Leuven University Press

Chapter Title: Thinking Liveness in Performance with Live Electronics: The Need for an Eco-systemic Notion of Agency
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Book Title: Sound Work
Book Subtitle: Composition as Critical Technical Practice
Book Editor(s): Jonathan Impett
Published by: Leuven University Press. (2021)
Stable URL: https://www.jstor.org/stable/j.ctv1ccbg96.12

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Thinking *Liveness* in Performance with Live Electronics

The Need for an Eco-systemic Notion of Agency

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Introduction

Live performance practices with electroacoustic equipment and digital audio media have grown enormously in number and diversity, as documented by a large body of publications. Here I am concerned with the basic premise those publications seem to share and often leave aside: the alleged "liveness" of highly technologised and mediatised performance. The difficulty is twofold: on the one hand, any attempt to define *live electronic music* is today an increasingly problematic task (Bertolani and Sallis 2016), due to the variety of connotations that have arisen in different social and cultural contexts since the 1960s at least (Bernardini 1986, 61). On the other hand, the notion of *liveness* is itself "historically contingent" (Auslander 2008, 60). Further confusion may also arise from the informal usage of *live* and related terminology, in the ubiquitous and hegemonic discourse of the mass media (live set, live streaming, etc.). In short, by and large, "there is clearly a loss of certainty as to what *live* is any more" (Emmerson 2012a, 10).

In this chapter, I want to try a peculiar and hopefully fruitful approach: I ask, how is one to think *liveness* in live electronic music performance practices? What are these practices telling us about liveness as a topic of larger theoretical interest? (such as discussed in performance studies and media studies [Phelan 1993; Auslander 2008; Schechner 2002; Salter 2010; McCormick 2015]). These are probably just ways to rephrase the more fundamental question, what is *live* in live electronic music? (Emmerson 2012b, 152; Sanden 2013, 87). However, by leaning on various interdisciplinary research efforts and by broadening the range of creative endeavours deemed of direct pertinence, the rephrasing may eventually expand the purport of the subject and suggest new directions for further analysis.

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We shall start with a few general remarks and the historical background. Next, we shall move to the main topic and discuss related theoretical implications. Overall, we discuss liveness as an experiential dimension of the agency that can be acknowledged to the techno-cultural assemblage involved in performance, inclusive of interdependent component resources, either human or non-human.

A biological metaphor turned into ecological and technological reality

The adjective *live* is typically used to denote real-time performance practices as different from studio production practices. But it also carries a clear and meaningful metaphorical value, suggestive of the opposition between biological phenomena *in vivo* (experienced by a living entity in real-world conditions) and *in vitro* (experimented on "in the lab," produced and observed in highly formalised, controlled, and protected working conditions). This semantics resonates in languages other than English (e.g., Italian *musica dal vivo*, Spanish *música en vivo*), while it disappears in others (French speakers regularly use the more generic *en direct*).

That metaphorical value is probably worth being recast in a more materially grounded view of the ecology of mediatised performance. It may be taken as referring less to the involvement of musicians or other performing artists, and more to the overall dynamics proper to a larger ensemble of several agents of a different kind, namely to the performance ecosystem (Waters 2007, 2011). The latter can be understood as a composite dispositif or assemblage consisting of mutually responsive components, whose network of interactions gives rise to a collective and hybrid form of agency. Later in this chapter, the notion of *eco-systemic agency* will be introduced, certainly not to provide yet another term of metaphorical value, but to characterise the complex interactional dynamics of the performance ecosystem and its "situatedness" in a material environment irreducible to an abstract or neutral container space. For a performance to be live, the real-space working conditions should be deemed no less crucial than real-time conditions.

The perspective elaborated in these pages is twofold. On the one hand, it approaches liveness with a conceptual framework drawn from studies in cognitive science, particularly as elaborated at the crossroad of cybernetics, biology, and related views in constructivist social science and media ecology (Maturana and Varela 1980; Varela 1979; Latour 1996; Maturana 2002; Hallowell 2009; Clarke and Hansen 2009; Froese 2011). That requires pondering issues of distributed agency in human–machine interaction (Agre 1995; Rammert 2008) and the interplay of situated and distributed action in common labour activities (Quéré 1997; Laville 2000).

On the other hand, I feel it appropriate and urgent to connect the discourse on liveness with broader questions concerning the environmentalisation of technology and the cybernetisation of the world (Hörl 2012, 2013). Live electronic practices are creative instances of contemporary media ecology. As such, they should be specially expressive of the current, widely shared conditions of

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individual and social life, that is, of the "technological condition" (Hörl 2015). At their best—provided they do not reduce themselves to fuelling the aggressive aestheticisation of mainstream communication media and the fetishisation of the latest "state-of-the-art" devices—live electronic performance practices may eventually define a domain of critical praxis where one asks, what is it like living in today's hyper-technologised world? How do we deal with and dwell in the techno-ecosystems we build for ourselves?[1]

In short, I suggest that live electronic performance practices are instances of artistic research in music (Impett 2016) that creatively explore—and return, in sonic shape—the conditions of the *living* in the face of the historical phenomenon of the becoming-environment of technology (Di Scipio, forthcoming). As such, they may enact forms of critical technical practice (Agre 1997) and "subversive rationalization" (Feenberg 1991; Di Scipio 1997, 1998) bearing on significant aspects of contemporary life, maybe in ways more peculiar and poignant than other forms of critical praxis can.

