Understanding Musical Practices as Agency Networks

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Abstract

This position paper proposes that creative practices can be usefully understood as agency networks. In particular it looks at interactive algorithmic musical practices and the takes a distributed view of the influences involved in such music making. The elements involved include humans, tools, culture and the physical environment that constitute a system or network of mutual influences. Such an agency network perspective is intended to be useful for the pragmatic tasks of designing new interactive music systems and developing new musical practices that utilise them. Drawing on previous research into generative music and computational creativity, various views on interactive music systems are canvassed and an approach to describing these as agency networks is developed. It is suggested that new human-machine musical practices may arise as a result of adopting an agency network perspective and that these, in turn, can drive cultural innovations.

Introduction

There have been many attempts at defining creativity in either humans, computational systems or co-creative interactions between them. In this position paper I propose that creative acts may, instead, be understood as networks of agency. This approach may be useful in computationally creative systems research in particular where philosophical questions about self-awareness, intentionality, and embodiment of machines can become problematic.

Definitions of computational creativity that focus on the outcomes provide quite some latitude for the effect of devices on this outcome independent of human influence. For example Boden states "Computational creativity (CC, for short) is the use of computers to generate results that would be regarded as creative if produced by humans alone" (Boden 2015:v). Other definitions have been more ambitious (e.g., Wiggins 2006:451) by implying a stronger sense of computer autonomy than suggested by Boden's phrase, "use of computers". Rather, these definitions suggest that the goal of computational creativity is for computational behavior itself to be deemed creative by human standards.

This definitional preoccupation can create confusion and disagreement amongst the field and, perhaps of more concern, it may limit avenues of research and development in human-computer artistic co-creation by discouraging pragmatic investigations. As Boden acknowledges, "Whether computers can 'really' be creative isn't a scientific question but a philosophical one, to which there's no clear answer. But we do have the beginnings of a scientific understanding of creativity" (Boden 2014:23).

Acknowledging my motivation toward the pragmatic production of interesting music and in the interests of promoting intellectual frameworks that stimulate artistic co-creation research, I suggest that agency networks (in the spirit of actor network theory) can usefully account for the contribution of people, machines, and cultural contexts to musical activities and outcomes. An agency network perspective is a distributed view of the influences involved in music making, or other creative tasks. The elements involved in the network include humans, tools, cultural conventions, and the physical environment; these constitute a system or network of mutual influences on creative processes and outcomes.

Notions of agency in creative tasks can provide a useful common ground between the intentional stance attributed to humans in such actions and the functionality and constraints attributed to tools and environments, particularly because when we look intently into creative action "the line between human intention and material affordances becomes all the more difficult to draw" (Malafouris 2008:33). In short, the agency network approach to displays of musicality defers claims to creativity and shifts evaluative judgements toward the pragmatics of personal or cultural value.

This perspective bears some relationships to Oliver Bown's suggestion that we can evaluate creativity as "actors forming temporary networks of interaction that

produce things" (Bown 2015:21). The agency network approach supports his view that creative authorship can be distributed to varying degrees between humans, tools culture and environment. Inherent in this perspective is that these creative relationships can be symmetrical in their influence (i.e., coupled) but may not be symmetrical in their contribution (i.e., varying roles and degrees of attribution). Bown proposes that such a view takes us beyond the consideration of either humans or machines as "islands of creativity" to a more nuanced evaluation of creativity. In this position paper I propose to additionally suggest that a view of creativity as a network of agencies may also have an epistemological claim to understanding, and perhaps even be the basis for generative processes for the design of human-computer co-creative systems.

In this article I will focus on music because that is the domain I am most familiar with; it may be that similarities can be found with other creative arts activities or even in other endeavours. I will be particularly interested in co-creativity within interactive music systems, but suggest that human-machine relationships are unavoidable even in what appear to be autonomous human or machine creative acts.

The article begins by examining the effects of algorithmic technologies on musical practice and musical culture, and investigates the making of music with generative computational systems as an emerging creative practice. It explores the impact that cybernetic interactions between musicians and algorithmic media have on conceptions of creativity and agency, and the potential to influence cultural evolution.

