Past and Current Tendencies in Technology-Based Music

JØRAN RUDI

Norwegian centre for Technology in Music and the Arts, NOTAM, Sandakerveien 24D, bygg F3, 0473 Oslo, Norway
Email: joranru@notam02.no

This article will, in a broad sense, discuss technology-based music from its early radio beginnings to the current participation practices, and seek to place both technical and musical development within broader trends of social development. The introduction of new technologies in industry, composition, mediation and consumption has, in a lasting manner, changed the way most of us listen to, participate in and make use of music in our daily lives. Electronic aesthetics has finally, following a development of nearly a hundred years, started to fulfil its initial promise of becoming widely accepted and popular outside of the narrow circles of musical expertise – a 'democratic' music unhindered by the hierarchies of the fine arts in their different configurations. But has it really fulfilled the original promise? Is it rather not so that both the music and its promise have changed over the years?

One thing is certain, our pre-adaption to aesthetic experiences has undergone extreme changes over the last twenty years or so. A paradigm shift brought about by digital media and distribution, as well as the networking of things, has directed large parts of humanity towards a new existence in the cross-section of technology and humanity, an existence where cyborgian qualities increase day by day.

1. EARLY INSTRUMENTS AND RADIO BEGINNINGS

The instruments that emerged from the early electrification were thought by many to have the potential for becoming a bridge between amateur audiences and their desire for active participation in music as performers (Wiggen 1971; Broman 2007). The skills needed for performance of traditional art music were beyond reach of what the majority of the population could hope to develop, and the cost of good instruments also prohibited broad segments of society from taking part. The new electronic instruments were easy to play, and although they often built on the traditional keyboard interface, the tones they produced were simple, compared to acoustic instruments, but with the allure of being new and unheard. Becoming a skilled performer still required years of practice.

The early electronic instruments sought to use the new medium of electricity for the purpose of expanding the musical palette, and they covered a wide range – from the strange-looking *theremin*, which was operated only by gestures in the air near the instrument, to new control interfaces such as the rotating dial of the *Sphärophon*[1] and the ribbons of the *ondes Martenot*.[2] More practically oriented keyboard instruments included the organs by Laurence Hammond.[3] These organs became popular and found their way into churches and religious congregation halls as good-sounding and relatively cheap replacements for pipe organs. Most of these instruments were capable of producing sounds that one could not easily get from acoustic instruments, and composers such as Olivier Messiaen and Paul Hindemith wrote for electronic instruments. Although the music was innovative enough, it was not often particularly radical by the standards of the day, or by today's standards for that matter. Little of it is performed today, although exceptions exist.[4]

The instruments were thought to be able to draw broader groups of people into making music, and they were thought to be particularly well suited for the new media technology, radio. At the time, composers increasingly wrote or arranged their music specifically for radio, with the purpose of creating a balance between the different instrument groups particularly tailored for broadcast. Recording was not yet feasible, and the musicians needed to squeeze together in front of

[1]The *Sphärophon* (1927) was an electric instrument developed by Jörg Mager, much because of his interest in micro-tonality, and originally operated by handles and cranks. His further development of the instrument added conventional keyboard control, so that it could provide pitches and discrete intervals as well as changes in timbre. The instrument is described in several sources, such as: http://120years.net/wordpress/the-electrophon-spharaphon-partiturophon-and-the-kaleidophon1921-1930 (accessed 21 August 2014) and http://acousmata.com/post/27443169341/jorg-mager (accessed 21 August 2014).

[2]The *ondes Martenot* (1928) was also first made without a keyboard interface, and where Mager used a hand crank to vary pitch, Maurice Martenot used a ribbon with an attached ring for a finger. Later, a keyboard interface was added in addition to the ribbon. See Chadabe 1997: 11–12.

[3]The Hammond organ (1935) adopted the tone wheel idea from the Telharmonium (1897), and developed it further by rotating the tone wheels in front of electromagnetic pick-ups. Timbre control happened through a registration interface as in pipe organs, and by way of technology with rotating speakers from the Leslie company, the characteristic phasing effects were achieved. A keyboard provided pitch control.