Historical background

Let's briefly recall that the rhetoric of liveness in the context of media communications was born in the 1930s, when it first seemed appropriate to distinguish the radio broadcasting of speech and music events ("live broadcast," equivalent to the French *émission en direct* and the German *Direktübertragung*) from the increasingly common practice of playing-back phonographic records ("canned music," typically used in a pejorative sense). In later decades, as new electronic media were integrated in artistic production, *live* eventually came to denote innumerable performative and communicative contexts. A widely accepted implication was that live music, made and heard "immediately," represents a more genuine experience than music played back from fixed audio media.

Yet, *live* has never really meant "immediate," with the sense "without technical mediations" (save in the rhetoric and the advertising of popular entertainment industries). On the contrary, this terminology has always referred to very specific technical and cultural mediations (Sanden 2013, 34), with multiple technological layers and related engineering competences. Today, in an age when common life appears by and large to be structured by and imbued with the immanent logic of electronic and telematic networks, it is reasonable to doubt whether there is really any ontological difference between *live* and *mediatised*: indeed, "live performance . . . itself is a product of media technologies" (Auslander 1999, 25).

1 *Techno-ecosystem* is a term borrowed from ecosystem design and engineering (Odum 2001; Prominski 2007).

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Live electronic music, live electronics

It is usually agreed (e.g., Sallis et al. 2018, 1) that the expression *live electronic music* was coined by John Cage in 1962 (with reference to his *Cartridge Music*, 1960) and then adopted for the most radical strands of experimental music that emerged in subsequent years, both in North America[2] and Europe.[3] Later, the shorter *live electronics* was also to become frequent, at least among practitioners. The latter is indeed a very telling expression, in that it assigns *live* directly to the *electronics*, not to the music or the performers. The semantic shift can hardly be without reason.

Taking advantage of portable sound-synthesis and -processing equipment (ranging from small-sized analogue synthesisers to various cheaper or self-built circuitries), those earliest endeavours aimed to take electronically generated music "out of the studio" (Chadabe 1997, 81) and to "animate" (Pousseur 1976, 243)[4] creative designs that were otherwise limited to fixed audio media (tape music) and were perceived by many as laboratory experiments (however wrongly). They ended up "vitalizing the work/environment relationship" (Centore 2011, 63). Partly inspired by coeval trends in the visual arts, many musicians started exploring a more direct relationship to the place(s) where their work was presented, and eventually devised site-specific sound installations in spaces other than concert halls and auditoria (art galleries, industrial plants, archaeological sites, gardens, living rooms, etc.). One could say, with some caution, that sound installations and other sound art practices emerged out of the earliest live electronic endeavours, between the late 1960s and early 1970s (Di Scipio 2017; Saladin 2017). That is clear from the work of such representative figures as Max Neuhaus, David Tudor, and Alvin Lucier, which was often poised between music and sound installation in those years.

In later decades, as computer music systems and digital audio technologies were increasingly accessible and interactively manageable, the term *live electronics* has come to be used for an increasing number of trends in contemporary music and the sound arts. On the one hand, there are new forms of chamber music pairing musical instruments with real-time digital signal processors—a repertoire that has grown ever larger since the early 1980s.[5] On the other, there is the huge body of more informal, improvisational approaches, often using handmade or hacked hardware (Collins 2009) and free software.[6] In recent years, these two general orientations have regularly

2 As in the work of Gordon Mumma, David Tudor, David Behrman, the Sonic Arts Union, Composers Inside Electronics, and many others.

3 One may think of Karlheinz Stockhausen's *Mikrophonie I* (1964), of course; however, we should not forget other relevant yet less well-known proposals by Hugh Davies, Franco Evangelisti, Mario Bertoncini, MEV (Musica Elettronica Viva), Gentle Fire, and so on.

4 Unless otherwise indicated, translations are my own.

5 Well-known examples include Luigi Nono's late works (technical support from the Experimentalstudio, Freiburg) and a few of Pierre Boulez's late works (technical support from IRCAM, Paris).

6 Examples could be drawn from the work of composers and sound artists of different generations and different aesthetic horizons, such as David Behrman, Nicolas Collins, Ron Kuivila, John Bowers, Owen Green, Pedro Rebelo, Andrea Valle, and many others. Recent proposals include improvisational approaches using "audio commons" (Stolfi et al. 2018).

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crossed and been mixed with extended playing techniques and "augmented" instruments.[7]

Overall, this makes for a wide territory of performance approaches. This territory becomes even wider when considering practices closer to more popular languages and communication contexts.

The techno-cultural quantum leap from instrument to environment

The expression *live electronic music* is sometimes used to also refer to certain bold musical efforts dating from the earlier decades of the twentieth century, particularly chamber music works scored for electronic instruments.[8] While this usage is widely accepted (Mumma 1975; Manning 1985; Bernardini 1986; Battier 1999), in the present chapter I consider it misleading. Not because of the overt anachronism, and certainly not because of a will to decrease the historical and aesthetic relevance of those early works, but in order to avoid infiltrating the discussion of the inherently mediated dimension of liveness with conventional views of technology implicated in music scored for and played with *instruments*, albeit electronic ones—namely, technical objects having a fixed, standard functional design that are meant to match well-established cultural expectations as to what music really is about.

