# BRIDGING THE GAP: THOUGHTS ON COMPUTER MUSIC AND CONTEMPORARY (POPULAR) ELECTRONIC MUSIC

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**ABSTRACT**

Two primary musical fields centred around the use of the computer in production and performance are computer music and contemporary electronic music. In recent years, music technology has become increasingly affordable and available to those with little or no musical training or institutional affiliation, giving rise to expanding numbers of practitioners whose engagement with music technology is informed overwhelmingly by their experience of popular and contemporary electronic musics. In this environment, it is interesting to consider the relationship between computer music and more vernacular forms, and how the omnipresence of music technology may lead to opportunities for engagement with wider musical contexts. Some key features of these fields will be discussed, taking as an example approaches to music performance using the laptop computer and the programs M and Ableton Live, as well as recent commentary in this area.

## 1. DEFINING COMPUTER AND CONTEMPORARY ELECTRONIC MUSICS

Despite the extensive involvement of electronic and computer technology in contemporary music, the academic focus of modern computer music possesses distinct interests separating it from broader contemporary music technology research. In and of itself, the term *computer music* is incomplete. Although it is a truism that computer music necessarily involves computers, the modern computer music field does not indiscriminately encompass all music composed on or with the aid of computers. Rather, it appears to have largely continued its inherited status as an exclusive and institution-centred domain. This has been achieved through a shift from a focus on technology to an emphasis on continued research and experimentation, continuing in the Western avant-garde and art music traditions.

Meanwhile, the contemporary use of computers in music composition and recording, while apparently using similar technologies to those used by computer musicians in the academic sense, can be viewed as a succession from older music production tools (such as tape recorders and analogue recording studios) to a newer and more efficient medium, with little calculated change in technique or sound.

The broader field of music produced with the aid of computers can thus be split into two sectors; firstly, the realm dominated by populist 'consumer applications' of music, as identified by Daniel Oppenheim [20], arisen from the commercialisation of analog or digital synthesisers and electronic music hardware since the mid-1960s. Contemporary electronic music is a prime example, consisting as it does of "sub-genre upon micro-genre of music which is based almost entirely upon, and impossible to conceive of without, the absolute regularity of tempo computers are capable of producing" [23]. The second, 'academic' branch of contemporary computer music, while necessarily engaged with technological issues, is founded more on the formalism, abstraction, and experimentation that has underpinned musical development in the twentieth century.

Examining the performance methodologies of computer music and contemporary electronic music reveals, not surprisingly, differences in their approaches to and conceptions of the music-making process. The latter term encompasses electronic music affiliated with (though not necessarily) popular music forms such as techno, dance, and electro which occur outside academic or institutional contexts. It also sheds light on how these approaches may complement each other to formulate solutions to the problems of laptop music performance.

## 2. PROBLEMS WITH PERFORMANCE

The use of the laptop in a performance setting presents a number of breaches to culturally instituted, normative definitions of performance. Qualities established and reinforced by acoustic and commercially-oriented performance are not inherent to the laptop medium, leading to a problematic disconnect between modes of musical production and reception in a live context.

Some recognised issues include perception of effortlessness [16] and non-liveness [14]. This can potentially be addressed through developing laptop instrumentality, focussing on expressivity, virtuosity [24], and perceptibility. Meanwhile, cultural antipathy towards technology in musical performance can be expressed as a tension between *pheno-text* and *geno-text* [8], where geno-text represents the desired and elusive grain, or 'human element' of performance, which is diminished by the integration of the machine.

Aside from these culturally-based challenges, the physicality of the laptop itself raises the issue of obscurantism and counterfeit [11]. To negotiate this, various techniques for literally or figuratively displaying the instrument have been explored, including screen projection and the implementation of additional, audience-scrutable interfaces. The role of the artist or author in performance provides an additional question

framing the above issues, as this role is subject to different definitions and interpretations dependent on the performance context. Each of these matters is further complicated by the rapid rate of technological change, which continually introduces new technical possibilities for performance.

The complexity of these issues and their interrelationships, as well as the uniqueness of any performance situation, precludes any definitive solution to the performance of computer music and contemporary electronic music. Nonetheless, they can be used to formulate an individual approach, informed by an awareness of the surrounding issues.

