Chapter 8
Material-Oriented Musical Interactions

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Abstract This chapter explores different perspectives on the role of musical tools in musical interactions, with a particular focus on entanglements of agency. These perspectives can run the full gamut from musicians claiming to be "played by" their instruments and essentially at the mercy of the inner workings of the instruments, to musicians feeling as though the instrument is transparent, and that their inner impulses are communicated as sounds with no resistance from the instrument. Viewpoints are presented from contemporary musical practices and from instrument designers and makers, and are connected with wider theoretical accounts of agency in technology. These discussions are then brought back to the context of the design and development of digital musical instruments, and to human-computer interaction more broadly, reflecting on the relationships between designers and their technologies, and on how the design and development process can be viewed as nested inside its own chain of technological and social influences.

8.1 Introduction

In his thesis on the use of technology in contemporary computer music, Worth (2011) draws a distinction between two approaches to creatively engaging with tools and technologies. The first is based on an idealist notion of artistic creation, where technology is viewed as an ideally transparent medium for communicating ideas. The second is a more material-oriented approach, which sees the technology as a necessary and creative mediation that can be a source of ideas itself rather than simply a means for their transmission. This chapter examines these perspectives in relation to both contemporary musical practices, and in musical human-computer interaction (HCI), arguing that whilst material-oriented perspectives have been a key aspect of aesthetic considerations over the last century, they have nevertheless been somewhat underrepresented in the literature surrounding the design of digital musical tools.

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The exploration of this distinction is useful for considering different conceptions of *agency* in creative engagements with technology (digital or otherwise). Communication-oriented perspectives tend to foreground the agency of the human, whilst material-oriented perspectives draw attention to the agency of the technology. Both perspectives are examined in relation to contemporary musical practices and in terms of the entanglement of these agencies. Karan Barad's notion of *intra-action* (Barad 2007) is put forward as a helpful and increasingly influential idea for navigating questions of agency. Agency is not conceived of as something that exists separately in the human and in the technology, but in the entangled whole, acknowledging the complex web of material and social concerns surrounding both the design and use of creative technologies. 'Intra-action' is distinguished from 'inter-action' as the latter generally assumes that separate agencies exist and are located in distinct individuals prior to their interaction. Intra-action, by contrast, suggests that these agencies are rather produced through their engagement with each other. Barad is clear that for her, this entanglement is not merely an epistemological issue, but an ontological one: there is an ontological inseparability of intra-acting components:

> […] agencies are only distinct in relation to their mutual entanglement; they don't exist as individual elements. (ibid. p. 33)

Taking this claim seriously poses significant questions for the communities of designers, practitioners and researchers concerned with exploring new digital tools, musical or otherwise. How does an acknowledgement of these entanglements of agency affect how digital tools are understood, engaged with, and consumed? How is the designer bound up in these user/technology intra-actions, and how do their decisions impact upon the uses to which their technologies are put? How does this change our understanding of the creative activity of musicians and artists and their approach to engaging with technologies? This chapter explores these questions through an examination of different attitudes to tool engagement in contemporary musical practices. A communication-oriented perspective is first elaborated that emphasizes the agency of the individual over that of the technology. This is followed by an overview of material-oriented perspectives on musical practice that embrace technological mediation. Finally, these perspectives are considered in relation to intra-action.

8.2 Instrumentality and Communication-Oriented Perspectives

The notion that thoughts can pass unmediated from the mind of a musician to a sounding reality is a relatively extreme formulation of the communication-oriented paradigm. However, aspects of this perspective can be found embedded in the attitudes of many writers, composers and tool designers. Worth refers to this as the "any sound you can imagine" paradigm (Worth 2011; p. 10). The expectations around new musical technologies in the first parts of the twentieth century seem closely allied in

places with this paradigm.[1] Griffiths (1995; p. 202) describes Stockhausen as being concerned with realising sounds conjured purely from his imagination. Varèse also envisioned closer links between thought and sound:

> I dream of instruments obedient to my thought and which with their contribution of a whole new world of unsuspected sounds, will lend themselves to the exigencies of my inner rhythm (Holmes 2012)

This passage has been quoted extensively in literature around new digital instruments and electronic music more generally. In terms of the communication/material distinction, this appears to be slightly contradictory: if the instruments are obedient to thought, how can they produce unsuspected sounds? Related idealist attitudes can be found in current discussions of digital musical instruments. In his keynote address at the 2016 Audio Developers Conference, Roger Linn—the designer of the LinnDrum and more recently, the LinnStrument—suggested that this paradigm is still a design ideal (Linn 2016):

> I always start from the ideal of, you've got sort of an RS232 port in your spinal cord [audience laughs] and you just think the music and it appears, and then everything else is an impediment.