Instrumental theories of technology have for a long time been of very limited use (Feenberg 1991). They can't help us, today, make a very necessary link between the material conditions of music-making and the hyper-technologised environments of individual and social life. A shift in focus from "composing for new instruments" (Appleton 1989) to "composing the instruments" (before also composing for and with them) (Davies 1981; Schnell and Battier 2002) is appropriate to secure a more substantivist view and bridge artistic praxis with critical theories of technologies (Di Scipio 1998; Impett 1998; Hamman 2002). But the shift needs to be stretched even farther, fostering novel views of "instrumentality" and "instrumental agency" (Magnusson 2019) and promoting an awareness that creative practices always take place in construed, artificial environments, structured by multiple technical and cultural mediators (Hennion and Latour 1993; Assis 2018, 2019).[9]

Therefore, of special relevance for a discussion of liveness are those live electronic practices where the artist's own appropriation and making of technological configurations forms a substantial part of the creative process. Such practices shape *dispositifs* that specify singular sound works (Baranski 2009;

7 As in the work of, among others, Jonathan Impett, Michelangelo Lupone, Simon Waters, Giovanni Verrando, and Giorgio Klauer.

8 Examples range from Paul Hindemith's *7 Triostücke* (for three trautoniums, 1930) to Darius Milhaud's Suite for ondes Martenot and piano (1933), from Percy Grainger's *Free Music 1* (version for four theremins, 1936) to Olivier Messiaen's *Fêtes des belles eaux* (for six ondes Martenots, 1937). The music of the Futurists' intonarumori can also be included.

9 Pre-Second World War examples consistent with a post-instrumentalist view of technology can be found in the appropriation and *detournement* of gramophonic devices, as in certain proposals by the very young Stefan Wolpe (Berlin, 1920s) and in John Cage's *Imaginary Landscape No. 1* (for two record players, large Chinese cymbal, and piano, 1939).

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Panaccio-Letendre 2011) and that are inherent outcomes of music-making (Magnusson 2019, 57). They remind us that music is not just about creating sonic structures and auditory experiences of peculiar aesthetic interest, but also about creating the means by which those structures and experiences materialise (Di Scipio 1998).

The living *and the performance ecosystem*

Confronting the question of liveness, we ask, Under what conditions can a dynamical assemblage of different resources (including, among others, human, mechanical, electroacoustic, and software resources) operate so that it can be experienced as a living process and described as a live event? What is there, in its operation, that can ever be felt as *living*? We need to address the fragile and precarious coupling of multiple human and non-human agents,[10] and the dynamics born of their situated exchanges and interactions.

It is often assumed (Small 1998; Emmerson 2007; Sanden 2013) that the crucial factor of liveness is the physical involvement of humans (instrumentalists, vocalists, technical assistants, "electronic musicians," etc.) capable of acting in real time *upon*, *in between*, and *in control of* various technical objects (sound-making and sound-processing devices), with the postulate that they do not resort to previously recorded audio or control signals. This view is most valuable in that it clearly relates performance to direct bodily action and emotional experience, viewed in fact as essential factors of liveness in performance studies. There is a tacit and taken-for-granted implication that the involvement of human beings provides the performance ecosystem with a source of causal processes and agency.

However, for a performance—not a performer—to be *live*, human action is perhaps a necessary but not yet sufficient factor. More decisive seems to be the enactment of a more comprehensive interactional dynamics, inclusive of other-than-human agents. Music—as composed, performed, listened to, and commented upon—always entails techno-cultural assemblages of peculiar "epistemic complexity" (Assis 2014), where representations, information, and action are materially distributed (shared, spread, or deliberately relinquished) across different kinds of mediators. In live electronic performance, that epistemic complexity involves a possibly larger array of mediators, and gives rise to thoroughly technologised cause-and-effect chains where "interactive contingency" is a more critical dimension of performance than "instrumental causality" (Rammert 2008, 65). One may say that the "live" character of performance concerns a larger "ecology of action" (Morin 2007), with the "circular causality" (von Foerster 2003) or the "tangled causality" (Sève 2005, 62) engendered by the multiplicity of lines of causation actually involved.

10 To be clear, one can only speak of *non-human* agents by deliberately omitting (maybe provisionally) the culture-specific and thus genuinely human element proper to any technical system and to any built space.

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Of central interest is that performance reveals human actions and machinic processes as dynamically coupled to and weighted against the spatial niche where the performance actually takes place. The resultant sound events bear audible traces of that coupling and that weighting. The liveness of performing—together with its liveliness and its livelihood—stems from the perceptible interdependency of heterogeneous agencies, affecting one another in ways *relative to real time and real space circumstances.*

The here and now, real space, and real time

In this regard, I should emphasise that *live* is not the same as *real time* (Emmerson 1994, 2012a). Computer music institutions have always customarily spoken of "real-time computers" rather than "live electronics," assuming the technologically-determined criterion of higher and higher computational speed in the description of performative resources.[11] However, the notion of *real time* is not in itself a sufficient criterion for liveness; rather, it needs to be integrated with a notion of *real space*, that is, with the audible presence of the material site of performance, including its physical, social, and cultural connotations (acoustics, logistics, various facilities, etc.).

Sanden (2013, 34) contrasts "temporal liveness" and "spatial liveness," noting that "they are not always considered interdependent [as they appeared to be in Walter Benjamin's concept of *aura*]." Still, for any action to literally take place, it takes time: the conceptual separation should not imply that the two can be split in phenomenological reality. It seems crucial to focus on the indivisibility of time-space coordinates in lived experience, in fact often evoked by the common language expression *the here and now*—moulded after the Latin *hic et nunc*. Clearly, "in the very heart" of a performance,[12] everything happens within and across a larger ecology of actions and perceptions that cannot be abstracted from a particular physical space of one's own material and cultural connotations.

