

DIGITAL DYNAMICS IN NORDIC CONTEMPORARY ART

Edited by Tanya Toft Ag



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Representation, Complexity and Control: Three Aspects of Technology-Based Sonic Art

Jøran Rudi

Today, digital technology permeates nearly all creation of sound for any media. This pervasiveness is the same for other types of content and for society in general. There is hardly any societal problem or challenge where digital technology is not seen as part of the solution – even in cases that on the outset do not seem to be candidates for this type of approach. For example, when refugees from Syria rolled in across the Norwegian borders from Sweden and Russia in 2015, one of the responses was a suggestion for making cell phone apps that would help refugees find the assistance they needed, and to help them find employment and other activities that would further support their integration. On the surface, apps and wireless access seemed an unusual means of helping people who had escaped war and tremendous suffering, but many of those who came were quite vocal about the lack of adequate Wi-Fi access in the temporary shelters where they were housed.

This anecdote has little to do with music but when people – those who have been forced to leave their previous life behind and run – put Wi-Fi access high up on their list of priorities, it says something about how important digital tools have become across the globe. Perhaps the refugees only needed to hear from their loved ones and talk to them, but in light of the importance they put on their portable devices, the idea of the app actually seemed pretty good. It may become a significant form of help, of course in addition to food, shelter, clothing and other bare essentials. The suggestion for an app was, in many ways, a timely response.

Digital media is important in mobilizing community efforts to help in the situation. In Oslo, for example, a Facebook-group started by a couple of artists quickly mobilized a large number of people to contribute their time to distribute emergency aid – in the form of food and clothes – to refugees who were poorly prepared for the winter conditions they met in Oslo in December 2015.

Against this backdrop, it is not difficult to accept the premise set out by the editor of this book that digital technology has profoundly affected tools, creation, distribution, experience and discourse in the arts. Since the art sector comprises a large and constantly developing set of efforts and functions, there are several types of dynamics at play. From the artist testimonials that were gathered in order to form a basis for the essays in this book, a number of topics have emerged as contributions to changing the creation, dissemination, participation and appreciation of artworks. It is also interesting to see a few artists expressing that digital technology has become such an integral part of their life and work that they do not find it necessary to reflect more on its role, and is perceived as ‘just another set of tools’ with no particular effect on artistic ideas and their execution. Whether this rejection of the imprint of digital technology means that these artists in fact have become cyborgian to

the degree that they just can't see the integration with technology in their practices, or that their creative ideas are unaffected, would be an interesting thread to follow, but it falls a little outside of the scope of this chapter, where the theme is the digital dynamics that have influenced representation and identity in the audio arts.

In this chapter, *audio arts* is not considered to be part of either music nor visual and conceptual arts. Audio art is instead thought of as a 'super-category' that encompasses the above. This categorization makes it easier to focus on the continuum of how sound is used in, for example, experimental music and sound installation art, rather than the differences between art genres (Rudi 2008).

The broad topics that have been identified in the artist statements are:

- Fascination and preoccupation with the new tools and affordances of digital technology
- Exploration of particular qualities of digital media and the use of these qualities as artistic material
- Questioning and exploring how the digital paradigm has changed the conditions for everyday existence
- New artistic practices and new types of works (participatory, remote, abstracted)
- The requirement of new competences for visitors and audiences

In addition to these general topics, some of the statements provided by the artists also reflect on globalization, pointing to the future that emerges more rapidly now than before digital technology became omnipresent. While emphasizing their international presence and profile, a few of the artists are also grappling with the notion of 'nordicness', referring vaguely to the importance of context, and the traditional preoccupation with nature. Some also add social perspectives and point to the egalitarian ideas that characterize the Nordic democracies to a higher degree than typically found in more strongly class-divided and hierarchical societies. Thus, two additional topics can be identified in the statements, which will make a meaningful expansion of the bullet list:

- Digitally influenced and digitally determined changes in behaviour
- Consequences of new distribution technology for Nordic identities and globalization in art

The range of possible discussions that follow from this collected bullet list is clearly too wide for one chapter and a choice of a more specific topic must be made. The digital paradigm permeates all sectors of society, and since the seven listed bullet points are interconnected, it is from this web of connections that I draw the topic for this chapter. We will discuss how digital technologies allow any type of digital representation to become material for processing, and how this type of conception and representation influences our sense and understanding of sound identity as well as identity on a wider scale. The focus will be on the audio arts but the perspective will span along a wider sector in order to provide the relevant

context. As we all know, sound does not exist in a vacuum, neither as a physical process nor as a social event (really, it doesn't!).¹

