

# Hugh Davies's Electroacoustic Musical Instruments and their Relation to Present-Day Live Coding Practice: Some Historic Precedents and Similarities

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## ABSTRACT

The purpose of this paper is to present the self-built electroacoustic musical instruments of Hugh Davies (1943-2005) to the international live coding community, and to propose points of similarity between Davies's practice and present-day live coding practice. In the first part of the paper, the context within which Davies's instrument-building practice developed, in the late 1960s, is outlined, and a number of specific instruments are described. Aspects of Davies's performance style, repertoire, and the ensembles with which he performed are discussed, as are activities such as instrument-building workshops and public exhibitions of instruments, in which he regularly participated. In the second part of the paper, four areas of connection with present-day live coding practice are suggested. Respectively, these focus upon live coding's status: (1) as part of a long historic tradition of live electronic music performance (as opposed to electronic music constructed in the studio); (2) as a practice in which the performer him or herself builds the apparatus (whether physical or code-based) through which the music is mediated; (3) as an improvised or semi-improvised art-form in which music is developed in real time, within a framework bounded by material or quasi-material constraints; and (4) as a community of practice with a distinct agenda of promoting understanding through engagement. This paper is presented as a case study in exploring live coding's historic precedents, and as a contribution toward situating live coding within a broader historical, cultural context.

## 1. INTRODUCTION

Hugh Davies (1943-2005) was a musician, historical musicologist, and instrument-builder, professionally active from 1964 up until his death in 2005. As well as making significant contributions to the documentation of electroacoustic music's history (Mooney 2015a), throughout his career Davies built more than 120 musical instruments and sound sculptures that 'incorporate[d] found objects and cast-off materials' (Roberts 2001) such as kitchen utensils, plastic bottles, springs, hacksaw blades, and many other materials that might normally be considered 'junk.'

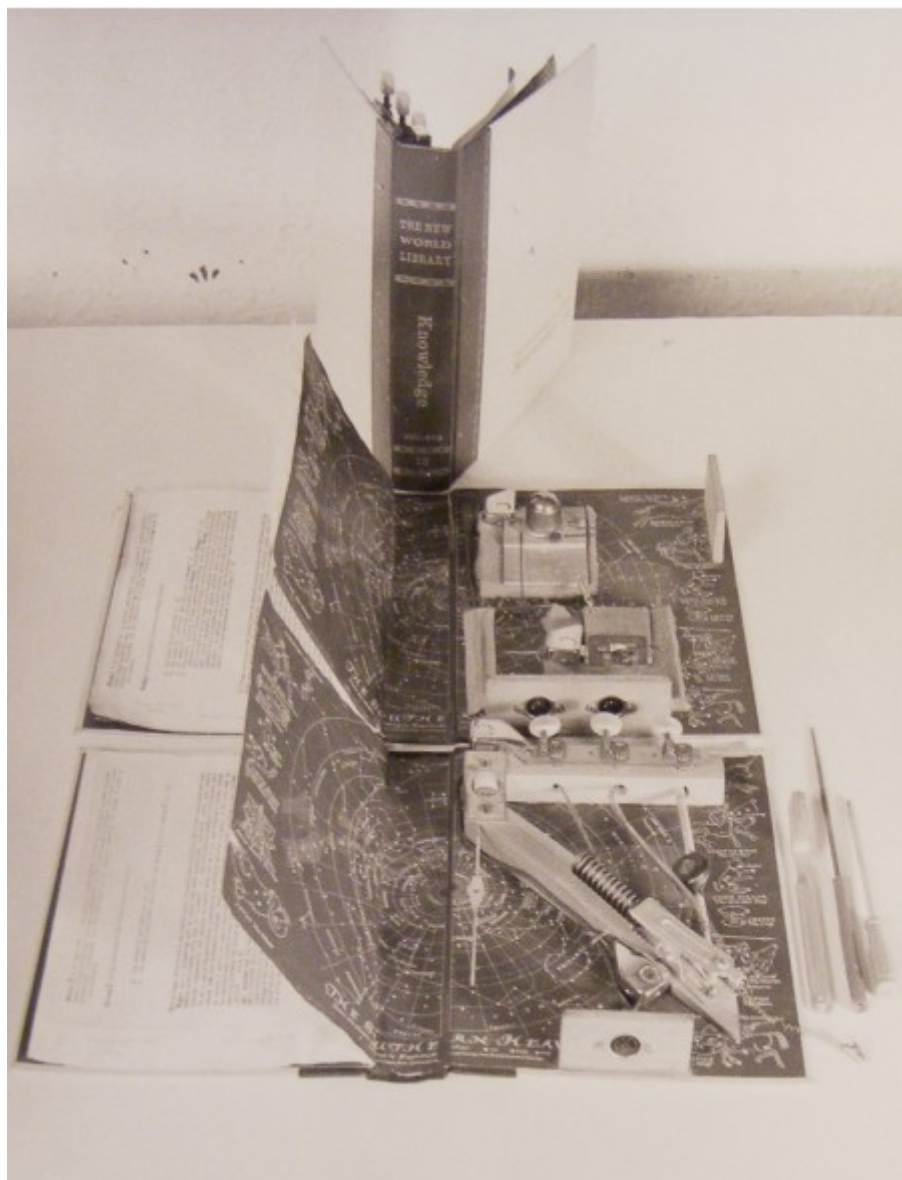
The reader is encouraged to watch the following video, in which Davies plays and briefly talks about one of his self-built instruments: <https://www.youtube.com/watch?v=wPT9A0IsGgs> (Klapper 1991). Specifically, Davies plays the first of his self-built solo performance instruments, which is a device called the Shozyg. (Towards the end of the video he also plays a number of others.) The Shozyg was built in 1968, and consists of a collection of fretsaw blades, a ball-bearing, and a spring, the sounds of which are amplified via two contact microphones that feed a stereo output. These objects are mounted inside the cover of a book that has had its pages removed; this is an encyclopaedia volume that covers the alphabetic range of topics from SHO to ZYG, which is where the instrument gets its name from. The Shozyg is electroacoustic because the means of initial sound production are acoustic, but the vibrations—which would be too tiny to hear otherwise—are amplified electronically. The Shozyg was designed to be played with the fingers or with the aid of accessories such as 'needle files, small screwdrivers, matchsticks, combs, small electric motors, small brushes, coins, keys, etc.' (Davies 1968a). (In the video Davies appeared to be using a screwdriver.) A second model of the Shozyg was built later the same year, comprising a different set of amplified objects; both models of the Shozyg are shown in Figure 1, below.