## 3. MEANS FOR RECONCILIATION

The most self-evident factor connecting computer music research and contemporary electronic music performance is the centrality of the computer to the musical process. Chadabe [12] suggests that these fields are likely to intersect, citing wider social forces contributing to the integration of popular music culture with elite 'high-art' computer music. This merge, according to Chadabe, may occur through the invention of applications that allow the public at large, with little or no computer-specific musical knowledge, to "interact in a sophisticated and creative way with a musical process" [13].

Although the literal interaction of an audience with musical processes is a concept more suited to a gallery or experimental happening than a dance-floor, the notion of sophisticated and creative computer-based interaction with musical processes has immediate applications for contemporary electronic music performance. Furthermore, the specific area of contemporary electronic music performance is well suited to researching new interactive possibilities. Chadabe [13] suggests that a possible role for computer music research is as a facilitator of musical processes and tasks for the benefit of those outside of the immediate computer music field.

Neill [22], expanding on many of the points raised by Chadabe [12] likewise asserts that interactivity may serve as the focal point for an integration of computer and popular musics. Integrating computer music and popular music culture can thus also be based on the practical pursuit of musical interactivity in a performance context.

## 4. PERFORMING CONTEMPORARY ELECTRONIC MUSIC

The performance of contemporary electronic music has evolved from, and is enduringly linked to, turntable technology. The use of turntables in performance is notionally limited by the performative and sonic conventions of musical genre. Virtuosic turntablism, prevalent mostly in hip-hop, provides the most extensive control over musical material. In electronic music, limited DJing practice is the norm, resulting in a more functional than creative role for the performer. The turntable model remains a widely accepted and well-understood performance formula for contemporary electronic music. Commercial technological developments on this model include CD turntables and DJing software, which address practical issues rather than broader issues relating to the nature of musical performance.

Given that turntables and their technological descendants have evolved from systems of music *consumption* (the vinyl artefact) rather than *production*, it follows that the logical extension of this limited approach is the incorporation of tools for the production of electronic music into performance contexts. Synthesisers, samplers, sequencers, and audio processors allow, at first glance, greater interaction with musical material. A practical implementation of these technologies to performance is complicated, however, due to their lack of specialisation for real-time contexts and the multi-layered complexity of contemporary electronic music.

Using production technology therefore necessitates a compromise between interactivity and improvisational potential, and a satisfactory level of musical complexity. In order to make full use of music production technology in performance, it is necessary to develop intuitive and reliable communication between performer input and a complex musical result. This provides a valuable opportunity for practical research into generative and other algorithmic music composition and performance techniques.

## 5. COMPARING M AND ABLETON LIVE

The different approaches to musical performance espoused by computer music and contemporary electronic music can be understood by examining two programs: M, distributed by MaxMSP developers Cycling '74 [15], and Ableton Live, developed by Ableton AG [7].

Ableton Live merges aspects of production and performance, relying on the DJ paradigm of cueing sections, breaks, and loops. The practical aspects of the DJing process are greatly facilitated by Ableton Live's software interface. M, on the other hand, builds an original interface for generative and algorithmic computer composition and performance.

The drawback of Ableton Live's usability, context-specificity, and comprehensibility is its normative and limiting view of performance. Conversely, the disadvantage of M's expanded performability and interactive potential is its lack of defined musical and cultural context, which contributes to its complexity and relative obscurity outside the computer music community.

### 5.1. M

M, written by a team of developers including David Zicarelli and Joel Chadabe in 1986 [17] and still currently available, represents a notable early foray into the domain of software capable of being used in both composition/production and performance contexts. This program generates MIDI output rather than audio data and allows the user to algorithmically process supplied content, generating new material from this information

[29]. M also incorporates performance controls, allowing users to map keyboard, mouse, or MIDI input data to program instructions [29].

The M user manual states, "M's powerful tools and musical controls let you work so quickly and interactively that the line between composing and performing becomes blurred" [29]. Despite this promise, the forbidding complexity of possibilities for algorithmic composition, control, and performance, combined with M's lack of embedded musical context, contribute to M's predominant position as a primarily academic compositional tool, precluding a more widespread use or acceptance by the music community at large. An online history of M by Cycling '74 is reticent about listing specific composers or performers who have used M [17], and therefore, apart from prominent figures such as Chadabe, the actual extent and method of its use is difficult to discern.