Many of the artist statements mention problematic aspects of the digital presence, and one emerging concern is the flexibility of identity, a flexibility facilitated and encouraged by digital presentation, self-presentation and interaction. Another concern stems from the types of surveillance that result from the constant visibility and the increasing need for confirmation that often follow in the wake of social media. Media use is increasing dramatically; we are, for example, on average, checking our cell phone more than 110 times a day (Woollaston 2013), and in this way we are adding significantly to the growing influence of media content at the same pace with which we reduce our private time for reflection and quietness. Users consciously or unconsciously conform to the norms that fill social media with likes, never dislikes, and smiling displays of success rather than the uncertainty and worry that follows struggle and difficulty. In comparison, the conformism in Woody Allen's film *Zelig* from 1983 seems like an innocent child's play.² The Zelig character ingratiates himself in widely different contexts, by radically changing his appearance and behaviour, and seems to completely lack any identity and personality other than those that he adopts. One can arguably say that media influence and praxis with digital media and software tools encourage certain types of self-representation, thus leading to a self-imposed suppression of individual variance in the identities presented in these media. We shape our digital avatars and they shape us.

Distance

Notions of identity and representation are intertwined, and although it might not seem necessary to include much philosophy in this chapter, Martin Heidegger's essay 'The Question Concerning Technology' from 1953 comes to mind. Heidegger was a student of Edmund Husserl and brought with him much of his teacher's thoughts on phenomenology in his understanding of technology's role in how our perception and understanding of the world around us changes, arguing that the character of things emerges when things show themselves in their own way. (This, however, did not bring Heidegger into the essentialist fold. Heidegger believed that identity was processual more than fixed, but a more thorough discussion of this will lead us too far off track in this chapter). What makes Heidegger's essay interesting is that he, on one hand, criticizes technology for creating distance, while on the other hand seems to encourage use of technology in order to not become subservient to it. I have found this dichotomistic relationship to technology in several of the artist statements, which form the basis for this book.

There are many things to criticize in Heidegger's thinking – his politics; his ahistorical view on technology, where older production modes are considered in keeping with natural order (thus not distorting perception) while only new ones pose challenges; his contention of truth, which is rather authoritarian; his reduction of technology to methods and things

(ignoring social aspects and competences), and more. Heidegger's views on technology does not necessarily allow for understanding new realizations of this natural order, however, the key point in his text that makes it relevant for our discussion about identity and representation is that something happens to our perception of identity when looking through a technological lens. In digital sound, for example, all sounds become material, rather than having identities of their own. In principle, they are reduced to pure physics – pressure waves that can be measured numerically.

As Mark Blitz summarizes in *The New Atlantis*, 'Heidegger draws attention to technology's place in bringing about our decline by constricting our experience of things as they are' (Blitz 2014). How Heidegger imagines it possible to avoid any cultural filter in order to let things appear unfiltered is not clear, but he fields an important point when arguing that we now view nature, perhaps also including human beings, only technologically – that is, we see nature only as raw material for technical operations. One might, as philosopher Bernard Stiegler, propose that a technological gaze is something inherent for our species, expanding the notion of technology to include a wider set of competences and not only the tools themselves. For example: The idea of a hammer precedes the actual construction, but a hammer is not a technology until someone knows how to use it, and it gains meaning by serving a function. The impetus for development is (probably) unwillingly problematized in the humorous saying that if a hammer is your only tool, all problems will look like nails. Thus, the concept of technology is placed squarely in the social domain – as not only a thing, but also understanding and know-how. Also, to Heidegger the technological lens is restricting, because we will only see the affordances – what is possible with the technology, what the technology 'wants to have happen', in a sense. In our case of sonic art, the technology becomes a means to an end and also directs the human activity, leading the users to perceive only the sonic aspects that technology allows us to grasp, not the sounds as they are. Phrased differently, the nearness of connotations and references that we experience in sounds disappear when the sounds are reduced to spectromorphological changes that tap them of origin, intent and significance. This was the essential intention in *musique concrète* when it was invented in the years following the Second World War. Engineer Pierre Schaeffer and fellow composers at Groupe Recherches Musicales at the French radio were developing a new musical language in reaction to the pompous orchestration in interval-based music such as Richard Wagner's and the serial music of the Second Viennese School. This was the period when purely synthesized electronic music was becoming a distinct genre, with Karlheinz Stockhausen as the most prominent composer. Of course, these musical inventions were analogue, not digital, but the compositional ideas from that time remain in much electroacoustic music of today, with abstracted sounds and musical forms that do not conform to the relatively stable paradigms of music for acoustic instruments.