Background

As computing systems have become more powerful in recent years, real time interaction with 'intelligent' computational processes has emerged as a basis for innovative creative practices. Examples of these practices include: interactive digital media installations, generative art works, live coding performances, virtual theatre, interactive cinema, and adaptive processes in computer games. In these types of activities, computational systems have assumed a significant level of agency, or autonomy, provoking questions about shared authorship and originality, about aspects of musicianship with interactive technologies, and about the future of musical genres where these practices are employed. These issues are redefining our relationship with technology and fomenting new debates about human capabilities, values and the meaning of productive activities.

Cybernetic interactions—those between people and technologies—have been recognised, periodically, as having the potential to influence musical developments (Machover and Chung 1989; Pressing 1990; Rowe 1993; Miranda 2000; Dean 2003; Pachet 2002; Gifford and Brown 2013). Recent theoretical advances in understanding the relationship between embodied cognition and music technologies lay the groundwork for the next stage of these developments (Leman 2008, Borgo 2012). These ideas are manifest in creative practices and, by using those insights to elaborate notions of musical agency, we may be better able to appreciate co-creation with generative media.

At the heart of all creative interactions is a sense of creative agency—the opportunities and responsibilities for decisions and actions in creative activities. Cybernetic co-creation, where creative control is shared with technologies, challenges our understanding of agency—both human and non-human. Research has examined how expert musicians manage these collaborations (Winkler 1998; Brown 2003; Collins 2006; Gurevich 2014). To date, researchers have mostly focused on individual instances of algorithmic music in experimental music contexts, but opportunities are increasing to study virtuosic practices in mainstream practices. This work has helped to identify the salient features of music interactions with algorithmic media and to use them to account for theories of co-creation and musical agency, in order to inform future cultural innovation and development. Musical practices that include algorithmic media—typically computers running interactive and/or generative software—and our interactions with them have been studied in recent years by this author (Brown 1999; 2001; 2005; Brown, Gifford and Wooller 2010; Brown, Gifford and Voltz 2013) and a number of others (Pressing 1990; Rowe 1993; Cope 2000; Pachet 2002; Nierhaus 2010).

In previous work I, and co-authors, have argued that to build and use "generative software that operates appropriately in a creative ecosystem, we must secure some understanding of how we interact with our existing partners and tools, and how they interact with us" (Jones, Brown and d'Inverno 2012:200). An underlying proposition in that work is that music made with interactive software constitutes its own form of musical practice and that opportunities for stimulating cultural development result from these new creative relationships. It is also important to appreciate how this interactive practice builds on a long history of technological usage more broadly. In the language of the philosophy of

technology, tools (including musical instruments) may be engaged with as ready-to-hand, under conscious utilitarian control, or as present-at-hand, experienced as an embodied engagement or in 'flow' (Heidegger 1977, Ihde 1979). Experiences with automated media transcend this duality in that technologies appear to us as musical partners with their own agency. This type of human-machine discourse—where "two entities are acting reciprocally upon one another"—has been labelled Interactionism (Agre 1997:53). Specifically this kind of internationalism involves moving from a technological representation of music, such as notated scores and recorded audio data, to a technological simulation (generation) of musical actions and outcomes. Generative algorithms might simulate compositional processes, human behaviours, or sociocultural conditions. Margaret Boden suggests that computer artists value the degree of machine autonomy that such automation provides; they find it, Boden suggests, aesthetically more interesting than when the computer is treated as ready-to-hand, or as a "slave" (Boden 2010:190).

Investigations into music making with automated media, such as those described in previous surveys of the field in Joel Chadabe's (1997) Electric Sound and Roger Dean's (2003) Hyperimprovisation, highlight the historical explorations in interactive algorithmic music and, in particular, the role of chance in providing novelty, and of improvisation (especially by the human being) in adapting to changing or unexpected events. These researchers also underscore the stylistic innovation associated with algorithmic musical practices over past decades, particularly the aesthetic connections with electroacoustic music, sound art and, more broadly, with experimental music.