Nonetheless, M is worth mentioning as an example of a program that directly addresses early concerns regarding the problematic aspects of performing computer-based music in general, despite the ambiguity of its known use within contemporary electronic music.

### 5.2. Ableton Live

Given the advent of affordable home computers powerful enough to permit significant audio handling and processing, the capability of software programs that incorporate both composition and performance has greatly increased in recent years. One such program is Ableton Live, available since 2001 [7] and in its eighth version as of early 2010. This widely used recording and performance environment is particularly prevalent within contemporary electronic music. Ableton AG, creators of the program, estimate the number of users at "several hundred thousand" [7], and provide a list of prominent Ableton Live users on a dedicated section of their website. Of 65 artists listed, 35 are described as either DJs or electronic musicians [2]. The program is billed as a product that "accompanies every stage of the musical process, from creation to production to performance" [3]. The central function of Ableton Live is as digital audio workstation software, which operates similarly to comparable programs such as MOTU's Digital Performer, Steinberg's Cubase, or hobbyist programs such as Apple's Garageband.

A multi-track sequencing and recording environment is the core of this basic functionality, allowing both audio and MIDI arrangement as well as features such as audio or MIDI effects and processing, software synthesisers and samplers, and the ability to capture audio or MIDI from external sources. Where Ableton Live crucially differs from these programs is in its attention to real-time use and performance. It includes a dedicated performance dimension, called Session View, as well as Arrangement View, which represents the standard multi-track recording environment described above. Using Session View, the user can choose from a large number of pre-loaded or recorded audio or MIDI segments ('clips') for uninterrupted, looped clip playback, unlimited by the temporally linear restrictions of a traditional multi-track environment. This feature is described on the Ableton Live website as "a powerful musical sketch and launch pad, allowing you to improvise freely with ideas" [4]. The notion of switching between modular looping sequences is commonly demonstrated in many hardware and software sequencers and is often a key feature of contemporary electronic music production. Given the colour-coded visual display, and the point-and-click interface of Ableton Live's Session View, this practice is developed into a considerably more user-friendly procedure, as graphically represented clips can be easily organised, cued, and recalled by the user.

Although Ableton Live is closely allied with the technologies of music *production*, the particular influence of computer-based DJing environments on the *performative* aspects of Ableton Live is worth considering. The popularity of Ableton Live among DJs has been mentioned, and specific features tailored for DJ performance are embedded within the performance system. Facilities for tempo induction, beat-matching and quantisation, headphone pre-audition, simplified cueing, effects, independent pitch and tempo adjustment, and EQing are included [5], replicating features found in software and hardware DJing technologies.

Ableton Live's performance capacity is introduced by the statement, "in all traditional sequencing programs, everything happens along a fixed song timeline. For a number of applications, this is a limiting paradigm", citing DJ performance, live sound for theatre, and film scoring as examples where a linear approach is not appropriate [6]. Session View, which allows sound clips to be layered, arranged, and selected in real-time, is thus a concept that is unusual when considering multi-track recording software, but a central feature of DJ software and practice [6].

There is necessarily some trade-off between ease of use and customisability, and the inflexibility embodied by Ableton Live's implicit focus on DJ practice is discussed by Blackwell and Collins [9], in a comparison with live coding. The authors cite Ableton Live's representational assumptions, such as an initial 120bpm tempo and 4/4 time signature, to illustrate the program's tendency to constrain and predefine user decisions [10]. The central advantage of Ableton Live thus lies in the unity of its recording and performance environment, rather than the DJ-influenced nature of the performance environment itself, consolidating the user's influence over the musical process as a whole.

### 5.3. Comparison

Comparing Ableton Live and M reveals some striking differences, although the stated objective of both programs is to consolidate the habitually separated fields of music production and performance.

M, described as an "intelligent composing and performing system" [15], places an increased emphasis on compositional interactivity with the program. This definition of M as a composing system is a key factor in identifying its difference from Ableton Live in performance, as M itself has creative input. M situates the fields of composition, recording, and performance as aspects of a single undertaking, rather than separate stages in the music-making process.

Meanwhile, Ableton Live shows more detachment between the composition/recording and performance processes, demonstrated by its separation of Arrangement View, for multi-track recording, and Session View, for performance purposes. Although it is possible to record live 'takes' from the Session to the Arrangement View, Session View requires a concrete repertoire of MIDI or audio material to be composed or sourced beforehand, effectively compelling production to precede performance.