Keith Potter—a close colleague of Davies's for many years at Goldsmiths, University of London—made the following comments in an obituary that he wrote in the *Independent* newspaper:

[I]n the 21st century, it seems that Hugh Davies's innovatory, do-it-yourself, lo-fi approach— *which in several respects prefigured present laptop culture*—is finding favour with a younger generation to whom this remarkable and iconoclastic innovator now appears as a significant father figure. (Potter 2005, emphasis added)

Potter does not specify precisely *how* Davies's approach prefigured present laptop culture, nor indeed which specific laptop culture it prefigured; but Potter's comments suggest that there might be some connections between Davies's instrument-building practice, which began in the late 1960s, and present-day live coding practice. The purpose of this paper, then, is to begin to explore what some of those connections might be.

The author has previously suggested some speculative points of contact between Davies's instrument-building practice and live coding, based upon three recurring themes in Davies's work: materiality, economy, and community (Mooney 2015b). In the current paper, two of these themes (materiality and community) are developed further; the third theme (economy) has for the time being been dropped, in order to allow for a greater focus upon the aspects that are most directly relevant to the field of live coding, though it is still considered relevant and will be further explored in the future.



**Figure 1.** Shozyg I (above); Shozyg II (below). Photo © Pam Davies. Courtesy of The British Library.

## 2. BACKGROUND AND CONTEXT

In 1964, at the age of 21, Davies became personal assistant to the avant-garde composer Karlheinz Stockhausen. Davies lived for 2 years in Cologne, where, amongst other things, he became involved in

performances of Stockhausen's latest work, *Mikrophonie I* (1964). *Mikrophonie I* is a piece in which two performers excite the surface of a large tam-tam gong, using a range of different objects such as drinking glasses, cardboard tubes, hand-held battery-operated fans, and kitchen implements (Davies 1968b). A further two performers amplify the sounds produced by the tam-tam using hand-held microphones, so that details of the sound that would otherwise be inaudible can be heard. Two final performers affect the further transformation of the amplified sounds using electronic filters, as well as controlling the volume; thus, there are six performers in total.