Worth (2011) and Haworth (2015) point to idealist tendencies in Smalley's influential notion of *spectromorphology* (Smalley 1997). Both authors point out that Smalley attempts to bracket out the technology in the reception of electroacoustic music, an idea that Haworth suggests also finds its way into the production of such music. Fell has pointed out the extent to which this impulse runs against the grain of contemporary art practice (Fell 2015), linking Smalley's approach to Shannon and Weaver's model of communication: the message should be transmitted clearly, and the technology should not add any noise to this message. Haworth (2015) highlights the extent to which this relies on the assumption that the technology is *neutral*, or that it should be neutral.

Feenberg's account of the impossibility of neutral tools (Feenberg 2002) can be considered in relation to musical tools: as with other technologies, musical tools can be said to have particular tendencies, biases and values embedded within, regardless of whether these tendencies have been consciously included in the design or not. Feenberg provides an account of how technologies are both a product of society and a driver of societal change, contrasting this with what he lays out as the dominant "common-sense" view that technology is neutral until it is put to use. The latter is termed an *instrumental* approach to technology, which can be compared with the communication-oriented perspective elaborated here. Green (2008) traces this instrumental perspective in attitudes to technology in music, highlighting how musical works came to be seen as transcendent, idealised and separated from the specifics of any individual performance. Ihde (1990) also challenges the possibility

[1] McPherson et al.—in Chap. 12 of this book—find the "any sound you can imagine" phrase used verbatim in the promotional copy for the *Oval*, a recently crowdfunded musical instrument. (McPherson et al. 2019).

of transparent, neutral technologies in examining attitudes to embodiment and technology. He identifies a contradictory tendency to want both the super-human abilities technology affords, but to simultaneously remove any technological mediation:

> I want the transformation that the technology allows, but I want it in such a way that I am basically unaware of its presence. I want it in such a way that it becomes me. Such a desire both secretly rejects what technologies are and overlooks the transformational effects which are necessarily tied to human-technology relations (ibid. p. 75).

Although Ihde presents this mindset as deliberately contradictory, this does not appear to be an uncommon ideal for musical instrument design. The Varèse quote given above provides the same contradiction: the instruments are completely beholden to the human agency, but somehow also enable unforeseeable possibilities; the transmission of human impulses should simultaneously benefit from the technological enhancement, allowing an exploration of new sonic worlds, whilst avoiding any interference with the direct expression from the musician. Leman (2008) suggests that:

> [w]hat is needed is a transparent mediation technology that relates musical involvement directly to sound energy. Transparent technology should give a feeling of non-mediation, a feeling that the mediation technology "disappears" when it is used.[2]

The word "feeling" may be critical here. An instrument may give a feeling of non-mediation and transparency, particularly when skills and expertise have been developed with that instrument over a long time period. This is however very different from actual transparency or non-mediation. A virtuoso violinist or saxophonist has not moved beyond the nature of the instrument. They are still very much coupled to the sonic affordances of bowed or plucked strings, or the nature of single reed dynamics. If there is a feeling of transparency and non-mediation, then the opposite may be true: the performer has immersed themselves so deeply in the nature of the medium that they no longer perceive the mediation. The performer may feel as though they can express inner impulses via their instrument, but the situation could be viewed as their inner impulses being completely shaped by their indoctrination to the specific nature of their particular instrument; their musical thought is completely governed by the nature of the physical instrument.

