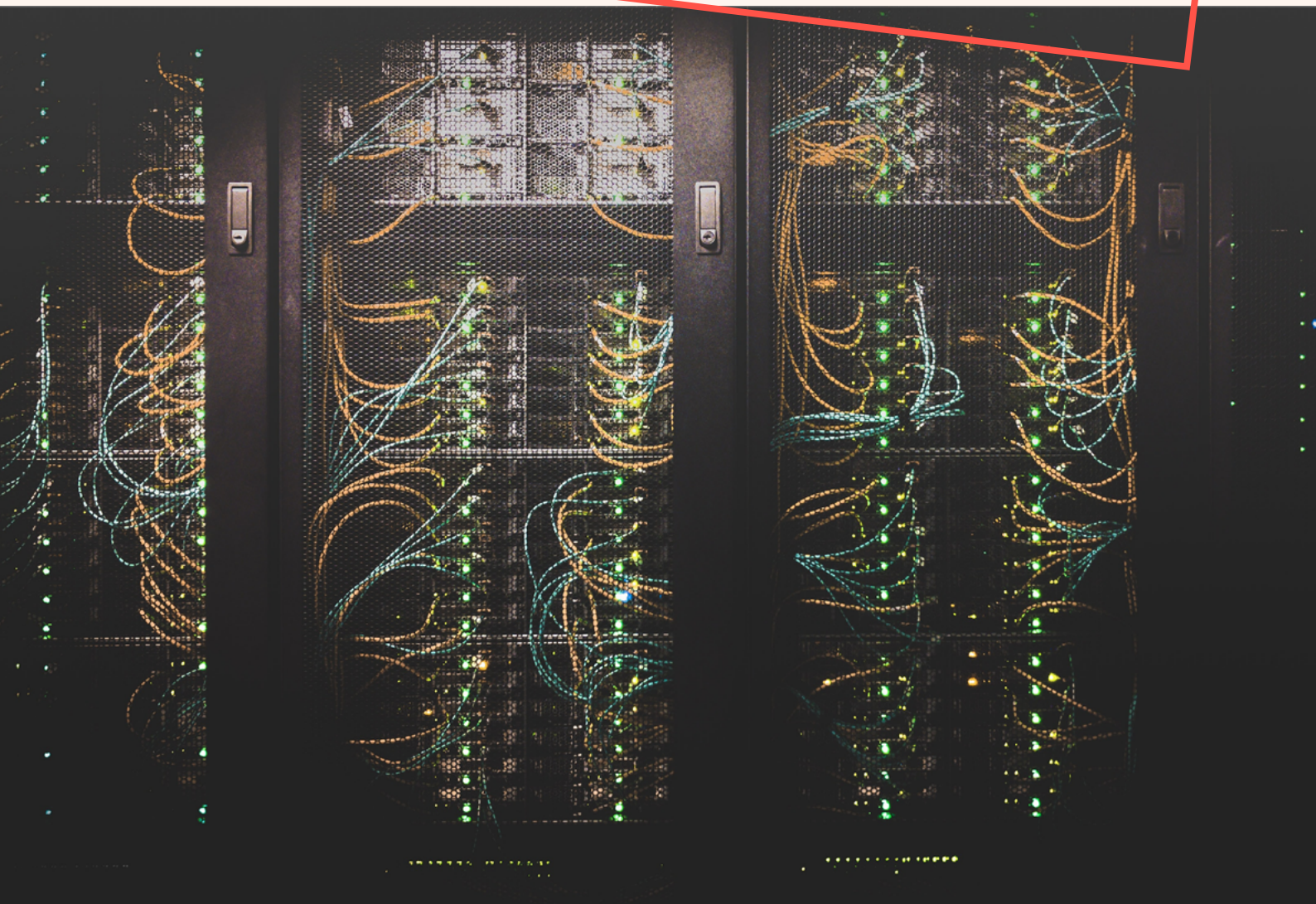


When recordings, speakers
and algorithms speak
New music and virtuality



MATRIX [New Music Centre]

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Text: Anna Vermeulen

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MATRIX
CENTRUM VOOR NIEUWE MUZIEK



When was the last time you listened to music without a technical tool? Without headphones or speakers? Without CDs, MP3 files or streaming services that offer playlists customised by self-learning algorithms?

Even in concert halls, you seldom hear purely acoustic music today. The sounds that the speakers send your way are sometimes recorded in advance, produced by instruments and bodies that are not present on stage. Sounds that are produced on stage, in turn, have often been manipulated to such an extent that you can no longer link them to their original sound source. Many sounds no longer even have a physical basis, consisting instead of immaterial codes of ones and zeros: digital sounds, artificially generated by computers and only made audible afterwards through speakers.