With respect to Davies's nascent instrument-building practice, three things are significant about *Mikrophonie I*. First, it involved the repurposing—which is to say, 'hacking'—of every-day objects as musical instruments. Second, it involved the electronic amplification of acoustic sounds that would otherwise be too quiet to hear. Third, and above all, it was a work of 'live electronic' music, that is, it involved the use of electronic equipment to manipulate sound in a live performance context, as opposed to producing electronic music on magnetic tape in the studio. From the end of World War II up until at least the beginning of the 1960s, experimental work in electronic music was overwhelmingly dominated by magnetic tape (Davies 2001, p.98); sounds recorded and transformed in the studio using tape manipulation techniques were painstakingly assembled into compositions by cutting the tape up with a razor blade and sticking it back together with splicing tape. A finished composition could easily take months to realise. The practice of producing electronic music in real time, to a reasonable approximation, did not exist, and did not start to become common until the 1960s; and Stockhausen's *Mikrophonie I* was among the earliest pieces to systematically explore this new area.

The three characteristics just highlighted—live electronic music, amplification, and the hacking of every-day objects—went on to become defining characteristics of Davies's instrument-building practice, and Davies himself acknowledged the influence of his experience as Stockhausen's assistant in catalysing this aspect of his work (Davies 1997, p.12). Another influential early work of live electronic music, however, was John Cage's *Cartridge Music* (1960), in which the otherwise inaudible sounds of various found objects are amplified by inserting them into the apertures of gramophone cartridges.

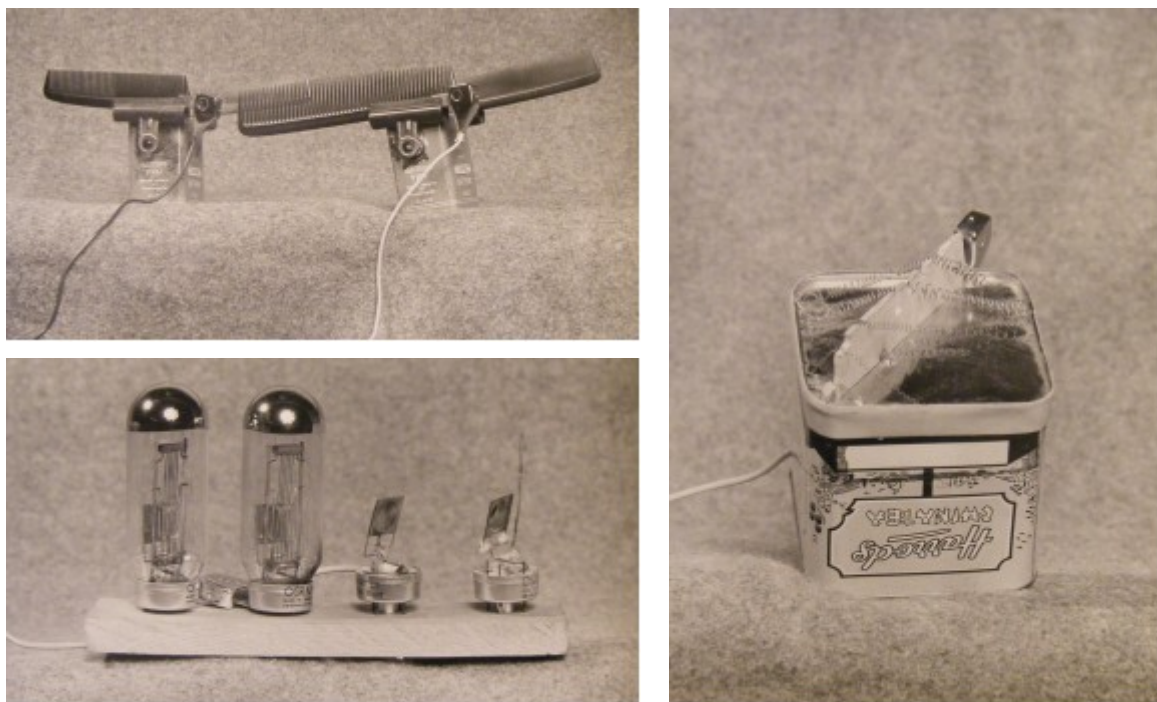


Figure 2. Some of Davies's early instruments. Photos © Pam Davies. Courtesy of The British Library.