Interestingly, this removal of references and recognition for artistic purposes is somewhat parallel to the issues that western music has run into when quoting and incorporating music from the developing world. These appropriations most often overlook the cultural framing and aspects of the original music, and the result is often perceived as ignorance, or slighting,

of the cultures from where the music has been taken. This type of musical migration is often understood as a form of exploitation, and artists from the developing world who provide this music are not often enough credited or paid for their work – it is only material. A prime example is Brian Eno's and David Byrne's *My Life in the Bush of Ghosts* from 1981, where the work of the North African musicians, radio hosts and others that was integrated at first was not even credited properly, not to mention paid. The artistic licence to quote the work of others is a slippery slope, and in the western music industry often contested as copyright infringement. The most extreme case of this is John Oswald's *Plunderphonics* from 1985 that consists entirely of short music snippets from hundreds of records. The record industry protested Oswald's appropriations, possibly also because Oswald had a political agenda that promoted cultural plunder as a basic artistic right.

For our focus here on the digital footprint in sonic arts, it is interesting to point out that when technological means are used to tease out hidden or less prominent features of sounds in order to exploit them musically, the sound processing itself implies some degree of reductionism. And, referring once more to Heidegger, this type of process is self-sustaining – mastery of the technology reinforces the technological filter. Heidegger's text was published in 1953, and its concerns about the distance that follows from technology use can still be traced in most modern musicology. In discourse of technology-based music, Leigh Landy's article 'The something to hold on to factor in timbral composition' raised related concerns already in 1994 (Landy 1994). In this text, Landy is grappling with the issues of how untrained listeners largely fail to appreciate (complex) electroacoustic music, and how composers might help them develop more fruitful listening strategies. He finds that the use of technical language when describing methods and technologies in the compositions are creating more distance than nearness, thus echoing Heidegger's main argument for the need to experience things as they are, unfiltered.

The difficulties for broad appreciation of technology-based art that Landy points to have roots that reach back to the beginnings of both electric sound and electrically generated images. For example, when A. Michael Noll and Bela Julesz, at the invitation of Howard Wise Gallery in New York, exhibited some of the graphical work they made in American Telephone and Telegraph's Bell Labs in 1965, they did not exactly meet with a warm reception. The harsh criticism that the exhibition received might in part have been motivated by the fact that computer renderings had sprung from military technologies for calculating ballistics (Taylor 2012: 20),³ however, the main drift of the criticism was that the works 'did not display any fantasy' and that 'they were cold and soulless'. The images had been generated from the calculations embedded in the execution of an algorithm and not drawn by hand. It should also be mentioned that one of the artists, Bela Julesz, was uneasy in calling the works art, while Michael Noll was fine with it. The artists ended up finding common ground when naming their exhibition of generative art Computer-Generated Pictures.

In sound, the situation was similar, although experimentation with unconventional forms and materials were well underway already before the Second World War with the

futurists and the Dada movement. In electronic music, Pierre Schaeffer's studies were not well received at first, and the pioneering work of Louis and Bebe Barron in scoring for the film *Forbidden Planet* in 1956 also met with questions of categorization. What was the right name for the soundtrack – music or effects? The original screen credit for the film was supposed to read 'Electronic Music by Louis and Bebe Barron', but this was changed at the last moment at the insistence of the American Federation of Musicians. The new credit read 'Electronic Tonalities by Louis and Bebe Barron'. It was the word 'music' that the musicians needed to see omitted. The economic motive for the union is easy to see – protecting jobs for their members and barring others from infringing on their territory – but the mere switching of the word 'music' with 'tonalities' was sufficient for the musicians to feel that the competition had been eliminated, or at least reduced. The episode shows that the questioning of whether machine-made expressions could in fact be called art held sway also in the auditory arts.