When readying and testing sound equipment in preparation for a performance, it is customary to set it up in a way to block or at least minimise the side-effects of the local acoustics and to avoid, as much as possible, a number of technical artefacts (circuit noise, sonic halo, excessive audio feedback, interfering radio signals, etc.). This is of course necessary to correctly couple the electroacoustic infrastructure to the particular room acoustics. This is also like bending the given space to behave in a way closer to a studio (albeit a provisionally installed studio). The live character of performance, however, stems from a direct confrontation with the contingencies of the particular situation, from an attitude that deals in constructive ways with less-than-ideal circumstances and working conditions. Liveness testifies to the impossibility of perfectly

11 For example, at IRCAM (as well as in other French institutions) it has long been like that, from the early 1980s (Manoury 2007) to recent years (Cont 2012; Bonardi 2015). Tristan Murail is among the few composers, in his country, talking of "musique électronique *live*" (Murail 1991; Béranger 2009). On the semantics of *temps réel* and related connotations, see Barkati (2009).

12 The English "in the very heart" is equivalent to the French *dans le vif* and the Italian *nel vivo*.

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integrating resources and disentangling intentional action from contingent (and contagious) factors: it springs from the ability of agents to maintain positive exchanges among themselves *qua* agents situated in—and therefore mediated by—the local environment. Note that this concerns not only *human* agents, but more heterogeneous resources and their interactional dynamics.

The *live* character thus implies that contingencies born of the real space are not perceived just as inevitable imperfections and annoyances one has to live with, but as opportunities for a productive coexistence and connivance (complicity). In a live performance, sound and music are born not simply *notwithstanding* real and thus less-than-ideal conditions, but also *thanks* to them.[13] Performance is when sound and music elude reification and can be finally perceived less "in themselves," independent of source and place (*objets sonores*, signal files, etc.), and more as "relational events," that is, belonging to the shared and interrelated conditions of lived experience (Di Scipio 2012, 2014).

Note that, during a performance, the sounding environment always includes both the sound delivered by performers and equipment, and a variety of incidental, random sonorities coming from different sources (including the audience). The latter are typically denoted as "noise" only to remark that they are not part of the intended sound fabric. Still, in real-time and real-space performance conditions, the local space is bound to vibrate from wanted as well as unwanted events, and it is not always fine to say that the latter are really foreign to the performance.

No matter how virtual the space evoked and represented by the performance of a particular work is, the very act of synthesising such a space takes place in real, material, and shared environments. In this regard, liveness certainly lies not in apparent cause-and-effect relationships, mimicked in sound and heard as realistic yet purely illusory (Emmerson 2007, 93), but in the cause-and-effect chains situated in the lived—not the represented—space. In any case, it can be argued that one learns more about liveness from practices where real-space conditions are not concealed or surrogated, or where strategies of virtual liveness—and "artificial life"—are deconstructed.

The emphasis on real-space working conditions implies a peculiar ethos: it demands ad hoc empirical arrangements that are bound to remain *relative* and even poor in technical efficiency, but are also meant to be *relational* in scope and purport. That is at odds, quite evidently, with the *absolute* reliability requested and expected of efficient and powerful engineering standards, and with a general view of modern electronic media as a technology empowering us to suspend or augment phenomenological reality. In its living dimension, performance stages and makes audible the relational and the relative even when it is pervasively structured by multiple technological layers, or perhaps exactly because of that.

To be clear, these annotations to the contingent and situated dimension of live performance should not be taken as tacitly referring to improvisational

13 Turning technical problems into opportunities is a recurrent *topos* in the history of (not only experimental) music (Di Scipio 2017).

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musical approaches only. They should not be considered alien in the context of more deterministic approaches where music performing is score-centred and bound to follow precise musical notations. We are trying to think liveness as a topic of broader theoretical relevance, of course, independent of the discourse of specific musical aesthetics.

The performance ecosystem as operative unit

A more detailed illustration of the perspective taken here would need to include many other issues and would require too lengthy a detour into methodological and theoretical matters (a preliminary tour de force is attempted in Di Scipio [forthcoming, 9–84]). Anyway, within the limits of this chapter, the main direction should be clear: my observations point out that liveness in highly technologised performance contexts refers to the phenomenology of a composite and heterogeneous operative unit whose partial components reveal themselves interdependent (mutually dependent) in their operations. The operative unit includes

- an ensemble of different (human, mechanical, electroacoustic, and digital) resources, understood as a *system*;[14] and
- a site (room, hall, court, or other) where that ensemble is installed and made to work, understood as the *environment* for the system and its components.[15]

The unit is incomplete until the *system* and *site* are materially coupled with each other, that is, until the very moment of

- performance, understood as the process (time-wise) and situation (space-wise) through which *system* and *site* materialise a larger and autonomous dynamical system.

Performance is when *system* and *site* bring forth a greater operative unit whose peculiar *agency* is not reducible to its individual components. Because both *system* and *site* may include several components and subcomponents, their coupling will give rise to an intricate ecology of local and global interchanges, a meshwork of feedback lines across multiple cause-and-effect chains. To emphasise the interrelatedness and situatedness, this manifold but integrated operative unit is called here a *performance ecosystem*—a term elsewhere utilised with reference to a certain number of creative sound practices (Waters 2007; see also Di Scipio 2003, 2008; Waters 2013; Green 2013; and several contributions in Waters 2011).

14 In the etymological sense of *σύστημα*, that is, an ensemble or assemblage of parts working together in close functional connection—the same as the Latin *compositus*, a composite of several parts. A working definition of *system* in general system theory is "a complex of interacting elements" (von Bertalanffy 1968, 55). Living organisms are "open systems," that is, systems interacting with their environment (ibid., 32). The current state of any single element in a system is a function of the single element's earlier states, of the current state of any other element, and of the current state of the environment.