M's approach to composition, recording, and performance is more holistic. Rather than requiring pre-composed material for recombination, the performer specifies types of behaviours, reactions, and patterns that are executed by the program in performance, or in real-time at least. In effect, using M involves creating material *generators* rather than material itself, therefore directly linking the operations of composition and performance.

Ableton Live and M may both be justly described as performance programs that provide an alternative to the paradigm of "being bound to a fixed timeline" [1]. This distinction involves firstly a straightforward difference of interactive scale. Both programs allow interaction at the *meso*- and *macro*-level, to use Roads' terminology [25], while only M offers interaction at the *sound object* level, and Ableton Live offers increased timbral interactivity. More importantly, there is a fundamental conceptual difference between these programs regarding the ways that composition and performance are related, as illustrated in Figure 1.

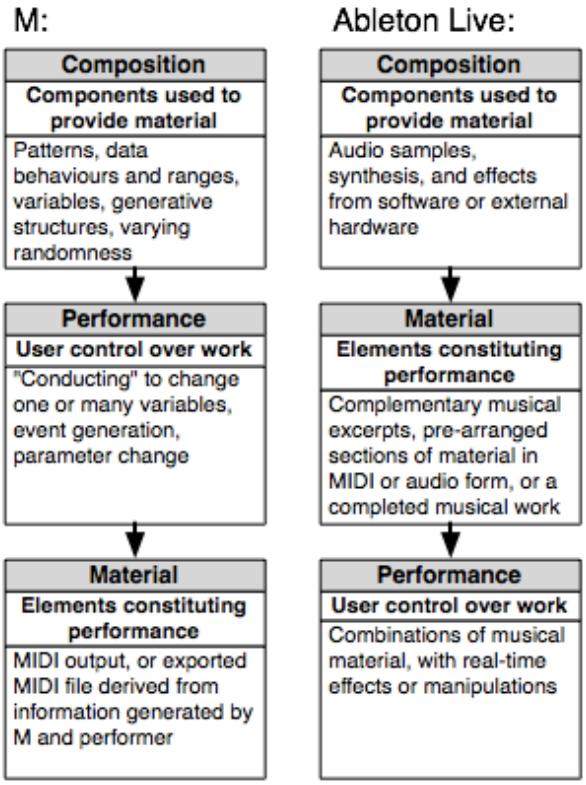


**Figure 1**. Contrasting relationships of performance/material in M and Ableton Live

There is certainly a degree of flexibility in the usage depicted in Figure 1, depending on the user and the features used in each program. Similarly, although the exact definition of the terms used, including concepts of composition, material, and repertoire, are open to debate, Figure 1 serves to underline two fundamentally different approaches to performance.

As an example, the concept of repertoire varies when applied to works created in M or in Ableton Live. Both programs require a repertoire of sorts in order to successfully enable performance. Ableton Live's repertoire consists of ready-made musical fragments assembled within the work in question, whereas M's repertoire differs in that it consists of indeterminate musical behaviours realised only through performance.

M thus embodies an *a priori* relationship of performance to material, as composition of and within the performance environment requires a theoretical deduction of the material that will result. Conversely, Ableton Live illustrates an *a posteriori* approach to performing musical material, as components are prepared beforehand and outcomes react linearly to the performer's actions. The pivotal ontological difference between M and Ableton Live is thus the centrality of the element of performance.

### 5.4. Performance attributes

This difference notwithstanding, Ableton Live and M both offer valid solutions to the rift between production and performance within computer-based music.

M extends performance by consolidating composition and performance into elements of the same activity through the use of generative and algorithmic processes. It also permits real-time interaction at the sound object level. Ableton Live extends performance by positioning it as an ancillary to a fully-rounded production environment, and furthermore provides extended control over musical result by allowing the performer to use self-composed material. The primary benefit of Ableton Live is its integration of production tools.

The compositional and performative possibilities embodied by generative processes and demonstrated by M, however, represent a different notion of performance that is not derived from DJ practice. Here, new material at the sound object level can be generated in real-time. The idea of real-time composition and improvisation in contemporary electronic music—a genre characterised by complex rhythms, timbres, and arrangements—is compelling. By adding layers of complexity and uncertainty, the user/performer is obliged to interact with the resulting musical material, producing an evolving dialogue rather than relying on a determinate, uni-directional flow of activity.