The objections to the early experiments with electronically generated sounds and images seem to have sprung from scepticism towards using machines for generating art. And they seem to be a fairly good match with Heidegger's notion that the use of technology creates distance to the process and identity of the material. But the objections might also indicate that it was the abstracted material itself that made the works difficult to accept. In computer-generated arts, the execution logically springs from human-made rules as an abstract – there are no tangible elements to touch and no method available to experience the thought process as it is deposited into sets of algorithms, rather than into pigments or instrumental performance practices.

These types of critical reactions evidence that strict logic and algorithmic execution does not necessarily result in public acceptance. Interestingly, similar logic and rule-based approaches for estimating artistic quality have been tried. American mathematician George David Birkhoff, for example, published a theory on aesthetic quality in 1933, in a little book where he, in addition to discussing earlier theories on aesthetic quality, also provided a collection of examples where his theory was applied in evaluation of music, poetry, visual and three-dimensional art. His simple formula $M=O/C$, where quality (M) is expressed as the ratio between structure (O) and complexity (C), shows the importance he placed on structure and that the aesthetic quality would increase with the decrease of complexity. Simple and structured was the formula of success. Of course, Birkhoff shows quite a reductionist view on art and he completely ignores receiver competence and context, while concentrating solely on the work itself. It should however be noted that Birkhoff believed that the intuitive perception of art should be considered more important than his formulaic description, so clearly, he had his doubts on the validity of his method, just as Bela Julesz in 1965 questioned whether his computer renderings were artworks. By using mathematics as tool and method, both involuntarily cast light on some of the fundamental problems in using metrics for describing aesthetical experiences.

Nearness

Musical use of technology often entails processing; twisting and turning sounds to tease out content and ‘liberate’ this content from the context and the more referential qualities of the original sound. This process has been postulated as necessary for experiencing sound as it is, not as what it means in a referential sense. Clearly, this type of abstraction can easily be said to create distance to the sounding object by blurring its identity, however, bringing forth and casting new light on content that has been concealed by established semantics, or generating new sounds from scratch, brings something new and unheard into the world. From this perspective, technology brings closeness and perhaps it is time to remember how Heidegger recalled that the Greek word *techne* (from which ‘technology’ is derived) originally meant ‘bringing-forth of the true into the beautiful’ (Blitz 2014). With this view, it is clear that technology can also bring out essential identity markers, and perhaps Heidegger’s main goal with his discussions was to open up the discussion of technology in order to better understand and embrace it, rather than ‘hopelessly rebel against it’, as Mark Blitz cites Heidegger in his essay in *The New Atlantis* (Blitz 2014). Only by grasping the affordances and making deliberate use of them can we avoid being dominated by them.

This line of argument has a familiar ring in Nordic music contexts, since it was frequently found among Scandinavian pioneers in electroacoustic music from the 1960s to 1980s, such as Knut Wiggen in Sweden and Kåre Kolberg in Norway. Only by using technology in music could composers take part in the development of society and assume their part of the responsibility for its development. Their arguments work well with Heidegger’s contention and it is no surprise that this relationship to the current media technologies can also be found in our artist statements, for example, in those of Laura Beloff.

The intention of creating something new is essential in all arts, and several artists in our reference group aim to reveal the affordances and features of technology by using it. Kristina Kvalvik, Niels Bonde and Elisabeth Molin have written about this in their statements. Technological qualities can be revealed by using technologies to ‘make’ rather than ‘consume’ something and the responses in, for example, social media-driven interaction will reveal something essential. A perfect example that appeared in the Oslo Press in June 2016 was the art project *iSynx*, where the filmmakers in Volt Film, well known for their documentary film about drone warfare, presented a fictitious contact lens. This lens should significantly enhance the lives of their users and they were looking for beta testers. Their claim was ‘*iSynx* is a personal AI operating system that will revolutionize your life by enhancing your body and mind’. According to the project’s Facebook page they had 700,000 original visitors, of which 1500 had signed up as beta testers (*iSynx* 2016). The beta testers had signed a contract where they gave away all personal rights, along the lines of normal social media practices, for use of their input to create automatic recommendations for users, based on the typical use of big data. They also gave away personal, medical and financial info, including credit card numbers. The website would record the user’s voice and *iSynx* would have the right

to sell these recordings to third-party companies, without any restrictions. The invasion of privacy was total – in effect, all sensory impressions captured by the contact lens would become the property of a company to exploit as it saw fit, and despite these harsh terms 1500 people signed up (iSynx 2016).

iSynx was an art project designed to feed into a debate on artificial intelligence, questioning where the delimitations should be for developing such technologies; it was not a real product or business idea. But it is difficult to imagine how an art project of this type could have been launched and be successful without (at least on the surface) being immersed in the technologies it set out to question. The *iSynx* project provides an example of how immersion in a technology is used for making a successful project about the technology itself, thus providing the experience of nearness.