15 A working definition of *environment* is an ensemble of systems other than the particular systemic unit under consideration, but structurally coupled to it through energetic or informational exchanges, and acting as its medium. Not everything in the surrounding space is part of a system's environment, as in fact the latter constitutes the *milieu spécifique*—the medium specific to the particular system.

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In its operation, the performance ecosystem is a *processual unit*: each single interaction among any two components or groups of components has, sooner or later, one or more effects (even missing effects could set the conditions for subsequent exchanges to take place). Furthermore, the performance ecosystem also defines a *spatial unit*: the effects of each single interactional event will spread across the ecosystem, thus affecting either concurrent or subsequent interactions to some lesser or greater degree. Multiple chains of causes and effects will eventually ensue, depending on component typology as well as on local and global feedback connections among components.

Furthermore, our operative unit will reveal itself *performant* inasmuch as it shows minimal and yet peculiar cognitive capacities: in a way perhaps reminiscent of a biological system (organism), the performance ecosystem as a whole can keep itself in operation and try to fulfil its goals only so far as it can somehow sense the environment and act upon it. This cognitive potential implies that it also construes for itself a body of observations about the environment, and about itself as an entity belonging to that environment. In which case, the performance ecosystem should be viewed as an "observing" and "self-observing" system (von Foerster 1960, 2003). The live or living character proper to its dynamics could be traced to its cognitive autonomy, that is, to its peculiar *agency*—the ability to take action in and with the environment.

The question is posed, where exactly are we to locate the very means by which an actual instance of a performance ecosystem can sense and act in the environment? Were one to connect liveness solely to the participant performers, the answer would be straightforward: the *locus* of cognition and agency lays in the involved human resources, constituting de facto an incredibly complex sensorial interface between machine and environment. However, in a composite, highly technologised performance ecosystem, it seems reasonable to say that agency is rather distributed across a number of distinct but interlaced component layers.

The performance ecosystem as bio-cognitive unit

We need now to reconnect our analysis to the biological metaphor implicit in talking of *live performance*. Assuming a constructivist epistemological perspective, we might finally take the metaphor more literally than figuratively, and try to work it out in the conceptual framework of neo-cybernetics (Clarke and Hansen 2009), where constructivist social science (Latour 1996; Mancilla 2011) meets system biology (Bich 2012; Bich and Arnellos 2012) and post-computational cognitive science (Varela, Thompson, and Rosch 1991; Barbaras 2002; Thompson 2009; Froese 2011). Common to those different research directions is an understanding of cognition as a biological phenomenon, and as a process of central interest for the phenomenology of embodied experience and enactive perception. The epistemological posture consists essentially in asking how information and knowledge about the surrounding world are construed by taking part in a shared world, rather than retrieved and analysed as symbolic representations of an objective, external world.

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Interesting research work in the area has focused on modelling entities described as "minimally-cognitive systems" (Etxeberria, Merelo, and Moreno 1994; Barandiaran and Moreno 2006; van Duijn, Keijzer, and Franken 2006), where cognition is investigated as it happens at the level of the simplest and most negligible biological organisms (e.g., unicellular organisms such as bacteria, protozoans, some algae, some fungi, etc.). Even the most trifling, tiny living forms feature some kind of sensory-motor system. Or better, they *are* materially constituted as sensory-motor systems. They implement more or less intricate instances of the fundamental *action-perception loop* mechanism by which a cognitive system is able to perceive the environment in order to act upon it—being, at the same time, itself perceived and acted upon by the environment, that is, by other entities in the surroundings (Maturana and Varela 1980; Stewart 1992, 1993; Maturana 2002). The most trifling, tiny living entity senses changes happening in its contiguous space and acts accordingly. Or better, it takes action in order to sense the environment and senses in order to take action in it. Action and perception are looped through the environment. With a formula, *life = cognition* (Stewart 1992; Thompson 2009, 81). A living organism looks for food (energy) in order to get to know the environment, but it needs to explore and know the environment (information) in order to feed itself. The recursive dynamic is captured less well in terms of *interaction* than it is in terms of *structural coupling*, in the technical sense of a permanent, bidirectional connection providing the interface for the reciprocal determination of a system and the nearest environment (*oikos*).

The agency proper to a particular bio-cognitive unit is forged through a whole history of specific system-environment exchanges: it emerges in the coevolution and the "concretion" (mutual creation) of system and environment (Jonas 1966). By bringing itself around, in fact, a bio-cognitive unit also transforms the surroundings into its specific vital space, into its "own" environment. With a formula, *life = cognition = building and maintenance of an environmental niche*. Therefore, however minimal and trivial, a bio-cognitive unit is an autonomous system. It is somehow capable of taking care of itself and of its spatial niche on the basis of a record of past system–environment exchanges, thereby developing a sense of self and, jointly, what we might call its *culture*. Such is, in overly short and rough terms, the overall process by which agency emerges in a living entity.[16]

Needless to say, any particular music performance ecosystem is, however simple and basic, a hugely complex kind of autonomous system. Nonetheless, in an operative sense, it is essentially a system able to sense the local (sonic) environment and cause changes in it.[17] This is because it has perceptual and cognitive mechanisms, coupled with the environment through sensors and effectors. In typical cases, it is performing artists who provide the ecosystem with such

16 In a different but related line of thinking, Gilbert Simondon (1958) coined the term *individuation*. In current social science research one may talk of a "situated process of subjectivation" (Rebughini 2014). One can say that "subjectivation"—the construction of an autonomous subject—is not an individual's affair but an intersubjective, social one, that is, "distributed" across multiple social relations.

17 Henceforth, by writing "local (sonic) environment," I suggest that *environment* is to be taken as *mainly* but not necessarily *only* related to sound.