[4]Two examples: the number of pieces written for example for the *ondes Martenot* has been estimated to between a thousand and two to three hundred. The number of pieces for Helmut Trautwein's instrument the *Trautonium* is very small.

Organised Sound **20**(1): 30–36 © Cambridge University Press, 2015. doi:10.1017/S1355771814000399

https://doi.org/10.1017/S1355771814000399 Published online by Cambridge University Press

the microphones for real-time transmissions. It was not until recording on lacquer discs, wire and tape was possible that musicians became free of the tyranny of real time. The new electronic instruments allowed for better control with the tone colours than traditional instruments, and this went hand in hand with the new demands for acoustic control posed by the radio. Mechanical acoustics were expanded by electro-acoustics, and all this technological development laid the foundation for a radical new type of music made from electronically generated and recorded sounds. It was radical in the sense that it consisted of new and unknown sounds that could not be found elsewhere in culture or nature, and/or because it insisted that musical content could be found in any sound, given that one listened for it. The music paired nicely with the creation of sound effects and atmospheres to be used in broadcasts.

2. ELITE CULTURE

The first electronic instruments largely found a niche within the existing musical paradigm, but they were also expanding the musical boundaries. However, it is reasonable to see electroacoustic music, in the most common understanding of the term, as emerging from recording technology, and the use of this technology for composition formed a qualitatively new music grounded in sonic qualities rather than pitch structures. Although there had been several precursors in experimental acoustic music, for example in the Futurist and Dada art movements, it was first and foremost the recording technology that allowed this new timbre-based music to find its different shapes, developing in leaps and bounds within the first three decades following World War Two. Composers could now retain, process and organise sounds in time, using recording facilities, microphones, mixers, tone generators and other electronic processing equipment that became part of the instrumentarium. However, this was expensive equipment at the time, and the genre completely depended on economical and physical resources well beyond composers' reach.

During this period, radio was a very important technology for connecting societies, and, as a radical and society-changing media technology, broadcasting carried huge responsibilities in the redevelopment of the European continent after the war. According to Norwegian historian Hans Fredrik Dahl (1999), radio was a technological invention, while broadcasting was a social invention. In the wake of radio development, electroacoustic music became an institutionalised genre, and the tools were available for only a few composers. Different schools of composition developed at the different national radio stations that hosted the music, and dialects appeared. The dialects, however, were not really that different in that they allowed for rich cross-fertilisation and genre blending. Sharp divisions between concrete and electronic music, absolute and programme music, and so on, quickly became blurred. One can also say that the highly prescriptive approach of the early electronic music, where a musical idea would be mapped out in great detail and realised through a laborious studio process, was tempered by the concrete music approach of unveiling imagined connections in abundant acoustic material through rigorous editing and processing. It was the affordances of media technology itself that changed compositional methodology – with a more rapid interaction between idea and sounding result, more complex works had become possible.

In the musical climate after World War Two, many composers felt a need to break away from the established notated musical paradigm, to search for a new musical mode of expression that was not yet corrupted, in the sense that it would be difficult to usurp for instrumental, political uses of the type that had been seen during the war. This avant-garde project took on many forms, and musical modernism grew. As an interesting aside, the notion that even this genre was politically neutral is incorrect. Saunders (1999) describes how for example the Darmstadt summer courses to a large part were funded by US intelligence services, and were exploited for political purposes in the cultural clash between East and West. In Eastern Europe, the idea of the supreme, individualist artist was generally not supported, and the arts were seen as having a role more directly applicable to the building of society. We find the same in the visual arts, and the international arts congresses during the postwar period were arenas for serious clashes of political nature between East and West, both of which mobilised the arts as active resources.) Musical modernism strongly believed in development, and in the notion that an avant-garde was needed to lead the way into new artistic territory. The avant-garde had the task laid out, and with increased public funding it became a hotbed for musical exploration and research. Building and maintaining an audience for the music was difficult, however As Milton Babbitt's article from 1958 attests, practitioners viewed the music as research, not fit for public consumption. The point is defended mostly from the perspective of art having a value that can only be understood from within the arts themselves – their internal logic, so to speak.