### 3. EARLY INSTRUMENTS (1967-8)

On returning to England, Davies found that he no longer had access to the sophisticated equipment that had been available during his time as Stockhausen's assistant, and could not afford to buy any such equipment of his own (Davies 1979, p.1). Hence, the very earliest of Davies's self-built instruments—dating from 1967—represent Davies's efforts to imitate some of the techniques he had encountered in *Mikrophonie I* using

found or cheaply available objects, including combs, broken light-bulbs, and springs stretched across the opening of a metal tin (see Figure 2). The sounds of these objects were amplified via contact microphones. These early instruments were originally developed as ways of generating sound material for tape-music compositions (Davies 1997, p.12), but Davies soon recognised the potential for using such contraptions in a live performance context, and began to build instruments specifically with live performance in mind.

#### 4. FIRST LIVE PERFORMANCE INSTRUMENTS (1968-72)

As mentioned previously, the first of Davies's performance instruments was the Shozyg, of which two different models were produced; these comprised a prefabricated selection of objects mounted inside the cover of a book, and a range of implements or accessories that could be selected to activate those fixed components of the instrument in performance. Beginning in 1970, Davies built a dozen so-called Springboards (Mk. III is shown in Figure 3), in which 'a number of springs (from two upwards) are mounted on a wooden board, and treated rather like strings' (Davies 1997, p.12). The springs were amplified, usually using magnetic pickups. Another one of Davies's instruments was the Concert Aeolian Harp (shown in Figure 4), first built in 1972, which consisted of a collection of 'thin fretsaw blades [...] mounted in a holder [...] [which were] blown on by the human breath as well as played with a variety of miniature implements such as a feather and a single hair from a violin bow' (Davies 1997, p.13).