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mechanisms, being of course inherently equipped with highly trained motor systems coupled with highly sensible auditory systems via complex neural networks. As expert practitioners, performers are able to coordinate audition and bodily action in incredibly refined ways. (Listeners, too, seem to be able to do so, when their response to a music performance turns from neutral *attendance* to true *participation* in the performative act).

In mediatised performance, and certainly in many instances of live electronic music, technical resources are often themselves (made) able to change their real-time functional process, either adapting them to other performative agencies (e.g., instrumental gestures and/or the sounds they make) or otherwise driving their operations depending on other events in the environment. Audio devices sense (via microphones or other devices known as *sensors*) specific features of the surrounding environment (sonic or other), analyse them (e.g., with some form of data processing), and regulate their internal process accordingly, in their turn causing minor or major changes in the environment through special effectors (signal converters, loudspeakers—devices also known as *actuators*). Their operative autonomy has the effect of laying down the material conditions for further changes due to the actions of performers or other technical apparatus (and listeners, of course).[18]

Acknowledging the agency of technical systems is not at all surprising, today: it often appears reasonable and normal, as in references to complex and maybe "intelligent" algorithmic models of human agency or other fully automated technical procedures. However, it must be clear that I am not necessarily assuming any artificial intelligence in the present discussion. I only mean to value the agentive role of sound equipment and related devices, in virtue of the nonlinear, limiting, transformative effects of their electro-acoustic transductions and the ergonomics of their material design—and to emphasise the increasing recourse to adaptive and self-regulating control mechanisms in analogue and digital electronics, which are indeed susceptible to turning mere *objects* into *agents*. Be it purposely designed or implicitly inscribed in the technical code, a kind of collective machinic agency ensues as multiple devices are made to affect one another's functionality in a "multi-agent system" (Weiss 1999)—independent of whether they also include "artificial intelligences," internet bots, and the like.[19]

18 Needless to say, *autonomy* (self-regulating behaviour) is not to be mistaken for *automation*. Automata are devices that operate unsupervised thanks to deterministic controls, independent of real-time and real-space contingencies. Very complex automata (including pre-AI robots and innumerable mechanical automata dating back to ancient times and the Middle Ages [Losano 1991]) can mimic animal behaviour in their exterior appearances, maybe also reacting to external events, but can modify neither their process nor the environment on the basis of their interactions: they do not include the functional analogies that specify living systems as cognitive systems, and thus remain essentially *allonomic*—as opposed to *autonomic* or, indeed, autonomous.

19 Among the early instances of this machinic agency one could include Gordon Pask's *A Colloquy of Mobiles* (1968), a mixed-media installation where a small network of multiple electromechanical agents manifests a larger, collective kind of intelligent behaviour. For other recent and not-so-recent examples, see Bown, Gemeinboeck, and Saunders (2014).

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The environment as the medium of the action-perception loop

The analogy with a generic biological-and-thus-cognitive system is only possible to the extent that we consider the performative resources as being inherently open to the local environment, in different forms and degrees. "Being open" to the environment happens through multiple cognitive mechanisms, that ultimately constitute a more encompassing and hybrid action-perception loop. As noted in the previous section, these cognitive mechanisms not only are those of women and men involved in the performance, but also include self-regulating mechanisms proper to a number of technical systems and subsystems, either dependent or independent of direct human control. As performers intervene in the medium (sound or else) through which they are mechanically coupled to the technical apparatus, the apparatus in turn intervenes in the same medium, to which it is in fact electro-acoustically coupled. The (sonic) environment is the very locus and indeed the medium of a composite action-perception loop, and the essential mediator of the structural coupling of human and machinic agents.

Mediation, however, is never a linear transfer of energy or information (Latour 1996). To a greater or lesser extent, the (sonic) environment transforms what it mediates. The environment implies multiple forms of agency, including the idle but crucial mechanical agency inherent to architectural shapes and other material designs, the inherent *affordance of the environment* (Gibson 1979) and the availability of objects to suggest (or hamper) convenient technical usages and physical arrangements (ergonomics). The emotional participation of the audience is itself a kind of collective agency, inasmuch as it reveals itself able to affect the proceedings of the performance, thereby increasing (or decreasing) its artistic significance. Various local facilities, too, may occasionally have an impact on the actual proceedings of a performance (e.g., lighting, heating systems, etc.).

The cognitive activities carried out by the performance ecosystem and its components are only carried out in and through the environment: they are instances of a situated cognitive dynamics, whose detailed processes are dispersed or distributed across the ecosystem components. They are crucial in order for the live character of the performance to signify a prompt and attentive interaction with the real-space and real-time working conditions. Reconsidered and analysed in systemic and operative terms, the biological metaphor implicit in talking of live performance seems now to be specially connected with organism–environment mutual relationships and co-determinations. Thus it takes on connotations closer to a more ecologically-oriented and indeed eco-systemic perspective.

Eco-systemic agency and liveness

The above discussion suggests that performance is live inasmuch as the composite ensemble involved in its process manifests a kind of eco-systemic dynamics (the latter is yet to be defined). It portrays liveness as a phenomenological character born of the open-ended and situated interplay of various types of

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agency: human (performers), technical (electroacoustic equipment, computer and digital audio devices), and environmental.

In ecosystem theory and engineering (Jørgensen and Müller 2000), an ecosystem is defined as a network of biotic and abiotic components sharing the same physical space. The design of artificial ecosystems is generally in agreement with that definition (Prominski 2007). The dynamics of the whole ecosystem emerges in the physical interconnectedness and interdependency of the component parts, as well as in the co-determination between the parts and the whole. This is crucial: each individual part is virtually an autonomous systemic unit in itself, but it can only pursue its potential autonomy (never fully achieving it) through a web of mutually affecting partners. The French sociologist and epistemologist Edgar Morin once spoke of "dependent autonomy" (1977, 204).