Electroacoustic music also became to be considered part of the avant-garde elite, aligned with the ideas of music as a type of research. In particular, this became evident when computers came into musical use, with heavy dependence on research describing acoustic and artistic principles in algorithms, hardware and software development, signal acquisition and processing, as well as composed works. The music became highly rational, grounded in algorithmic control of complex processes. The differences between electronic and

https://doi.org/10.1017/S1355771814000399 Published online by Cambridge University Press

concrete music were slowly being erased in the digital domain, and especially from late 1980s onwards. Rapid advances in computation power and signal processing tools largely replaced the focus on synthesis that had dominated computer music when disk space was small and computation slow. This digital development also had other effects on composition; moving data and algorithms from other domains into the music was easy, and this led to a 'scientification' of the genre, where the music could easily draw quite directly on algorithmic representations of phenomena in nature. This lent a quasi-scientific aura to the music, easily evidenced in composers' programme notes from the time. Sonification is clearly a more scientific example of this trend. The discussed links between the sciences and the music strengthened the impression of electroacoustic and computer music as being an elitist genre.

With few exceptions, traditional electroacoustic music and computer music never became popular genres in broader segments of society, although electronic sounds and media clearly were pushed into mainstream culture from the late 1970s onwards. It seems that the lack of breakthrough for traditional electroacoustic music was not due to the timbral character of abstracted sounds, but rather to the expressed musical self-understanding of being an avant-garde discipline, and performance practices where few performers could be watched and experienced during concerts. Although performers often were included in concerts, concert programmes were dominated well into the 2000s by pieces played from fixed media. We shall see that with the technical development from late 1990s onwards, musical performers have again pushed quite clearly into the foreground, with innovative practices taking the place of technological focus.

3. CHANGES IN ATTITUDES AND THE MUSIC THAT SUPPORTS THEM

Electroacoustic music has been understood as belonging to a serious art domain, and has largely positioned itself as an avant-garde discipline. The focus on technical innovation has been dominant in computer music, and new methods and tools have been introduced frequently. The timbral innovation has been huge, and a large number of spectacular pieces have drawn on this innovation. This constant assignment of value to technical innovation, in combination with the exclusivity of expensive technical tools only available through institutional affiliation, strengthened the perception of the music as unusual and difficult. Despite its promotion in prestigious contexts such as world fairs,[5] it has with few exceptions generally not attracted large enough audiences to become a prominent part of the everyday music scene in any country. One can speculate about the reasons, and in addition to the performance practices and the genre's self-understanding mentioned above, one can hypothesise that the level of abstraction in the music places too significant demands on audiences for appreciation, given humanity's common preferences for intervals in music. The unfortunate fact is that this music never enjoyed public support on a scale even close to that of traditional art music – a scale that is necessary for building a commonly accepted canon. In light of more recent developments from the 1990s, one might also hypothesise that the historical lack of lower-level access to the music technology and the resulting narrower base of support in the general population also factors among the reasons. However, in most Western countries, the music has a footing in academia, and is thus stably supported as a genre with a limited footprint in broader society.

The synthesiser became a popular technology among musicians in the 1970s, and invited broad participation with the easy access of the common keyboard interface. The instruments found their way into conventional and not-so-conventional rock music, as well as art music, where it most often appeared in combination with traditional instruments. Good examples of the use of digital synthesisers in art music can be found for example in the catalogue of mixed music that was developed at Ircam by Tristan Murail.[6] The genre of pure electroacoustic music was not really developed by the use of synthesisers; it was when computer synthesis with more flexibility and fewer hard mappings became possible that electroacoustic music developed the more detailed and comprehensive control strategies that characterised this type of machine music. And it was with the introduction of cheap computers and sequencing technology that pitch manipulation merged with digital signal processing, and electroacoustic composition started to become the new folk music, in many formats and genres. The number of people who accessed these tools grew radically in the 1990s, hand in hand with the enormous growth of content on the worldwide web. Software became easily available, file sharing became possible,

