid states although there is some structure provided by the score 'the electronics is never the same, and my response is never the same, only the openings are the same' (Davis and Reid 2018) The system is designed to exploit the notion of re-configuration of the instrument in real-time to push the performer to explore the instrument in different ways in every performance.

Using Ihde's terminology, the performance system can be interpreted in a number of ways. As the system is designed such that machine learning algorithm is 'making decisions' about the reactions of the instrument, constantly thwarting the performers intentions, it could be conceptualised as an instance of Ihde's alterity relation, the technology 'as other' (Ihde 1990, 97). This configuration suggests a separate pre-existing human and technology with clear distinct boundaries, 'the other' with which we interact. In contrast to this, a post-humanist viewpoint would allow for a more fluid description of technologies and their boundaries such that the technology and humans are not pre-existing entities but are co-constituted through their interaction.

If we conceptualise the instrument/performer as one system we can think of the cello performer as one entity, in Verbeek's terminology we could write this relationship as:

player/instrument → sound.

This is particularly pertinent for the *Feral Cello*. This instrument itself has un-defined boundaries. Although an acoustic cello could be considered in itself a confined entity, an instance of Norman's 'frozen agency', described and confined by its bodily construction, the *Feral Cello* expands on this definition by adding algorithms running on computer hardware, as well as sensors and actuators that physically alter the response of the cello itself. Following Waters (2007), we can question the self-evident boundaries between, instrument and performance environment and rather consider the system as a 'performance ecosystem' that takes into account the changing bodily relationship of the performer to the cello in the real time of performance, as well as the response of the system to its wider context, the space within which it is performing. Although this conception of conjoining of player and instrument can feel like a collapsing of entities, really it is a celebration of re-distributions and multiplications of agency (Norman 2013, 282), for it is only through recognising the agency of the cello within the system that we can make the cyborg construction.

The *Feral Cello* can also be interpreted as an instance of Verbeek's composite intentionality, where we can consider the intentionality of the performer as mediated through the intentionality of the technology:

player—> instrument—> sound.

Verbeek characterises this kind of mediation as one in which we become aware of how technologies are 'experiencing' the world (Verbeek 2008, 393). Within this context we can think of the *Feral Cello* as making 'decisions' about its audio output through an interpretation of its sensory input, i.e. its intentionality is based on its understanding of its own 'lived experience'. This raises interesting questions about how the machine is making decisions and based on what data, how is it classifying the incoming audio. When we train the algorithm, we are looking for features that differentiate the musical gestures from each other. We then programme the system to look for patterns in these features to make the correct feature selection. There is no getting away from the fact that this is a process of mapping from a human understanding of musical features to a machine understanding of musical features, and it could well be the case that in the process of performance the *Feral Cello* will make selections that are the best fit based on its machine understanding, its own intentionality, that do not necessarily correspond to our own human interpretation of the music. These discrepancies are what makes the system interesting and act as a catalyst for the improvisational nature of the music. Such considerations are useful in terms of improvisation theory, as the coupling of the cello to the performer provides an unknown to spring off from. It helps the performers get away from themselves to approach every performance anew. The *Feral Cello* can thus be considered as a physical example of a system where 'human and non-human actors are equal contributors, rather than 'agnostic, oppositional concepts of mastery' (Norman 2013, 282).

Final thoughts

The post-phenomenological conception of the musical instrument challenges the notion of a musical instruments as a frozen agency to be activated as transparent conveyances of the musical intention of a performer. Rather, they posit the instrument-player boundary as

fluid sites of negotiation where the boundaries of the performer/instrument can be interpreted as a co-joined, multi-stable assemblage of items. A boundary, where there is a melding of the machine and human, the instrument and the performer that recognises, to paraphrase Borgo, the organic as part of the cybernetic. (Borgo 2014). In this conception, the player/instrument assemblage has a combined intentionality towards the creation of the sound. Such that the resultant sound is the product of the intertwined meshing and mixing of these entities as one. In this way, following Evens' (2005, 83) terminology, the intermingling of the liquid surfaces is made evident.

Notes

1. Free improvisation is a musical movement that strives to play without rules. It grew out of a Jazz tradition in the early 60s and is defined by Derek Bailey as music that 'has no stylistic or idiomatic commitment. It has no prescribed idiomatic sound'(Bailey 1992, 83).
2. zsa.descriptors is a library for the programming language Max that enables real-time analysis of spectral properties of sound.

Notes on contributor

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Disclosure statement

No potential conflict of interest was reported by the author.

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