The main agents in the performance ecosystem are therefore to be seen as autonomous-but-dependent loci of action: they can only pursue their task through other agents involved, notably including the local (sound) environment. Each behaves itself through its individual action-perception loop, but the latter is tightly intertwined to all other loops through the common surrounding environment—which in turn mediates (transforms, directs, favours, or contrasts) each individual action and perception. Taken together, the multiple action-perception loops realise a more intricate control loop belonging to the performance ecosystem as a larger autonomous system: it indeed provides the latter with a hybrid and non-centralised cognitive apparatus. We can say, in short, that the agency in performance is inherently distributed across and among several different resources.

From distributed to eco-systemic agency

Distributed agency is not centralised in human actors and spreads across multiple resources, including technical ones (Laville 2000) and for many years now also hardware and software resources (Rammert 2008). Besides, we should not forget the environment, the role of which is simultaneously constitutive and dialectic: being *distributed* across the environment (Laville 2000), agency is in fact also *situated* (Quéré 1997; Biset 2012), that is, it is relative to the spatial niche offered as the performance space. This dialectics of *distributed* and *situated* is also a peculiar dimension of live performance. Even more so in consideration of the sheer technological complexity we meet today in most private and public spaces, including of course places where musical and sound-art works are presented. We "cannot ignore the agency that is wielded by the environment" (Hansen 2009, 114). Following a neo-cybernetic view, the performance ecosystem shall be considered a "system-environment hybrid" (Hansen 2009), and its agency described as a distributed agency of peculiar hybrid constitution.

It is today common among scholars to characterise such composite and dynamical assemblages as *multi-agent*—or, maybe more aptly, *inter-agent*—systems. These terms evoke artificial intelligence and related research, in a line of technological innovation inspiring, among others, various developments

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in interactive computer music and interactive sound art (Hamman 1997; Dahlstedt and McBurney 2006; Bown, Eldridge, and McCormack 2009; Bown and Martin 2012; Bown, Gemeinboeck, and Saunders 2014; Stapleton 2017; Tatar and Pasquier 2019; Sanfilippo 2019). However, multi-agent systems implemented in such developments typically involve multiple instances of the *same kind* of agency, often of a kind that has been called "algorithmic agency" (Rutz 2016). The agentive role of the physical performance space is very rarely overtly acknowledged (Di Scipio 2003; Waters 2007; Di Scipio 2008; Borgo and Kaiser 2010; Borgo 2016). A notion of *eco-systemic agency* is especially needed in order to include the site of performance, understood as the environment actively mediating between other resources, either human or technical (Di Scipio 2018; Di Scipio and Sanfilippo 2019; Di Scipio forthcoming, 77–80).

The threefold structure of eco-systemic agency

We can parse eco-systemic agency in three distinct agentive couples or inter-agencies:

performer ↔ environment,
performer ↔ equipment,
equipment ↔ environment.

These are distinct subsets of recursive processes in the performative ecosystem (we are not concerned here with the agents possibly included in the subsets). The first can be loosely referred to as the experience—for example, essential to instrument playing—of "feeling one" with the room. The second concerns, of course, human–machine and human–computer interaction (for a long time the subject of a large body of research and theory). It also concerns the ergonomics and the "ergodynamics" (Magnusson 2019, 10–12) of instruments, controllers, and other tools handled by performers—their size, shape, and building materials.[20] The third seems instead to define an area never really theorised, and only researched by practitioners interested in designing site-specific and self-regulating sound generating systems, working unsupervised by human performers (Sanfilippo 2019; Di Scipio and Sanfilippo 2019).

Yet, only for the benefit of analysis can the three be discussed as distinct, separate subsets of the complete performance ecosystem. In the very moment of performance, they work as co-dependent agencies constituting a larger ecology of overlapping feedback loops (figure 8.1).

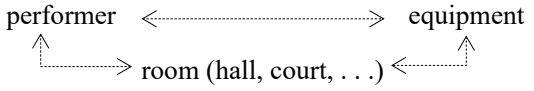

Figure 8.1.

20 The direct contact with objects of different materials opens up a scenario of physical and bodily involvement that has been nicely described as "dialectical materialism in action" (Keil 1995, 3). Here we see no reason why this should not include the direct manipulation of electroacoustic and digital resources, as instead claimed in Keil (1995).

Figure 8.1. The threefold loop structure of the performance ecology. Each of the three types of agency included here actually implies a network of subcomponent agents and loops.

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Clearly, different approaches involve different priorities and differently nuanced blends of (several instances of) the three types of agency. In actual performance contexts, the dynamics of the performance ecology is determined by *how* and *how many* recursive subsets are really integrated and experienced as partners in the complete ecosystem process.

Strong and weak liveness

The notion of liveness elaborated here seems more directly related to creative sound practices where the mentioned three dimensions of eco-systemic agency are more fully integrated. They illustrate what we might call *a strong notion of liveness*: highly technologised performance is experienced as live inasmuch as it implements a rich entanglement of several different agencies and fosters a more global eco-systemic agency of possibly higher dynamical complexity. And that, *despite* but also *thanks to* the exposure to contingent real-time and real-space circumstances. A "strong notion of liveness" hence implies that the environment is experienced as an agentive factor and as the medium in which the coupling of human and machinic agents can be creatively manipulated.