[5]At the world expo in 1958, Le Corbusier's assistant Iannis Xenakis built a pavilion for Philips that Edgar Varèse filled with sound and music, and where also Xenakis's *Concrete PH* was heard for the first time. In 1970, Norwegian composer Arne Nordheim presented the *(Footnote continued)* piece *Poly Poly* in the Scandinavian pavilion in Osaka, while Karlheinz Stockhausen was responsible for the music in the neighbouring German pavilion. The Pepsi pavilion at the same expo contained the probably largest multimedia performance ever shown, a type of expression shared by Iannis Xenakis's work for the French pavilion. Nordheim's *Poly Poly* consisted of six tape loops that would meet only after more than a hundred years of playing time. Roughly the same type of looping technique was used by Tor Halmrast in his commission for the Norwegian pavilion for the Sevilla Expo in 1992.

[6]Tristan Murail's website features a complete list of works, where *Allegories* and *Winter Fragments* can serve as good examples of his mixed music from the period at Ircam. www.tristanmurail.com/en/oeuvres.html (accessed 26 May 2014).

https://doi.org/10.1017/S1355771814000399 Published online by Cambridge University Press

and community-building bridging virtual and physical domains became a reality. An abundance of digital tools and media productions trained audiences in appreciating digital sounds and aesthetics. Larger-than-life, near-field and out-of-this-world aesthetics have since commonplace, and with this widespread use and strong media exposure, electroacoustic aesthetics have finally been accepted among the general public. The possibilities opened up by digital technology have become the norm; we are in a post-revolutionary situation.

4. DEVELOPMENT OF PARTICIPATORY PRACTICES

Increased participation outside of conventional production centres came with a development in aesthetics, and new genres appeared – electronic dance music, ambient music and all more indistinguishable genres that for reasons of brevity can be labelled electronica. Sound art and soundscape works went through a revival, fuelled by the availability of new tools. Timbrally, not much of this music was new; the techniques had already been used in experimental music, and precursors were many. Still, this was a new development, but more in terms of social aspects than technical aspects. Electronic tools were used to create dance music with faster beats and more intensity than musicians could provide with mechanical instruments, and with sample manipulation that would have been impossible with analogue methods. The machine imprint was overtly clear also with regard to the time-precision. But, more importantly, the music was the key element in dance parties the likes of which the world had never seen before, and the ambient genre (which was invented by Eric Satie and redeveloped by Brian Eno, among others) took on a new function, as a music to foster relaxation.

Experimental electronic art in chamber format brought yet new audiences in contact with electronic tools and methods, and the term sound art came into use by visual artists and musicians both. Naturally, sound is not a new resource for visual and multi-disciplinary art, but digital tools have made it easy to combine the abstract listening modes from music with the source recognition that cross-media approaches often depend on. Sound art as both practice and term is much older than digital technology, but the new and expanded practices signify a social change. The do-it-yourself practices (DIY) that have developed outside formalised education represent a step away from established views of competence. When new genres such as noise music developed, they contrasted with computer music in several ways – technically, aesthetically, performatively and socially. To say that these expressions were protests against computer music is tempting, but the new genres were probably rather a better fit for the different intentions and needs of social groups and performers. So while new practices emerged, the technical tools were the same. The use of electronic noise, for example, has been an integral part of electroacoustic music since the first experiments. Noise music was nonetheless a novelty, because it was loud and insistent, because it rejected any conventional compositional development, and because it attracted new musicians without formal background as well as a new, urban audience. Another significant and widespread form of music that we can think of is soundscape works, where the ecological focus and moralistic aspects are often retained from the 1970s tradition, but with the addition of laptop-based live performance-situations. The recording, composition and performance of these works are highly technology dependent, and credible surround recordings and representations are unthinkable without affordable and advanced music technology. Such works have also found their way into museum exhibitions.[7]