Human-machine co-creation

In her book on computer art, Boden defines creativity as "the generation of novel, surprising and valuable ideas" and explicitly includes musical concepts and artefacts within the term 'ideas' (Boden 2010:1). She outlines three types of creativity; combinatorial, exploratory, and transformational. Of particular interest here is that, firstly, computers seem quite capable of these processes (perhaps with some limitations in assessing value) and, secondly, that her definition leaves open the possibility of also adopting Mihaly Csikszentmihalyi's assertion that creativity "arises from the synergy of many sources and not only from the mind of a single person" (1996:1). Co-creation between musician and algorithmic media meets this criterion and resonates with the associated theory of distributed cognition, which acknowledges that our competence is reliant on support from the world around us (Merleau-Ponty 1962; Perkins 1993; Clark 1997). Just as in the past, when musicians have relied on each other and acoustic instruments for enhanced musical expression, so today and in the future, algorithmic computer systems do and will play their part. How these interactions operate for effective musical outcomes can be usefully understood, I propose, by thinking about them as networks of elements with particular agency. Different musical practices will arise from different configurations of agency networks.

Examples of musical practices that include algorithmic media are: Generative Music (Eno 1996), Live Algorithms (Blackwell, Bown and Young 2012), Live Coding (Collins et al. 2003), Interactive Music Systems (Rowe 1993), Mobile Music Making (Tanaka 2004), and Algorithmic Composition (Cope 2000). These involve the kinds of interactions typical of most human musical collaborations, such as synchronisation and coordination, outlined as crucial by David Borgo (2005) in his interrogation of musical improvisation amongst jazz musicians. To date, algorithmic musical practices have been employed predominantly in experimental or avant-garde musical genres.

Less obviously, perhaps, automated media have played a part in the rise of contemporary electronic (dance) music since the latter part of the 20th century (Kirn 2011). Software sampling and sequencing technologies have been significant in the development of these genres. In general, technologies such as step sequences and parameter control, while 'automated', are not generally characterised as algorithmic, although algorithmic processes have been increasingly present in commercial music technologies in recent years (e.g., Apple Logic Pro's 'Drummer'). Some notable EDM artists, including Aphex Twin and Autechre, have taken advantage of algorithmic techniques. Driven by technological and cultural transfer from academic and experimental practices—like those described above—to popular music, the need to appreciate and articulate the characteristic of interaction with algorithmic music processes is all the more pressing. Models of interactive music practices as an agency network 'system' can play a part in assisting the understanding and design of these new musical practices.

The emergent behaviour of human-machine co-creation practices implies that we consider the human and machine components as part of a creative system, a perspective that is particularly favoured in the field of

cybernetics. The uses of Cybernetic principles within digital arts I have previously reviewed (Gifford and Brown 2013). A more detailed overview of Cybernetics is provided by Andrew Pickering's (2010) history of the field, which includes some references to its use in the arts, and extends his earlier work exploring human interactions with the materiality of the world, specifically in the field of scientific discovery.

Musical co-creation between humans and computationally creative software has accelerated in recent decades as the computing tools for real-time interactive media and the means of audience interaction through mobile devices have become ubiquitous. It is timely that an agency network perspective be catalyst for re-examining these interactions and, in particular, exploring their use in contemporary culture. The focus of such a perspective, as proposed here, is a better appreciation of the concept of musical agency as it applies to all elements of the co-creative 'system'.

Toward a networked approach to musical agencies

Agency can be simply defined as the ability to produce an effect. This definition is often constrained further to the production of an *intended* effect. Human beings have always been accepted as having agency, especially through their ability to act intentionally to satisfy needs and desires. Ascribing non-human agency, however, requires intellectual care. Going even further, to describe algorithmic media as "creative machines" (Lewis 2011:460)—as we might wish to do in situations of co-creation—is particularly precarious as debates within the computational creativity community attest.

For the purposes of this article I will refer to the capacity of human beings or technologies to generate music as their *musical agency*. It might seem controversial to ascribe agency to non-living things; however, inspired by the work of anthropologist Alfred Gell (1998) it seems reasonable to say that artefacts and machines have (at least) a relational agency that depends upon their interaction with human intentions and cultural conventions. Gell suggests that inanimate artefacts (like works of art) can be influential and 'cause things to happen' within a cultural context. It seems less controversial, then, to suggest that 'animated' machines capable of generating sound automatically (such as generative computer music software), might have musical agency. This arises, following Gell's logic, because of their relationships or interaction with human makers, performers, and audiences—a cultural context that contains intention and meaning—as part of the to-and-fro of creative collaborations (Brown 2012; Brown, Gifford and Voltz 2013). Lambros Malafouris further suggests that such interaction itself may not 'say much' about the agency of interacting elements, but he suggests that we look to see what "constitutes a meaningful event in the larger enchainment of events that constitute the activity" for greater insights into the presence of 'pragmatic agency' (Malafouris 2008:25).