Gurevich and Treviño (2007) highlight a tendency to revert to communication-oriented conceptions of the creative process in much of the literature surrounding new digital instruments, particularly in regard to HCI and the New Interfaces For Musical Expression (NIME) conference:

> According to this model, an expressive performance should cause the listener to experience the intended emotions or at least understand the expressive intentions of the composer and performer. (Gurevich and Treviño 2007; p. 107)

The authors argue that this model has dominated at the expense of other possible models, and show that experimental music and improvisation provide alternatives that

[2]The term "disappear" is used in a different sense from Tanaka's use of the term in Chap. 9 of this book, where it is used to denote a more literal invisibility (Tanaka 2019).

can broaden the discussions around digital instrument design, subsequently framing the paper as:

> […] a call to reposition the evaluative apparatus of the NIME community in a nuanced, humanistic discourse rather than a (necessarily) reductive engineering discourse. (Gurevich and Treviño 2017)

Gurevich and Trevinño point out that the communication-oriented model of musical activity is reified in this established approach to designing musical instruments:

> In the NIME discourse, there appears to be a desire to preserve the text/act paradigm described above, to replace the performer's instrument with a "new interface" while retaining the expression.

Fell closely associates this focus on expression with Western classical music, suggesting that the music is constantly attempting to push the listener to feel specific things (Frabetti 2017). This is therefore a specific cultural perspective. This view of expression appears to be embedded deeply in recent commercial ventures, as noted above with regard to the LinnStrument, and found in the foundational statements of companies such as Eigenlabs ("a dream to make the world's most expressive electronic musical instrument," Eigenlabs n.d.) and Roli ("everything we make […] is designed to let music-makers be more expressive", Roli n.d.). These statements suggest the follow-up question: more expressive of what? A focus on expression may of course be important in a commercial sense: consumers of musical technologies may prefer to think that creative agency lies entirely with them, and that the product does not impose itself in any way on their creative process. Designers wishing to sell their technologies may therefore feel the need to play down the technology's role in the creative process.

8.3 Material-Oriented Interactions

Material-oriented perspectives on creative interaction provide a contrasting viewpoint. This perspective is assembled here from a range of sources. The point of overlap is a consideration of the mediating influence of technological artefacts, and an acknowledgement of the role that tools play both in understandings of a particular creative domain, and in shaping specific creative actions and outcomes. Creative ideas, directions, goals and outcomes are developed through an exploration of the specific properties of tools. Tools and instruments are viewed less as conduits through which ideas and meanings can be passed, and more as instigators and collaborators in the formation of creative outputs. The bidirectional nature of the interaction is foregrounded: the material "kicks back".

This attention to the particularities of the medium and the interaction can be found in a range of contemporary practices. Szepanski (2001), Hamman (2002), Fell (2013), Worth (2011) and Haworth (2015) present examples from contemporary electronic and computer music, highlighting the importance of specific technologies

to the aesthetic approach of a variety of artists. Keep (2009), Cox and Warner (2004), and Bailey (1992) track similar tendencies in post-Cageian experimental music and improvisation. Keep coins the term *instrumentalizing* to refer to exploratory practices that respond to the emerging sonic properties of a sound object:

> The performer's perspective of a musical instrument is […] effectively changed from the traditional role of being a predetermined thing that realizes a musical language outside or indifferent to its self, to being an act that explores an object for its inherent sonic properties. (Keep 2009; p. 113)

He links this attitude to interaction with the development of free improvisation. Bailey (1992) discusses two distinct viewpoints on the role of the instrument in improvisation: pro-instrument and anti-instrument.[3] The two are strikingly contrasted, echoing some of the distinctions drawn above between communication- and material-oriented attitudes. Anti-instrumentalists are described as attempting to remove the influence of the instrument as though it were an obstacle.

> Technically, the instrument has to be defeated. The aim is to do on the instrument what you could do if you could play without an instrument. (ibid. p. 101)

This attitude can be compared with the communication-oriented paradigm: the instrument is an invisible, un-mediating conduit for musical ideas to pass through. Bailey's description of pro-instrumentalists is very different however, and he claims that this is the dominantly held view in all areas of improvisation: the instrument is described as a helper, or a collaborator:

> The instrument is not just a tool but an ally. It is not only a means to an end, it is a source of material, and technique for the improviser is often an exploitation of the natural resources of the instrument (ibid. p. 101)