New groups of practitioners with electronic tools have often replaced the non-real-time composition with live performance. These expressions have developed without institutional support, and continue to do so, although institutional embraces abound. Educational institutions, which often struggle to stay relevant for new student groups, are frequently developing curricula to absorb the new digital aesthetics, but although this is evidence of a necessary and positive attitude, it is no longer the educational institutions and national resource centres that define genres, quality and value. Hierarchical control of access and musical form has lost its relevance. However, while it is easy to see how broad participation, the development of new genres and social contextualisation bring a new dynamic into the music, it is equally easy to see how few new masterpieces are introduced – important works that advance self-reflection within new media and show groundbreaking use of principles or technology. Paradoxically, now that the focus on technical development no longer dominates the field, the aesthetic advances are small. Real-time performances that favour musicianship most often result in episodic form, where the musician can concentrate only on a few audio streams at a time, and the result is often musical smalltalk. But we have gained wide participation, wide distribution and a great many villages that communicate within themselves but not much outside of them. And it seems more fun to participate than to just listen.

DIY aesthetics also include various forms of hardware hacking, including development of control

[7]A recent example is MOMA's exhibition *Soundings – a contemporary score* (10 August to 3 – November 2013) featuring among other works Jana Winderen's recordings of bats' flight vocalisations, deepwater fish and insects – *Ultrafield*. For Holland Cotter's review in the *New York Times*, see: www.nytimes.com/2013/08/09/arts/design/soundings-features-art-with-audio-elements.html?emc=eta1&_r=0 (accessed 26 May 2014).

https://doi.org/10.1017/S1355771814000399 Published online by Cambridge University Press

interfaces. This is another lo-fi approach that has its historical parallels in, for example *Arte Povera*, with many of the same self-imposed limitations that follow from usurping existing technologies instead of constructing them deliberately. An academic offshoot in this direction can be said to be the conference New Interfaces for Musical Expression (NIME), which aims to advance the field of musical control, connecting organology with electronics. In that field, there has been a significant amount of criticism of acousmatic and linear fixed media aesthetics as well as conventional loudspeaker concerts. Bringing live performance back in a purely electronic manner is a well-known approach when reinventing electro-acoustic music. There are laptop and cellphone orchestras, which to a degree allow traditional musicianship to connect with electronic sound sources and processing, as well as conventional acoustic instruments that are extended by sensors. The interface type no longer poses the same challenge as it did before; the focus has moved on to the more musical aspects of control. Live coding is another example of a new artistic crossroad where programming meets performance, and the growing interest in sound installations can be understood as yet another type of reinvention. Installation art, sound art, and soundscape art and music are all new genres that draw freely on electroacoustic techniques and materials, and their focus is on the artistic practice rather than the technical affordances. Technological invention no longer warrants the same type of interest as it did twenty years ago; users have become accustomed to a situation where technical issues can be easily resolved, the technical boundaries for artistic exploration are fewer than ever before.

5. COMPETENCE IS TECHNOLOGY

Technology may be understood not only as objects and processes, but also as sets of competences. This description of technology is often found in technology studies literature, as for example in Bijker, Hughes and Pinch (1987). Through analysis of a variety of examples, it has been shown that technological systems are shaped by their social contexts, at the same time that they contribute to changing these same contexts. One can say that knowing how to use a technology is indistinguishable from the technology itself. A thoroughly discussed example is that of the bicycle, found in Bijker (1997). The key argument is that the invention of this two-wheel mobility was tempered and developed in society; namely, that the direction of the development was shaped by the opportunities that were opened up for new, emerging user groups, especially women and lower-income groups. This brought a degree of social change.

When technology is embedded as shared understandings and know-how, it also includes more or less clearly defined goals and problem-solving strategies (Bijker, Hughes and Pinch 1987), and these are shared between consumers and professionals. In many ways, this linking of practices and ideas is the essence of a paradigm. This perspective on technology is comprehensive and inclusive, and opens up for discussion what is often labelled 'digital competence'. The term points out that digital information technology distinguishes itself from other types of technology, and confirms the understanding of this as a paradigm shift. Digital technologies have brought new strategies for thinking about problems and solutions that are not much older than twenty years. Digital tools have become commonplace, and permeate most sectors in society on many levels: work, learning, leisure and social participation in general. Digital competences are considered to be essential for full participation in modern society: the digital revolution is over; we are in a post-revolutionary phase. In this sense, it is fair to say that digital technology is (or was) radical; it has brought about lasting changes.