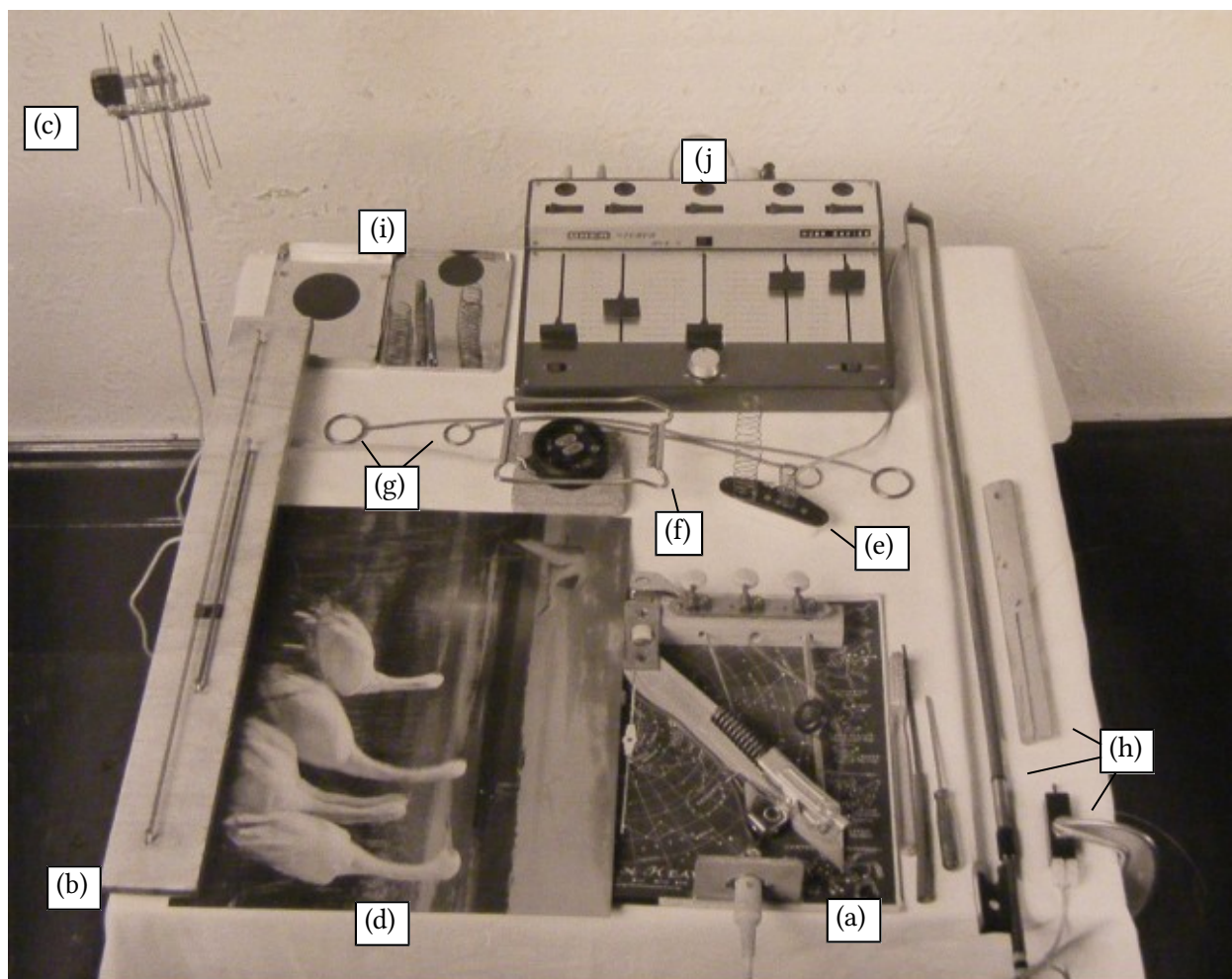


**Figure 3.** Davies with Springboard Mk. III. Photo © Michael Dunn. Courtesy of The British Library.

Davies combined several of his self-built instruments in a compound instrument that he referred to as his Solo Performance Table (a.k.a. Multiple Shozyg, 1969-72). The Solo Performance Table (see Figure 4) incorporated versions of the three instruments mentioned previously—the Shozyg (Mk. II), Springboard (Mk. V), and Aeolian Harp—as well as an amplified 3D photograph, 'whose grooves [were] played by running fingernails across them at different speeds', two unstretched springs amplified via a magnetic pickup, a metal egg-slicer amplified via a further magnetic pickup on top of which it is sitting, two long springs 'with keyrings by which to vary their tension', again amplified via the aforementioned pickups, and



a guitar string amplified by being mounted inside a turntable cartridge (recalling Cage's *Cartridge Music*), 'whose tension is varied by [a] bamboo holder', and which is either plucked or bowed (Davies 1974). In all of these self-built instruments Davies's tendency to repurpose, modify, or hack ready-made or every-day objects can clearly be seen. A custom-built multi-channel mixer was used to mix the various amplified sounds together in real time during performance.



**Figure 4.** Solo Performance Table, incorporating: (a) Shozyg Mk. II (1968) with a range of playing implements; (b) Springboard Mk. V (1970); (c) Concert Aeolian Harp (1972); (d) 3D postcard; (e) two unstretched springs and magnetic pickup; (f) Egg-slicer and magnetic pickup; (g) Long springs with key-rings to vary their tension; (h) Guitar string mounted in gramophone cartridge, with bamboo tensioner and bow; (i) Diaphragms used in conjunction with egg-slicer, plus further springs; (j) Custom-built multi-channel mixer. Photo © Pam Davies. Courtesy of The British Library.

## 5. PERFORMANCE CONTEXT AND CHARACTERISTICS

Davies's self-built instruments were typically played in improvised, semi-improvised, and/or process-driven contexts. In the late 1960s and early 70s, Davies played his instruments in three different performing ensembles: Music Improvisation Company (1969-71), Naked Software (1971-3), and Gentle Fire (1968-75). Music Improvisation Company and Naked Software were both improvisation ensembles, the former somewhat jazz oriented, the latter less idiomatically-driven. (Even the name Naked Software suggests possible connections with computing.) Gentle Fire, on the other hand, specialised in performing compositions rather than improvisations *per se*, but favoured indeterminate scores that left a significant degree of interpretative freedom to the performers, or works that developed according to some kind of (as it were) 'algorithmic' process. These included works by Stockhausen, Cage, Brown, Grosskopf, Wolff, and others, as well as several of Gentle Fire's own *Group Compositions*, which were process pieces devised collectively by the members of the group (Davies 2001a; Emmerson 1991).