Smartphones are already pointing us in directions where we typically like to go, based on information from us and our friends, and unsurprisingly, the omnipresence of social media is a topic for several artists in our survey, such as Marie Munk and Joonas Siren. But how does this work in the audio field – does digital audio bring the same sense of nearness, immersion or participation? Although the artistic development has resulted in genre-mixing and many grey zones with mixed identities, there are several relatively clear lines of intersection in digital audio art: (acoustic) interval-based vs. technology-based music, electroacoustic music vs. more conceptual sound art, conventional acousmatic music vs. more critical genres such as noise, glitch and other live-based, rebellious and non-institutional forms, etc. These divisions might not all be interesting here, and the types of sounds, the level of processing and the use of conceptual, extra-sonic references vary widely. What is common is that recording technologies are crucial, as in the early electroacoustic music, especially the development of digital equipment. Recorders and microphones of very high quality are available for a low cost compared to the pre-digital situation, and in combination with the dramatically falling prices on computers and software, the economic and institutional barriers for playing around with sound have disappeared. Mats Jørgen Sivertsen from our survey is one of a number of artists who has emphasized the increased opportunities that follow from this, and Mia Mäkelä describes the new technological situation like this: ‘My whole art production can be fitted into a two square centimetre physical space (SD card)’ (Mia Mäkelä, artist testimonial in this volume: 45).

The availability has opened windows into working with sound, both as abstract material and in a more documentary sense, and the multiplicity of artistic approaches to working with sound is arguably the most important development in the sonic arts; competences have become widespread, and the sensitivities that listening relies on are much better distributed among the population than they were pre-digitally. Digital sound fills media everywhere, and soundtracks in films and games routinely include complex and deliberately constructed psychoacoustically effective soundscapes. This type of first-hand experience brings nearness, and in the instance of the arts (if they are any good) also reflection. The everyday sound environments are effective in their use of technology to make us feel presence,

nearness, immersion and overwhelming larger-than-life soundscapes, and with the recent re-emergence of Virtual Reality, we see a huge interest in 3D sound for headphones.

Representation

The principal difference between analogue and digital technology is in the representation. Analogue, physical representation of sound is continuous but digital representation consists of strings of 1s and 0s – and is the same for all types of content. The re-formatting of a continuous signal to discrete numbers is a re-interpretation that makes the content easily available for mathematical operations and is hugely powerful. Since all types of data can be represented digitally, data from, for example, an image can easily be rendered as sound and vice versa. Of course, these types of cross-use of data might not be particularly meaningful, but they are possible.

Arguably more meaningful than this cross-use is the use of sensor data from the environment, findings from the sciences, recorded data from visitor and audience movement and actions, etc. With the right formatting and relevant mapping to sound processes, any data can be used meaningfully, and this type of appropriation is often used for providing artworks with both structure and identity. One of the artists in the survey, Mogens Jacobsen, uses data in this manner and works with computer code in different languages for programming behaviours in different objects. A recent example from his portfolio is the installation work *Probabilistic Audio Dice Roll* from 2015, where a dice is thrown based on data from radioactive decay in uranium glass (Mogens Jacobsen Official Website 2015). The roll is a sonification of radioactive decay, much the same as the Geiger counter that emits a beep for each radioactive emission – a classic example of sonification. Jacobsen brings the process of radioactive discharge from one domain into another, and by making it audible by way of digital techniques he makes it available to our senses.

Sonification is defined as the representation of data by non-musical sonic means, and a humorous example from the Norwegian oil industry is the implementation of a cash-register sound in an analysis software – the sound would be triggered when a possible oil-carrying layer in the geological data from the seabed was found. Possible profits were represented in a tongue-in-cheek manner.

In music, works get a quasi-scientific character when explicit use of numbers from, for example, the natural sciences are used for structure. Clearly, listeners are enabled to experience relationships that would otherwise be unavailable for the senses, but whether this approach results in added artistic value is less certain. Regardless, this type of experiential focus brings new material into the arts, and although it is not always possible to hear what the composers would like to emphasize, the listener nonetheless experiences something that is out of the ordinary. This is an important aspect of digital representations in itself – that they actually make new material available for experience. This type of new content in musical discourse gave an air of ‘scientification’ to the music, and the language that was introduced

for describing these types of works revealed a more research- and technology-oriented approach. It happened in acoustic as well as in technology-based music, and exact analyses of spectra and other measurable impulses were used to give structure and orchestration to music for ensembles of various sizes. The most prominent example of this genre from the international scene is the French spectral school, and the same types of techniques were used by several composers in Scandinavia as well.