Music technology is a natural component of this revolution, digital is not only sets of hardware or methods for composing and listening to (consuming) music; it has changed the role of music in modern life from a relatively context-dependent, social activity to an individualised and personalised production of experience. With the inclusion and distribution of digital sound and digital-sound technologies in mainstream fabric of music production and distribution, digital practices are today a normal part of everyone's lives in the Western world – close to everything we hear is mediated through the digital mill, and most users are comfortable with new digital tools. This pre-adaption, as the researcher and artist Insook Choi calls it, finds its forms through interactive media such as games, apps, smartphones and tablets, and through variations of telepresence and self-publishing on Web 2.0 and 3.0.[8] The everyday expectations of digital media are high, and most often formulated without understanding of and regard for the engineering underlay of the products that swarm the consumer market. Many aspects of digital technology are no longer expressed as novelties; they are understood, they are internalised, they are part of a shared competence.

6. THE NEW FOLK MUSIC, A CYBORGIAN CONSTRUCTION

A precise definition of folk music does not exist; however, the term is used to describe traditional music

[8]The terms Web 1.0, 2.0 and 3.0 are commonly understood as follows. Web 1.0: conventional publishing through edited websites, diffusion of research and media expressions. Web 2.0: self-publishing through for example blogging, and websites such as *YouTube* and *MySpace*. Web 3.0: social media with push and pull methods, messaging and merging of web content and smartphones; websites such as *Facebook* and *Twitter*.

https://doi.org/10.1017/S1355771814000399 Published online by Cambridge University Press

without composers, or music where the composers are unknown. It is also used to describe music old enough for the origin to be uncertain, and finally music that has survived without notation – transferred by ear, and performed according to established tradition. All of these elements draw on shared competences, and these shared competences have bound the music to local contexts and social or geographical group signifiers. There has been waves of folk-music revival, which has resulted in re-interpretation and the mixing of folk music with other music, such as in 1970s jazz and, before that, the romantic, orchestral tradition with its 'cultivation' and carefully crafted idea of musical, national identities. Folk music was thought of as having long roots. Current globalisation, however, blurs the borders between folk music and world music, and interestingly assumes a lot of shared competences when musicians from different parts of the world join for performances, although the cultures might be vastly different. The link of authenticity to local context and nationality has been broken.

A similar global alignment is found in music technology, where the same tools and methods are employed throughout the world. Unsurprisingly, with the level of absorption of digital electronics into everyday life, there is a general, shared competence and practice within the genres of electronic music, mediated by the Internet through both normal dissemination and community-building via social media and other platforms. In combination with cheap and available digital tools, electronic music can thus be said to have become the new, international folk music, equally well understood and accepted everywhere in the first world and much of the second. This folk music can be found in constructed environments, as the term 'Internet village' from the 1990s suggests, but also in more general mediation channels with content shared through social technologies. Recorded performances and documentations, technical and theoretical deliberations, ideas, exchanges and works under way form the digital backbone of this new folk music. This shared information and competence is at the core of the new digital music that has emerged outside of the traditional electroacoustic community.

When electronic sounds, music and tools have permeated modern informal musical culture to the degree that it can be understood as a new folk music, the situation also exposes a deep change where the ideas of electronic music as an avant-garde development have lost their defining power. Although it would be unfair to propose that the new folk music expresses a standstill, it arguably lacks some of the musical radicalism that characterised the earlier developments of concrete, electronic and computer music. But can the musical and social absorption of digital sound technology nonetheless be said to form a radical leap? Arguably yes, and the radical leap consists of how technology has changed composers, musicians and audiences, blurring traditional distinguishing lines. Further, with the level of technology absorption in every level of interaction with music that we experience, our competences and expectations have developed accordingly. Music technology and its sounding results have changed us.