An early application of the notion of agency to music appeared in Timothy Taylor's book Strange Sounds (2001), where he focused on the influence of electronic and digital technologies on musical culture. He did not, however, examine the impact of algorithmic approaches. With a not-dissimilar cultural agenda, the proposition I pose here is that understanding creativity as a network of agencies may influence the ways algorithmic technologies are integrated into musical practice. Like many of the relevant writers in this field, Taylor considers musical culture to be a "system" made up human, technical and social forces—the position most famously suggested by Bruno Latour in his Actor Network Theory (Latour 2007). While generally supportive of the role of technologies in moving musical culture forward, Taylor often characterises technologies as constraining. In celebrating human re-use, or misuse, of a technology for new musical purposes—as when DJs repurpose turntables—he suggests this is evidence that "Human agency struck back" (Taylor 2001:204) against the 'resistance' of technical design. My view of this interaction is more optimistic than Taylor's.

Also drawing on Actor Network Theory as a model, Pickering examined how people and material things are interrelated and each has an effect on how activities (in his case, science) play out. "The basic metaphysics of the actor-network is that we should think of science (and technology and society) as a field of human and nonhuman (material) agency. Human and nonhuman agents are associated with one another in networks, and evolve together within those networks. The actor-network picture is thus symmetrical with respect to human and nonhuman agency" (Pickering 1995). Pickering's more recent book, The Cybernetic Brain (2010), extended this view of material agency within an historical survey of the pioneers of cybernetics, some of whom explored cybernetic principles in audio-visual contexts, and Pickering himself has a growing interest in the connection of material agency to the arts (personal correspondence).

Theories of material agency have been applied to artistic contexts such as making pottery (Malafouris 2008). Recently, Chris Salter applied the notion of material agency directly to musical processes, in particular sound installations. Salter is especially concerned with the materiality of sound and sonic environments and the way in which artists and audiences interact with this materiality. Like Gell, Malafouris and Pickering he attributes the agency of objects to their contextuality: "... agency is not located in objects or things but situated in practice, it is 'in the flow of the activity itself'" (Salter 2015:40). With possible extensions of this view, the position taken in the article is that it might be helpful to attribute agency more directly to non-human actors, or as an emergent property of interaction between them, within musical practices.

The term 'musical agency' has been used on previous occasions; for example Blackwell, Bown and Young defined it as "the influence someone or something has on a body of music" (2012:164). This definition is one similar to that applied to agency in general, but constrained to the musical context; it indicates, however, an explicit acknowledgment of human and non-human agency. In his more recent writing Bown makes an even more explicit claim along these lines that "All human creativity occurs in the context of networks of mutual influence" (Bown 2015:17).

Such literature attests to a growing interest in the issue of agency as an explanatory theory about the operation of creative practice. I suggest, however, that there are problems in using underspecified terms too liberally, and in directly applying to artistic contexts, those concepts (such as material agency) that have been worked out in other domains. Therefore, it is proposed that there is a need to explore alternatives that might lead to more detailed and appropriate definitions and understandings of musical agency.

In the case of automated media, such as algorithmic music software, there might be more to agency than 'reflected glory' during interaction. This is not only because of the generative capability of computer systems, but perhaps also because agency need not be simply 'present' or 'absent'. Instead, there can be degrees of agency, and a non-human agent might have limited, or partial, agency within the network of co-creative relationships. Some could argue that agency is only awarded by the transferred intentionality of its designer/programmer; the hypothesis, explored here, is that algorithmic agency is an inherent potential and independent of human intentionality. A potential that can be realised (or emerge) through interactivity.

The idea of partial agency or, perhaps, dimensions of agencies may appear somewhat intuitive, but was formally proposed by Victor Kaptelinin and Bonnie Nardi (2006). To some degree, in opposition to Pickering (and Latour), they suggest that agents in a network of interaction might have asymmetric degrees of agency. That is, the human might have more, or different, agency than a computer system but it would still make sense to talk of the computer as having agency in that limited way. A "more expansive treatment of agencies is needed", suggest Kaptelinin and Nardi, "to capture the complexity of phenomena related to modern technologies, especially intelligent machines" (2006:243). In particular, I suggest, we need to consider how ideas about networks of musical agency may lead to a better understanding of the dynamics of creative musical practices (and creativity more generally), especially practices with algorithmic systems. This perspective resonates with George Lewis' view: "Understanding computer-based music-making as a form of cultural production obliges a consideration of the discourses that mediate our encounters with the computer itself" (Lewis 2011:457). It follows then that, not unlike Salter (2015) suggests, theories about musical agency may provide insights into musical practices that employ algorithmic processes, and might open new opportunities for evolving musical culture.