Another and simpler example is in the increasingly popular genre of soundscape recordings, where another artist in the collection of testimonials, Ewa Jacobsson, observes the importance of combinations of digital, social and biological processes. Technological advances in portable recording and sound reproduction technology have provided the basis for rapid growing popularity of this art form. Tape reels have been replaced by flash memory, simple microphones have been replaced with microphones sensitive enough to record ants walking, hydrophones are able to capture sound hundreds of meters below the ocean surface, and arrays of microphones and loudspeakers make it possible to render sound in three dimensions for high fidelity. However, by placing microphones or inserting plugins for processing in the studio production, deliberate choices are being made. What is recorded and produced is still a selection, and nature becomes what we make it.⁴ Processes and patterns are extracted and put before our senses by way of technology, either through simple editing or by the more technically involved capture of the necessary data that can be used for abstracting principles for further modelling, such as sonification. One early example of this approach is Rob Waring's *Sonomatrix* from 1995, where natural processes are being played out across a grid of 64 speakers (Rob Waring Official Website 2016).

World renowned Norwegian artist Jana Winderen records below the ocean surface, at great depths, and the recordings she brings to the surface reveal a world of sound that few of us would otherwise be able to hear, both because it is difficult to get down into the deep and because the internal noise in our bodies disturbs our ability to listen when we are immersed in water. This type of increased availability is also recognizable in the exoticism of soundscape recordings from endangered ecosystems or in the advanced recordings of microscopic sounds that are well below or above the human hearing threshold, amplitude – wise or spectrally. Digital recording and processing technology brings new content to our attention and this changes our perception of the environments and systems from where the sounds are taken, as well as our notion of what is music. Representation with digital means has made it easy to expand the arts with new material.

Complexity and Control

One of the most important aspects of digital technology is how easy it is to create and control complex dynamics; complexity in how data can be interpreted, information extracted and flexibility in its representation. Analysis of sound, for example, is based on measurements of air pressure – 44,100 measurements/second for CD quality. Each of the measurements gives

a number, and by looking at these numbers in different ways, one can find frequencies, rhythms, amplitudes, instrument and sound types, musical qualities and genres, and so on. Mathematical operations are the key in both analysis and processing, and sounds can become twisted and turned in innumerable ways. Sound and acoustics are already complex phenomena and digital tools increase the possibilities for control and development of increased complexity. The sheer number of possibilities seems endless, and the easy use of modern software or apps stimulates meandering exploration without requiring much preparation from the user. The abundance of tools makes it possible to produce musical results without having any idea of which choices have been made in the software, and the result is a steady focus on novelty. Norwegian computer music pioneer Knut Wiggen warned against some consequences of this situation as early as 1970, when he wrote about how the critical potential in the new music could be undermined (author's translation): 'There are several composers today who want new processing equipment – new tools – in order to become the first one with a new type of sound. It makes little difference whether this sound has any basis in their musical imagination. The electronic sound becomes a gimmick. The sounds become a result of how the equipment works and not how we would like it to be' (Wiggen 1970: 61).

In this statement, Wiggen points to the need for understanding the technology in order to realize the artistic ideas. It is not sufficient to just use technology, the artist also needs to understand (at least something of) what is happening in the process. This was a necessary prerequisite in the early computer music but less important in the synthesizer tradition that rapidly gained momentum in the 1970s. These concerns are no less valid today. During the 1980s and into the 2000s, software became increasingly complex and users needed a good understanding in order to make informed choices. A new type of composer or sound artist emerged, an artist that mixed the roles of producer, engineer, technologist, musician and composer. A prime example of this type of composer from the ranks of the early pioneers is Jean-Claude Risset, who was in charge of computer music when the French centre IRCAM opened its doors in 1977. Risset had been active as a researcher, composer and musician since the early 1960s and contributed significantly to the understanding of how musical spectra develop. His work *Sud* (1984–85) fully exploits this acoustic research (Risset 1965).⁵

It was arguably in music that use of data from science and other disciplines first took hold. In Norway, British composer Natasha Barrett made a hallmark for herself already in the 1990s when using data from natural processes to control the generation, processing and playback of sound in installation works such as *Mimetic Dynamics* (1999) and *Displaced: Replaced* (2001). In the years that have followed since, installations and music from her studio show that she has maintained this interest on complex control of sonic events through digital means. And it is not only the works themselves that show this focus on control of complex data; the program notes and other textual descriptions of the works are technically oriented.