Technological development has reached a level where innovations in themselves rarely become the focus of musical development for either performers or listeners, and this is different from earlier electronic music, where technical innovation was at the core. An easily available indicator here is programme notes, which are much less technically oriented now than only twenty years ago. The technological basis is taken for granted; it has become internalised and has in this way become part of the artistic infrastructure. This type of internalisation is of a cyborgian character – remembering that competence also constitutes a technology. When technology and technological competence become integrated in this way, they have in a deep sense changed how we think about and live with music – much the same tendency that can be found in adaptive technologies for health purposes, where digital control of essential body functions rapidly becomes possible, and where augmented and technology-enhanced experiences increase life quality. We can think of intelligent, adaptive and rechargeable implants for hearing and monitoring of human biochemistry for medical purposes, Google glasses and so on. Within the arts, currently it seems to be the artistic practice with technology that forms the locus; the interest is in performative aspects and innovative use. It is reasonable to expect body hacking to become useful also in the development of music technology and related fields.

Adaptive, wearable media technologies are an emerging field, and one can consider intelligent, adaptive hearing aids as an obvious precursor. The combination of digital tools and music thus allows for construction of complex control of musical environments on an individual basis, as technologists are learning how to let users manoeuvre an increasing number of elements in their everyday sound world. In this sense, it is fair to say that the new folk music is part of an increasingly cyborgian development that grows with the general increase in technology use. And the key aspect of this development is arguably social – if the technology does not meet with social acceptance and come into everyday use, the consequences will be negligible.

7. CLOSING REMARKS

The conclusion of this type of article will necessarily be open, since it describes a process of ongoing development. Digital technology has become the new folk

https://doi.org/10.1017/S1355771814000399 Published online by Cambridge University Press

instrument, and technology-based music currently emerges in much the same way as traditional folk music, although without the local anchoring to site and population group that traditional folk music depends on. The new folk music is global, with dialects that are quite similar across continents and national borders. An important aesthetic issue is that the artistic value of this technology-based music is not determined by experts, different from the historical genres of electronic and electroacoustic music that have been encapsulated as stages in an ongoing development that have landed us where we are today. Of course this does not mean that these genres have disappeared, but the practices emerging today commonly find interaction and performative aspects more interesting than the composition of fixed works and fixed media presentations.

Genre demarcations have become less important than earlier, and technology-based music has to a large degree returned to its original rebellion against the musical establishment. The avant-garde led the way in search of a new musical territory; however, this new musical territory has become quite different from first imagined, although electroacoustic aesthetics have became commonly accepted. During this process, the distinguishing lines between composer, audience, composition, performance and mediation have been blurred, with cyborgian, internalised aspects of technology as the most important characteristic of this new musical reality. The future that actually happened is clearly different from what the pioneers were planning for.

REFERENCES

Babbitt, M. 1958. Who Cares if You Listen. *High Fidelity* 8 (February). Reprinted under the title 'The Composer as Specialist' in Stephen Peles (ed.), *The Collected Essays of Milton Babbitt*. Princeton, NJ: Princeton University Press, 2003.

Bijker, W. 1997. *Of Bicycles, Bakelites and Bulbs*. Boston, MA: MIT Press.

Bijker, W., Hughes, T. and Pinch, T. 1987. *The Social Construction of Technological Systems*. Boston, MA: MIT Press.

Broman, P. O. 2007. *Kort historic over Framtidens Musik*. Stockholm: Gidlund.

Chadabe, J. 1997. *Electric Sound: The Past and Promise of Electronic Music*. Saddle River, NJ: Prentice Hall.

Dahl, H. F. 1999. *Hallo-hallo! Kringkastingen i Norge 1920-1940*. Oslo: Cappelen.

Saunders, F. C. 1999. *Who Paid the Piper?*. London: Granta.

Wiggen, K. 1971. *De två musikkulturerna*. Stockholm: Sveriges Radios Förlag.

https://doi.org/10.1017/S1355771814000399 Published online by Cambridge University Press