Improvisation has particular value for the single-performer-and-computer model, as external musical influence in the form of either collaborators or instrumental input is absent. This can run the risk of developing a 'closed circuit' in which the performer bears complete responsibility for navigating a fixed musical space. By developing a more reciprocal interchange between human agents and performance software, the concept of performance in contemporary

electronic music is expanded from a reliance on pre-built arrangements, loops, and structures, to one that incorporates elements of real-time music creation—focussing on creative interaction, improvisation, and immediacy.

## 6. ENGAGEMENT AND RECIPROCITY

There is significant tension engendered by trying to insert a performance dimension to a musical form such as contemporary electronic music, as it is based almost entirely in 'off-line' studio production. The performer firstly does not possess the physical and mental capacity to perform these complex musical works in the same one-to-one physical-gesture-to-acoustic-result capacity as an acoustic musician. Ensemble performance would increase the possible complexity of musical output, but although computer music laptop orchestras abound, little precedent exists for contemporary electronic music.

Using the computer to facilitate performance triggers many questions: what aspects of the musical work should the performer interact with, to what extent, and how should this occur? Will increasing interaction diminish the quality of the musical result, or will limited interactions diminish the quality of performance? Furthermore, how can the audience—both habituated to the musical work as a product of the studio, and instilled with notions of acoustic performance—be satisfied with what this type of performance offers? These questions are perhaps not definitively answerable, but searching for solutions across both contemporary electronic music and computer music at least offers additional perspective.

### 6.1. Recent developments

It is difficult to say whether any significant reciprocity, in a creative sense, has developed between computer music and other fields of research or musical cultures over the past decade. Certainly around 2003 interest in the laptop computer as a means of performance, and in the commonality between glitch and computer music, seems to have peaked (see [26], [28]). Presently, the laptop as a creative instrument in this field endures mostly through live coding and through the formations of various laptop orchestras (see [27]), but on the whole the continued association of computer music with primarily classical (Western or non-Western), jazz, and experimental contexts remains intact. It has been somewhat surprising that so few investigations treating contemporary electronic music have occurred during this time.

Furthermore, concerns about the lack of triangulation or detachment of computer music, such as those raised by Landy [18], Chadabe [12], Zicarelli [30], or Ostertag [23] have largely abated, although a brief and timely commentary by Myatt [21] should be noted. In retrospect, it seems probable that the proliferation of the laptop computer circa 2001 led to a spate of live music-making and experimentation by both academic and non-academic composers, similar to other new technologies in recent years such as RFID tags, the Nintendo Wii controller, and the Apple iPhone which have likewise experienced arcs in popularity. This common focus has since subsided following the diminishing novelty of the laptop, and the establishment and increasing ubiquity of commercial performance software such as Ableton Live.

Despite the persisting distance between computer music research and contemporary electronic music, popular music, and non-academic computer music, it is hoped that the fruitfulness of integrating or at least considering these areas has been demonstrated.

### 6.2. Future developments

Recent years have shown little discernible increase in the relationship between computer music research and more popular music forms, a number of intrepid live coders notwithstanding. It would be reckless to suggest that there is an impending flood of computer musicians and researchers who will address this issue. Any progress in this regard from the direction of the computer music community at large is likely to be gradual, and a 2006 statement by Eric Lyon is telling. He affirms, concerning the reciprocality between popular and computer musics, that "this influence has worked both ways, with increasing numbers of academic computer musicians incorporating beat-oriented, tonal or other vernacular elements into their computer music" [19].

If beat-orientation and tonality are, in 2006, still considered vernacular and relatively unusual elements, future significant developments in generative composition and performance of contemporary electronic music will most likely originate from non-academic quarters. Artists, software designers, and programmers with an interest in contemporary electronic music constitute a community that is both dynamic and unpredictable.

## 7. CONCLUSION

Performance in contemporary electronic music is ripe for investigation, and leads to additional explorations of improvisation, interactivity, and creativity, both in this and further musical contexts. As a tool for performance and real-time interaction, the computer is still a relatively new instrument. The ubiquity of the laptop computer in particular, and the increasing accessibility of music software combine to provide an ever-growing population of potential meta-composers and performers. It is hoped that computer music research, as well as other research fields and non-academic practitioners of contemporary electronic music, will engage with this possibility.

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