Cultural evolution with algorithmic media

There is a common narrative around technology-driven human development. Daniel Pink provides a succinct summary, writing; "Last century, machines proved they could replace human backs. This century, new technologies are proving they can replace human brains" (Pink 2005:44). Musical examples of this include Colon Nancarrow's Studies for Player Piano (1948-1992), where machine performance challenged the physical limits of human performative capability, and the software Shazam that can 'listen to' and identify musical works even when our own memory fails us.

Pink cites the defeat of chess champion Garry Kasparov as a case in point of cognitive skill replacement. His recipe for moderating interpretations of this as technological determinism, is to add "the capacity for art and heart to our penchant for logic and analysis" (Pink 2005:222). This is not such a new prescription. A more authoritative source is the philosopher Martin Heidegger who, in his essay The Question Concerning Technology,

observed that "the essence of technology is nothing technological" and went on to suggest that "essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology and, on the other, fundamentally different from it. Such a realm is art" (Heidegger 1977:35). It is in this spirit of adopting a poetic orientation towards the technological that an agency network view of musical practices with computational media is proposed. A poetic (aesthetic) view corresponds, also, with a more pragmatic understanding of agency networks as an evaluative frame for co-creative music making.

Rather than being drawn into pessimism due to technological determinism, there are reasons to be optimistic about algorithmic music as a creative force and stimulus for cultural development; indeed there are pockets of society in which this is already occurring. Specifically, there are notable individuals who have worked diligently to bring together the skills required to make this practice a success. The musicians cited throughout this article are some of these. If history is any guide, then cultural leaders should pave the way for this practice to become more mainstream. At present, success requires persistence and passion. Fortunately, both music and computing are pursuits that people become passionate about, and where the pursuit of virtuosity—either as a performer or as a software developer (hacker)—is desirable and exemplars well documented (Turkle 1984; Pachet 2012).

Adopting an agency network approach to creativity research and system development may provide a more comprehensive picture of emerging cultural practices, taking care to account for the complexities of these creative acts within our current technoculture. Observing the mutual influences of musicians, technologies and cultures should help refine notions of musical agency. Such an approach takes account of the dynamics of cultural developments arising from musical interactions with computational media, so that new understandings might lead to a better appreciation of these practices, and provide some predictive power to inform the design of future interactive music systems and music activities with them.

Conclusion

The work reviewed here supports the position of the article that creative practices can be usefully understood as an agency network. This position shifts the focus of attention from individual objects, actors or elements as being (or not) creative, and moves our gaze toward a distributed view of interactions and relations amongst participating influences.

Agency networks are systems of participating elements that have varying types and degrees of agency. Elements in the systems are 'coupled' such that they are mutually influencing, but their contributions to the musical outcome are not the same, and generally not considered equal. As emphasised by Kaptelinin and Nardi, agency varies in different dimensions (yet to be fully worked out), and the relationship between agencies is dynamic and changes over time. In the language of Pickering and Malafouris, within the 'dance of agencies' different elements may take the lead at different times.

The perspective provided by considering creative systems as agency networks is useful for the pragmatic tasks of designing new interactive music systems and developing new musical practices that utilise them.

Some may consider that an agency network approach to describing creativity simply side-steps the issue of creativity altogether, perhaps it does. But if one's objective is to improve artistic and innovative outcomes using computational systems, then the development of theoretical positions that provide more diversity and nuance, such as describing types and degrees of agency, may well stimulate new approaches and tactics. If one's objective is purely philosophical, to understand or computationally model creativity, then it may be that reconfiguring theoretical discussions around agency may not suffice. Also, there remain questions of perceived autonomy, and of human predilection to seeking relationships of cause and effect in the world—even where none exist. An agency network perspective may not directly address these issues but its foregrounding of the distributed nature of influences in music making systems opens up questions for further consideration by computational creativity researchers, designers of computer music systems, and musicians who interact with those systems.

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