This reframing of means and ends in relation to musical tools is subtle, but of particular significance for HCI. In the context of free improvisation, the tool's role isn't to directly afford easy access to some material beyond itself. The tool *is* the material itself. This attitude links closely to the deliberate avoidance of overt self-expression found in experimental music. Alvin Lucier provides a useful clarification, pointing out that music can be expressive, without being self-expressive:

> A river is expressive, but is not expressing anything. (Lucier in Rusche and Harder 2013)

Viewing musical tools as sites for exploration rather than direct self-expression suggests a subtle but important change in emphasis from a tool design perspective. A communication-oriented perspective strongly suggests a sense of control, in order to tame the instrument and ensure that it accurately transmits the musician's intentions. The subtleties of the sounds produced—phrasing, timing, pitch inflection, and so on—are manifestations of a performer's whim. A material-oriented perspective and a focus on exploration, suggest alternate attitudes to control. The instrument is sounded experimentally, and the sounding results are not necessarily fully anticipated by the

[3] Bailey does not view these perspectives as mutually exclusive, pointing out that musicians will likely experiment with both approaches.

musician. The possibility of finding something unexpected becomes an important factor (Mudd 2017). The idiosyncratic particularities of the material are dwelled on rather than avoided.

Fell relates his own musical practice to his dad's approach to building an extension on their house: rather than having an initial drawing or set plan, he began by simply placing bricks, making structural decisions as they became necessary (Frabetti 2017). This account has much in common with Suchman's notion of "situated action" (Suchman 1985), particularly the example that she gives at the outset of her book 'Plans and Situated Actions' that highlights a contrast between European and Trukese approaches to navigation originally drawn by Thomas Gladwin. Both the Europeans and the Trukese had particular destinations to reach, but Gladwin notes that the Trukese would not set out with concrete plans, but would simply set out towards the destination, and respond in an ad hoc fashion to conditions as they arose. This contrasts with the European approach where every stage of the voyage was related back to a meticulous initial plan. Although the 'destination' in creative work is vague, the differing attitudes to navigation highlight contrasting attitudes to engaging with technologies. Suchman links the European approach to the "scientific model of purposeful action," which suggests a mastery over the elements, and an attempt to dominate the situation. In the present context, the Trukese approach provides a perspective on creative tool engagement that is neither completely submissive to the material at hand and the specific situation, nor completely dominating. In this sense, Suchman's situated view of interaction bears considerable similarity with Barad's elaboration of intra-action.[4]

Suchman's account of situated action provides a useful way of framing the tension between the agency of the human user and the predilections of technology. The notion of a "dialogue" with creative tools, touched on above, is often elaborated in relation to free improvisation as a way of thinking about this balance of agencies (Bailey 1992; Lewis 2000; Mudd 2017). This resonates with Donald Schön's notion of reflection-in-action as a "reflective conversation with the situation" (Schön 1983). Schön emphasizes the importance of a receptiveness on the part of the user (or the designer) to what comes back from the material in question: how they resist, surprise, and help to reframe the practitioners perspective of their activity.

Terms like "dialogue" and "conversation" may be limiting however, as they attempt to ascribe specific agency to the separate entities. Several authors have proposed a more fluid relationship between the artist, the technology and the final result. Bowers et al. (2016) deliberately explore complications of agency in their recent design-oriented research project, *One Knob To Rule Them All*. Eleven individuals used this title as a design provocation, creating a range of musical interfaces that explore questions of control and agency, with many of the systems restricted to only a single dial as the input control. In this project, the authors cite Barad's notion of intra-action as an important idea in their own work, and as an important consideration for the NIME community more generally. The authors express a preference for tools

[4]See particularly Suchman's description of interaction as an "ongoing, *contingent coproduction* of a shared sociomaterial world." (Suchman 2007; p. 23; emphasis in the original).

that create challenges rather than tools that "simply bend to our will," preferring a model of interaction where "agency shifts in the mid-ways between person and thing". Fell deliberately distances himself from the term "dialog", invoking intra-action as a way to avoid the separation of individual agencies between technology and the user that "dialog" implies (Frabetti 2017). This, for Fell and Frabetti, is seen as a way out of the tension between mastery and subordination in relation to technology.