In contrast, a *weak* notion of liveness seems proper to practices where only one out of the three dimensions of eco-systemic agency is involved, as is the case with approaches equating liveness with real-time human–computer interaction.

Quite evidently, the binary opposition *strong versus weak liveness* is overly simplistic, considering the variety of performance approaches. Each particular approach is likely to mark a different spot in between the two opposites. Each is likely to feature its own, unique blend of human, technical, and environmental agencies. In any case, no judgement criteria or aesthetic normative assessments are implicated. For lack of better terms, the terminology adopted here only aims to draw, on the basis of the above analysis, a clear conceptual framework for further inquiries into a spectrum of practices too often indistinctly qualified as *live* (Di Scipio forthcoming, 81–84). It might also be useful to convey the idea that, in their particular manners of coupling human machinic and environmental agencies, different live performance practices capture different ways of understanding the thorough mediatisation of individual and social life in today's world. As prompted in an earlier passage, live performance practices are willy-nilly expressive of what it means for an individual artist or group of artists to go through the historical phenomenon of the *becoming-environment* of technique and to confront the technological condition of (not only) human life. That perhaps defines "what *more* there is to [live electronic] music than sound" (Croft 2007, 65, my interpolation).

Summary and final annotations

This chapter has attempted first and foremost to provide a characterisation of liveness through the lens of the performance ecosystem, understood as a techno-cultural hybrid assemblage of its own cognitive and agentive capacities.

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Second, it has attempted to locate the potential of live electronic music practices as relative to that notion of liveness.

I have connected the live character of performance with the emergence of a kind of eco-systemic agency, insisting that the material environment be included as a crucial agent in the assemblage of human and non-human resources. To that aim, I have elaborated a functional analogy with living systems qua biological-and-thus-cognitive systems: the agency of a living system is one and the same with its exposure to (and dependence on) the surrounding physical space plus related contextual, contingent factors. Performance is live inasmuch as the performance ecosystem shows an operative autonomy born in the structural and yet fragile joining of human, machine, and environment. That requires that the achievable autonomy, by definition, can never be without some level of heteronomy.

In such a neo-cybernetically oriented view of liveness, it is not inappropriate to hear echoes of broader questions in the politics of knowledge (Feenberg and Hannay 1995): albeit never fully achievable, autonomy (freedom of choice and action) always requires competent appropriation of one's own means of action, plus an awareness that ones' own means of actions are distributed in (and sometimes relinquished to) the shared social and physical environment. In fact, the recursive structure of what we have called *eco-systemic agency* (figure 8.1) seems nothing but a particular case in a much broader scenario of huge political relevance (figure 8.2).

Figure 8.2.

This threefold loop constitutes a genuinely complex relationship central to thinking the contemporary world, as preliminarily illustrated by ethnotechnologist Gilbert Simondon (1958) and discussed again and again in more recent decades, from multiple perspectives (Morin 1977, 2007; Guattari 1989; Bogue 2009; Clarke and Hansen 2009; Hörl 2012, 2015; Barthélémy 2015). Asking what and where the live character of highly technologised performance is may be equivalent to turning the question of performance liveness into a question of bio-political relevance (Di Scipio 2014, 2015).

Living (in) machine environments

Live electronic practices create vivid sonic images of that broader, "bio-political" scenario. They can do so, in virtue of a constitutive but frail coupling of humans and machines under real-time and real-space working conditions—in situated, *in vivo* conditions. Independent of specific aesthetic orientations and technological contexts, they ultimately seem to acknowledge and make sonically perceptible that, at a general level, the threefold relationship

Figure 8.2. The complexity of performance ecology today maps directly onto broader issues of political relevance.

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"human–machine–environment" that structures the dwelling of humans on earth is not only a peculiar phenomenon of modern, postmodern, and contemporary societies, but also a more fundamental phenomenon constitutive of what it means to be human.[21] And that, at a more particular level, the array of technologies today structuring the shared spaces where people live and meet act less as extensions or augmentations of the physical space, and more as constituents of a different, hybrid environment. Creative artistic elaboration of this hybrid constitution testifies, in perceivable form, to the fundamental awareness that *technique* and *nature* are both social constructions.

The plurality of live electronic practices surely mirrors various aesthetics and historically contingent views of art- and music-making, yet today it seems especially to mirror different manners of *living in electronic environments*. Such practices ask, how is life that is lived through actions and perceptions profoundly mediated by, or even relinquished to, interconnected technical layers and codes? In several different ways, ever since their inception in the 1960s, live electronic practices have ultimately had this to claim: "we are natural-born *cyborgs*."[22] Today such practices also show that artistic research commitment can be a territory where the nexus of "continuity between technique and nature" (Simondon 1958, 244) can be tangibly experienced and imaginatively worked out.

Finally, when deliberately appropriating, designing, and shaping up the performance ecosystem, live electronics not only emphasise the human constitution of the utterly technologised environments we live and dwell in, but also show very well that the naturalisation of technical mediators ends up making these mediators invisible and obscures their actual impact in individual and social life. That conveys a powerful dialectical meaning. By way of turning the hybrid constitution of techno-ecosystems into phenomenologically shared auditory events, these mediators audibly expose the human, all-too-human reality of our pervasive technological condition.

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21 This implies the well-known theory of *exteriorisation*, developed by various authors over the decades—among them Leroi-Gourhan (1945), Simondon (1958), Stiegler (1994), and Agamben (2002). In this view, technical means are designed, implemented, and placed by human beings in their environs, exteriorising cognitive functions initially situated only in the body.

22 "Natural-born cyborgs" is of course a well-known title (Clark 2003).

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