Another example of complex sound control has been found in Swedish Åsa Stjerna's installation *Currents* from 2011, where she inputs data from a scientific research project

on North-Atlantic ocean currents into a dynamically changing work that was installed at the Norwegian Opera and Ballet in Oslo. In part, the data from the ocean controlled the development of the installation, according to the website of NOTAM (who produced the event), and was piped to Oslo by way of a scientific computing centre in Stockholm.

Key terms in working with complexity and control are co-variation, dependency and coupling of disparate elements. Inserting data and controlling complex systems is essential in many of the digital arts, and there is little doubt that the new tools have changed the artistic approach for many artists. Artists Bjørn Erik Haugen and Tor Jørgen van Eijk discuss in their statements how digital tools have changed both their way of working as well as the content of their work.

Concepts

Perhaps the most interesting artistic results from the adoption of digital technology are within cross-disciplinary and concept-driven arts. Broader perspectives are brought into the arts by defining conceptual links between both disparate elements and constructed connections that can be given physical shape with more ease than with only analogue tools. Visitor movements or deliberate actions can easily be captured and used to control artistic details, and 'live' generative art has become an important genre. One recent example of this approach is Asbjørn Blokkum Flø's commission from Bergen Center for Electronic Art (BEK) in 2015. Here, he grabs sound from a café in real time, analyses and processes it into electric trigger signals that are sent to a number of sculptures shaped as small towers. The triggers activate electromagnets that pull hammers of different materials and sizes, and they beat on steel plates where thicknesses and sizes have been carefully calculated to produce specific sets of frequencies. By combining hammering on the different plates, well-defined spectra are created, and in a way they are direct representations of the captured speech patterns from the café. The title of the work is *Doppelgänger*, the German word for Double, and Flø gives us another representation of the café conversations, based on conceptual recognition, distortion, materiality and distance. The exactness in this work would have been unattainable without digital technology.⁶

Signal capture, analysis and mapping can be done with ease, and this opens up elements that have previously been unobtainable for reinterpretation and exposure. An unavoidable consequence is that the identity of the material changes and it becomes difficult to see the 'original' – in fact the entire concept of the original is in flux. One example: In the early 2000s, we executed an experiment at NOTAM where we had approximately ten highly qualified listeners (composers of acousmatic music) rate different versions of six to eight genres of music: orchestral, ensemble, folk, ethnic, pop, rock, etc. The versions were simply the originals compressed with different algorithms and to different degrees, and we did this testing in order to help a Norwegian music download service that was being built at the

time find the best compromise between download time (compressed file size) and quality. We asked our ten listeners to focus on sound quality – on which version sounded the best – and surprisingly, their ratings were all over the board. There was no consensus. We had been careful not to provide information about which files were the originals and the answers showed that there was no clear identification or agreement of neither original nor quality. With modern production technologies, the entire identity is at play as new aspects are emphasized.

It is perhaps easier to see this flexibility of identity that follows digital technology if we look at the self-publishing that is the backbone of social media, where the selective self-presentation blurs the distinction between reality and fiction, as several artists in our survey have pointed to. Marie Munk is particularly clear in her description of the media-driven presentation as ‘the way people behave and communicate with each other’. As technology becomes increasingly immersed with both our bodies and our lives, the way in which we are ‘present’ changes, both physically and mentally. ‘Our bodies are no longer sacred or honest, but highly manipulated – just as any other aspect of our lives. Even nature, which used to be understood as pure, is no longer reliable. Technology is capable of manipulating every aspect of our bodies, lives and nature, which is both intriguing and fear provoking’ (Marie Munk, artist testimonial in this volume: 66). Or more briefly, as Joonas Siren puts it: ‘I have a real life persona and a digital online persona, and none is more real than the other’ (Joonas Siren, artist testimonial in this volume: 34).