8.4 Implications for Design and HCI

None of the above discussion is oriented towards establishing clear implications for the design of creative digital tools. The discussion complicates the situation rather than simplifying it, highlighting the essential bind of the designer: their work is fundamentally entangled with the creative work of their users. The accounts of creative practice given by Fell, Bailey, Keep, Bowers et al. and others spell out attitudes to using technology that explore the particularities of the available mediums. These accounts seem to place an almost unbearable responsibility on the designer: they cannot hide behind a guise of neutrality, but are demarking creative limitations that are to become the subject matter of the creative investigations of others.

Viewing the design of creative tools as a creative act in itself can be helpful however. As with the material-oriented musical practices discussed above, the design process itself can be material-oriented. That is, it does not need to start from a clear idea of the final product, but can develop iteratively as an exploration of a particular medium. To clarify this point, the nesting of material-oriented approaches can be thought through in relation to a specific example: the use of a hypothetical piece of musical software created with SuperCollider, a relatively accessible computer music programming language. The musician engages with the specific affordances of the hypothetical program created with SuperCollider and creates something through this negotiation of the software. Moving up a level, the designer of the particular program can also be cast in this light: they create the software through a material-oriented engagement with the affordances of SuperCollider, the available unit generators, functions and structuring devices. Rohrhuber et al. (2011) claim, in a discussion on working with SuperCollider, that "thinking within a given language, some ideas may never occur".[5] Moving up another level, the creation of Supercollider itself can also be seen as a negotiation of the possibilities made available by the specific limitations of existing computer languages and processing power (McCartney 2002). This process acknowledges the creative significance of what Frabetti calls the "moving target" issue within software engineering, that software design doesn't progress through set problems being examined and solved. Problems emerge and shift during the process.

[5] See also Rowe et al. (1993) for discussions around the specific affordances of the graphical musical programming environment, Max, and perceived links between the way the software was designed and implemented and the nature of creative projects created with the software.

As discussed above in relation to Fell and Bowers, Barad's notion of intra-action provides a way to navigate between considerations of the technology's agency and the user's agency. Intra-action steers away from either extreme position—that the technology is dominated by the user, or that the user is dominated by the technology—by questioning the localization of agency within individuals (human or non-human). Barad describes the writing of her book, *Meeting the Universe Halfway*, as an "iteratively and mutually constitutive working out, and reworking of book and author," and that Barad and the book "have intra-actively written each other" (Barad 2007; p. *x*) The intra-action precedes the identities of separate subjects. She also points out that this is not a binary process, and that a wide range of material and social factors are involved in this process of arriving at both book and author. This entanglement provides a useful way to think about the relationship between author (or 'user', in HCI parlance), technology and creative work. It acknowledges the significance of the materials in creative activity without denying the author's own agency. It also acknowledges the complicated web of influences within which designers must work: entangled with their own materials (e.g. particular coding environments, platforms), as well as the wider cultural environment surrounding them and their work.

8.5 Conclusions

This chapter has explored contrasts between communication- and material-oriented perspectives to engagements with musical technologies. The material-oriented perspectives drawn from contemporary musical practices highlight the importance of acknowledging the role of the technology in creative practice. These perspectives view technological interactions less as means to particular ends, and more as ends in themselves: the tools are not conduits to particular material, but are the material themselves. Following Fell and Bowers et al. Barad's notion of intra-action is put forward as an important consideration in negotiating questions of agency in musical tool engagements. Intra-action provides a model of tool engagement that navigates between an overly-idealist perspective that views the tool as an ideally neutral non-mediating transmitter of musical ideas on the one hand, and an overly technologically deterministic perspective where the artist is locked into the proclivities of the tool on the other. Suchman's description of the relation between plans and situated actions fits well into this framework, and her conception of interaction as "contingent coproduction" mirrors the collapsing of individual agencies suggested by Barad.

As noted at the outset, the discussions in this chapter don't provide any simple answers in relation to questions of agency in the design and use of musical tools. An acknowledgement of material-oriented approaches to thinking about engagements with musical technologies highlights the complexity of the role of the tool designer, and the significance their design decisions may have in influencing musicians exploring their tools. Feenberg's account of how technology is both a product of society and a driver of societal change is paralleled in music technologies: they are both a product of existing aesthetic ideas and communities of musical practices, and a driver of changes in these ideas and practices.

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