Gentle Fire's *Group Composition V* involved the rolling of dice to determine musical events and electronic processes, and various other physical and conceptual systems designed to constrain the action possibilities within an otherwise open musical framework. In *Group Composition IV*, it was the instrument itself that governed the process by which the music unfolded over time. This was an instrument built, not just by Davies, but by all five members of the group, comprising four large, suspended metal racks amplified via contact microphones, which all of the members of the group played simultaneously. 'The instrument is the score of what we're playing', is how one member of the ensemble described *Group Composition IV* (Michael Robinson, quoted in Plaistow 1973). It was the instrument itself that governed the actions of the performers, and hence the way the music unfolded over time; the instrument provided, as it were, the 'algorithm' driving the music's development, via an exploration of its affordances and constraints. Process in Davies and Gentle Fire's work is discussed further elsewhere (Mooney forthcoming/2012a, 2012b).

From the early 1970s onwards Davies began to perform more as a soloist, and less frequently in ensembles, but his solo performances retained the improvised, semi-improvised, or process-driven approach just described. Although the sound-world and overall structure of a performance might sometimes be planned in advance, it would never be entirely predetermined. Rather, Davies's performance practice was one of continual exploration of the musical possibilities of the instrument(s) at hand:

What [Davies] requires of anyone who plays his instruments is that he or she should become sensitive to what the instrument is capable of doing and what is natural to it... (Roberts 1977, p.8)

When he talks about his work it is noticeable that Davies constantly uses phrases like "the instrument tells me what to do", [or] "the materials show me how it should be." (Roberts 1977, p.11)

One might suppose that it was these kinds of principles that were continuously at work when Davies selected objects and playing techniques from his Solo Performance Table. One gets the impression of an exploratory framework, circumscribed by the instrumentarium's material properties and constraints, through which the music was allowed to develop as an emergent form via a continuous process of interaction between performer and instrument.

## 6. WORKSHOPS AND EXHIBITIONS

Davies's instrument-building practice was not undertaken solipsistically, nor purely for his own artistic gratification. On the contrary, Davies actively sought opportunities to engage a wider public, both in the playing of his existing instruments, and in the invention of new ones. Davies's frequently staged instrument-building workshops for children (Davies 2002, p.96), for example, as well as regularly exhibiting his instruments in art galleries, where members of the public would be encouraged to play them. Such activities were underpinned by a commitment to 'learning by doing', an ethos symbolised by the very first of his performance instruments, the Shozyg, which was described in the BBC's *The Listener* magazine as 'an encyclopaedia degutted to substitute direct experience for learning' (quoted in Davies 1974, p.5).

## 7. DAVIES'S PRACTICE AND LIVE CODING: FOUR SUGGESTIONS

For the purposes of the present discussion live coding is defined as the manipulation of computer code in a live performance to generate or influence the development of music in real time. (Live coding is, of course, practiced in other, non-musical, scenarios, but these are not directly considered here.) How might the present-day practice of live coding be related to Davies's instrument-building practice as I've just outlined? As a starting point for further discussion, four suggestions are offered.

### 7.1 Live Electronic Music: Historic Precedents

First and foremost, both Davies's practice and the practice of live coding are forms of live electronic music, that is, they both represent attempts to generate music by electronic means in the context of a real time performance, as opposed to producing electronic music off-stage in an electronic music studio. This might seem like stating the obvious, but in this case stating the obvious is an important thing to do, since it allows Davies's practice and live coding to be thought of as constituent parts of a broader historic trajectory. Within such a framework, one might look for precedent aspects of live coding practice, not just in Davies's work, but in other previous incarnations of live electronic music, such as those documented by Davies in his extensive article on 'Electronic Musical Instruments', published in the *New Grove Dictionary of Music and Musicians* in 2001 (Davies 2001b). For example, Davies refers to the use of 'miniaturized circuitry and

microcomputers' in the work of David Behrman, Paul de Marinis, Larry Wendt, and the California-based League of Automatic Composers (Davies 2001b, p.101), the latter of whom used KIM-1 microcomputers in live performances:

With a debut performance in Berkeley in 1978, the League's performances consisted of each human member's KIM-1 networked together through flimsy, 8-bit parallel ports through which each device could be used to generate its own sound as well as receive and process data from other machines on the "network." (Salter 2010, p.206)

Whether or not these computers were actually *coded* during real-time performance, the simple fact of their use in a live performance setting at all represents a part of the historic precedent for today's live coding practices that is worthy of further exploration. As another possible precedent, David Tudor's *Rainforest* pieces (1968-73), which involved the use of 'instrumental loudspeakers' made of aluminium, steel, wood, and glass as 'signal processors' in various different permutations, might be thought of as a physical predecessor of MaxMSP, where multiple signal processing modules connected to one and other in an infinitely permutable combinatorial system. Might Davies's Solo Performance Table, comprising multiple self-contained instruments encapsulated within a single overall framework, be likened to a collection of object instances within an object-oriented programming framework? These examples do not share all of the features of present-day live coding practice, of course, but they do show how certain characteristic aspects—such as the use of computers in live performance, or the presence of an infinitely permutable signal-routing system—were present in forms of live electronic music that predated live coding *per se*.

## 7.2 Building, Making, Modifying

Second, in Davies's practice, as in live coding, it is the performer him or herself that builds (and/or modifies) the structures through which the music is mediated. Davies built his own instruments, which were then used in performance; live coders develop the algorithmic structures by which the music is mediated in real time, as the performance proceeds. On the surface of it, the idea that Davies's instruments were built before the performance, whereas in live coding the building takes place during the performance might appear to point to a fundamental distinction between Davies's practice and live coding; but does that apparent distinction really stand up to close scrutiny?

To quote Thor Magnusson in the documentary *Show Us Your Screens*, 'this requirement of starting from a clean slate [in live coding] is always an illusion' (Magnusson, quoted in McCallum and Smith, 9'44"). In live coding, there is always a part of the programming infrastructure that pre-exists the performance, whether it's the programming language itself, a higher level abstraction such as a graphical user interface, or a portfolio of functions or algorithms written in advance; whatever coding is done on-stage is simply an addendum to, or modification of, those pre-existing materials. This fact, of course, challenges the notion that live coding is concerned only with building code *during* the performance. Conversely, with Davies's instruments, it is true that parts of the instrument are built in advance of the performance, in that there is a collection of pre-existing materials that Davies brings on to the stage with him, but the ways in which those materials are combined and interacted with remains open-ended, and changes reactively as the performance proceeds, as appropriate to the musical development and the performance context. The choice of different accessories when playing the Shozyg, or the different combinations and interactions with the constituent objects of the Solo Performance Table, are examples of this. The use of screwdrivers and other such improvised addenda might even be thought of as modifications to or augmentations of the instrument itself, somewhat reminiscent of the way pre-existing code structures are modified, permuted or augmented in live coding. In other words, Davies's performance practice includes live manipulation and selection of the materials that constitute the instrument, just as much as it involves assembling those materials in advance.

In both Davies's practice and in live coding, then, there are materials that are built in advance of the performance, and modifications, selections, and augmentations of those pre-existing materials that are made in real time, as the performance proceeds. (A further sense in which Davies's practice and live coding might be thought of as similar is that they both involve the appropriation and modification of *ready-made* objects: every-day objects and household items in Davies's instruments; external function libraries and pre-written functions in live coding.)

### 7.3 Improvisation Bounded by Material (or Quasi-Material) Constraints

Third, both Davies's practice and live coding involve improvised, semi-improvised, and process-driven—that is, algorithmic—aspects. In live coding it is perhaps self-evident that there are algorithmic processes at work, since algorithmic processes are fundamental to all coding scenarios. Live coding also can involve an element of improvisation, though; to quote live coder Dan Stowell:

For me it's about improvisation... How can you get towards a position where you can really improvise with the full potential of computer music, on stage? (Stowell, quoted in McCallum and Smith, 1'44")

Davies's practice, similarly, includes both improvised and 'algorithmically-driven' elements; it developed, as discussed previously, in improvisation ensembles, but also in groups that specialised in the performance of process-driven works. In some cases, as in Gentle Fire's *Group Composition IV*, the process itself was explicitly circumscribed by the material constraints of the instrument itself; a situation which might be likened to the way a live coder's actions are ultimately constrained by the characteristic or 'material' properties of the chosen programming environment.