Media presentation can be as innocent as the composer’s use of sound to guide audiences in installation and performance situations, creating a flow of events that he or she finds attractive, or it can be more politically coloured, as when technologically shaped sound is used to instrumentally change human behaviour. The distribution of technologies and social networks create new behaviours on a broad scale, and this process can be productively described as reprogramming of our sensory apparatus, much like what Marshall McLuhan described in 1967 and has written about several times since (McLuhan 1967). Examples of these types of artistic concerns are found in both Laura Beloff’s and Niels Bonde’s statements, and they are implicit in Jacek Smolicky’s responses to the editor’s questions as well. Audio technology is being used to encourage certain behaviours and discourage other types, and the situation is a product of both technical affordances and social framing.

[WWW-technologies](#), that among the pioneers were imagined to be liberating and democratizing, have become an essential part of the society’s mainstream and lost the critical potential they were once believed to have. Herbert Marcuse, a popular philosopher in the 1970s, explained that societal acceptance of critical practices actually removes their critical potential (Marcuse 1964), and the self-imposed suppression of individual originality that dominates current social media follows from this type of broad acceptance.⁷ Peer pressure seems stronger now than ever before, and the combination with commercial use of big data has a powerful influence.

Closing Remarks

The digital paradigm of binary representation has opened up the arts for new material, and although the technology has lost its allure for some artists such as Vibeke Jensen, who has become 'more drawn to the tactility of physical materials, hands-on situations and processes' (Vibeke Jensen, artist testimonial in this volume: 94), other artists such as Jacob Remin have been using the technology itself as material. In a more comprehensive perspective, Laura Beloff for example is doing the same thing when she exploits our technological competences to deliberately change our behaviours. The technological affordances of media have become tools and topics for artists all around. For audio arts, one can certainly claim, as composer Luciano Berio did in 1953, that artistic use of technology takes place in a continuum and does not appear in a schism,⁸ but then one must ignore the particularity of the representation and how it opens new layers of complexity, control and conceptual developments as we have described them above. The distance to the sounding object itself can certainly be said to increase with the digital representation when compared to the analogies that were carrying earlier technologies, but, as a magnifying glass, digital technology brings composers and listeners closer to the sound than before – and it is easier to change focus to new and hitherto unappreciated aspects of the sonic world.

This distance is complicated – on one hand it is a step away from the immediate sensory experience, but it also creates a mental space for more of a conceptual richness and stronger connection to the 'real' world, in fact, strong enough for the distinction between 'real' and 'representation' to become blurred. Heidegger was concerned about distance and argued that it could be overcome by exposing perspectives that emerged with the use of technology itself. In the current digital situation, the distance to the objects that follow from digital representation seems to be a prerequisite for developing the nearness that follows from immersion in the technologies, whether it is the make-believe identities of social media, the micro-approaches in sound processing, or the conceptual manipulation where reality and fiction meet. These abstractions realize the deeply human identity that is embedded in and follows from our technological gaze, and the situation can be likened to Escher's drawing of hands that draw themselves, except that this time it is the human code that modifies its author.

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Notes

- 1 As a physical phenomenon, sound is pressure waves and if there is no material in which the waves can be propelled, there can be no such pressure waves.
- 2 In *Zelig* by Woody Allen (1983), the main character appears in a large number of circumstances and always fits in by changing the way he looks and acts. In the film, this condition is recognized as a disorder.
- 3 The early computer systems used for this were the ENIAC and EDVAC. Both systems were developed during the Second World War, for military purposes (Taylor 2012: 20).
- 4 This is an underlying perspective in much of the writings about 'dark ecology', which in essence puts humanity and its activities back into the ecological equation as part of

nature, not separate from it. Important theoreticians are Timothy Morton and Slavoj Žižek.

- 5 Jean-Claude Risset also published a catalogue of synthesized tones in 1969, where he gave examples on spectral characteristics of intonations on several instruments, written during his time at Bell Labs in New Jersey.
- 6 A video of the work is available on Vimeo: www.vimeo.com/99662254. For research articles on the engineering aspects of the installation, please see Flø and Wilmers (2015a, 2015b).
- 7 Herbert Marcuse was a student of Martin Heidegger, and his term 'repressive desublimation' is explained in detail in Marcuse (1964).
- 8 Luciano Berio wrote: 'the electronic creation or manipulation of sounds should be seen as a phenomenon not of schism but of continuity, springing from the same historical and human motives that guided the development of music from Palestrina to Dallapiccola' (Berio 2009: 4).