Whether or not computer code can be considered 'material' is worth a brief diversionary discussion in the current context. According to Magnusson, code might be considered 'material' in the sense that 'it is a direct and non-ambiguous prescription of the computer's electronic gates' (Magnusson 2014, p.1); it is, in other words, material by proxy. Interactions with code, then, are in a sense material interactions by proxy. This is perhaps most clearly foregrounded in the many software packages whose graphical user interfaces use physical metaphors, such as MaxMSP, where the user connects patch-cords to objects. There are, of course, not *really* any patch-cords in the physical material sense, but the interaction is a material one functionally and metaphorically speaking, and a truly material one in the sense that it has a corresponding deterministic influence upon the computer's electronic gates. In this sense the live coder, operating within a given software environment, is bounded by the 'material' constraints of that environment.

However, irrespective of whether code can truly be thought of as material, Davies's practice and live coding are similar insofar as the music develops in real time, in an improvised or semi-improvised way, and within an overarching framework that is bounded by the constraints—material or quasi-material—of the chosen instrumentarium or programming environment.

### 7.4 Community Engagement and Interactive Learning

Fourth, in Davies's practice and in live coding, there is a clear desire to promote understanding through participation, which manifests itself in a distinct demonstrative, or perhaps even 'pedagogical' aspect, and in community or group-based activities with an emphasis on hands-on engagement. For example, Davies frequently staged instrument-building workshops for children, and exhibited his instruments in art galleries where members of the public were encouraged to play them. In live coding, a community-driven aspect is evident in the many open source software frameworks that are used and contributed to by live coders, or indeed developed specifically for live coding. Hands-on engagement is also evidenced in the many 'Hackspaces' and 'maker' events in which live coders sometimes participate (e.g. Leeds HackSpace 2015; Maker Faire UK 2015). All of these kinds of activities have strong agendas of learning and making, or, rather, learning *by* making.

One specific practice that both Davies and live coding have in common is the practice of 'screen sharing.' In live coded performances, it is common practice to video-project the computer screen, so that members of the audience can see how the code being typed relates to changes in the music (Sorensen and Brown 2007). To quote from TOPLAP's draft manifesto...

Obscurantism is dangerous. Show us your screens. (TOPLAP 2011)

(*Show Us Your Screens* is, of course, the title of the documentary that has been cited twice previously.) Similarly Davies, in live performances, used to video-project images of his hands while playing his self-built instruments, 'enabling the audience to make a clearer connection between what they see and what they hear' (Davies 1997, p.13). In both Davies's practice and in live coding the video-projection is undertaken in order to facilitate audience engagement, and a better understanding of the processes by which the music unfolds.



## 8. CONCLUSION

The preceding discussion has focussed upon articulating areas of similarity between Hugh Davies's instrument-building and performance practice, which developed in the late 1960s and early 70s, and the present-day practice of live coding. In summary, it has been noted that both are forms of live electronic music in which the performer him or herself takes responsibility for defining the structures through which the music materialises. Both are performance practices in which the music develops in an improvised or semi-improvised way, as an iterative and reciprocal interaction between a performer and a given framework, where certain elements are fixed before the performance, and certain elements are selected, manipulated, and/or modified as the performance proceeds, but where the range of possible interactions is ultimately bounded by certain material or software-based quasi-material constraints. Finally, both are associated with hands-on, community-based activities that are designed to facilitate engagement and understanding through participation.

'Live coding is a new direction in electronic music and video', claims the TOPLAP website (TOPLAP 2011). Of course, there *is* a sense in which live coding is a new and exciting field, but there is clearly also further work to be done in situating live coding in its broader historical, cultural context. By drawing a comparison with Davies's work, it has been demonstrated that non-trivial similarities with live coding can be found in a performance practice that predated live coding as we currently know it, and involved neither computers nor computer programming *per se*. It is hoped that this paper might stimulate further thought, discussion and research as to how such an agenda might be usefully extended in future.

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