Listening to music today is something we do almost exclusively using forms of technology. The sound and media scientist Jonathan Sterne has commented that the tools for producing and reproducing sound are so closely interlinked that we can no longer distinguish them.¹ In this way, listening to music becomes a virtual experience, in which genuinely 'real' (physically present) and apparently 'real' sounds, movements and bodies are inextricably tangled. Simply put, virtuality can be understood as something that appears to be real, but also refers to the murky boundary between the real and non-real.²

This article focuses on three of the many technologies that are crucial to the virtual experience of music: (1) sound recordings, (2) microphones and speakers, and (3) algorithms and intelligent machines. The examples will show how composers and sound artists use them in creative ways. Besides opening up a world of new sounds, these three technologies often raise questions as to what 'live' means now and about the relationship between humans and machines.

1 Jonathan Sterne, "Media or Instruments? Yes. On Hybridization," *Offscreen* 11, no. 8-9 (2007), https://offscreen.com/view/sterne_instruments (6/3/2020)

2 Sheila Whiteley, Shara Rambarran (red.), *The Oxford Handbook of Music and Virtuality*, (New York: Oxford University Press, 2016), 1.

SOUND RECORDINGS

From reproduction to creation

It must have been a magical moment when the phonograph found its way into homes all over the world in about 1900.³ We have long since got used to it, but recording technology made it possible to 'capture' the elusive phenomenon of sound. Suddenly people could listen to music without the physical presence of musicians and singers. From the time when the phonograph was introduced to today, recording technology has mainly been intended to record live music in a way that is as true to life as possible – as we can tell from terms like 'high fidelity'.⁴ The technology turned the fleetingness of music into a saleable product, in a development that led various authors, such as Theodor Adorno and Jacques Attali, to heave sombre sighs. But explorations of the unintended effects of this technology have led to creative applications for recordings.

Misusing recording media

In the early 20th century, several artists experimented with the creative potential of the new recording technology. One of the few remaining examples of this is the 'Grammophonmusik' that **Paul Hindemith** and **Ernst Toch**, presented at the festival Neue Musik Berlin in 1930. The two composers played their compositions originally designed for gramophone records. They had made them by layering recordings of voices and instruments as well as manipulating the playback speed to make the voices sound unnaturally high (when the speed was increased) or very low (when it was slowed down). As rudimentary as these experiments may seem, the crucial point is that they were exploring the techniques and specificities of recording technology (such as the simultaneous change in playback speed and pitch) in their search for new sounds.⁵

Toch and Hindemith abandoned their experiments, which were extremely expensive and time-consuming, but works and performances cropped up time and again over the course of the 20th century that made creative misuse of these sound carriers and their playback technologies.

John Cage was one of the first to resume the path travelled by Toch and Hindemith. In his *Imaginary Landscape No. 1* from 1939, he uses two turntables alongside a muted piano and cymbal. The playback speed of the records is manipulated with test frequencies. In the original performance, the piece was performed and mixed in a radio studio and then broadcast live in a concert hall. This brought the tension between what was happening on stage ('liveness') and what was not ('mediation') to a climax. By using turntables as an instrument, Cage introduced the recording medium to the live space of the concert hall. Oddly enough, he did so virtually, since the music was created simultaneously, but in a different place (the radio studio) to the listening experience (in the concert hall).⁶

3 Mark Katz discusses that enchanting moment in *Capturing Sound: How technology has changed music* (Berkeley, Los Angeles: University of California Press, 2004), 8-47.

4 Read more on this subject in Jonathan Sterne, *The Audible Past: Cultural origins of sound reproduction* (Durham: Duke University Press, 2003).

5 Katz, *Capturing Sound: How technology has changed music*, 102.

6 Paul Sanden, *Liveness in Modern Music: Musicians, technology, and the perception of Performance* (New York, London: Routledge, 2013), 95-97.

The 'glitch'⁷

From the 1960s onwards, records and turntables also turned up in Fluxus happenings, where they were coated in glue, burned or cut to pieces. Inspired by the Fluxus attitude, **Christian Marclay** began experimenting from the 1980s onwards with the rich sound world of 'noises' that you can create with this kind of unconventional use of records. He developed a series of techniques to evoke cracks, scratches, clicks and pops from the records and record players he used as instruments on the New York improvisation scene. What is more, he channelled his postmodern disdain of genre boundaries into his own experimental version of hip hop sampling, by gluing together fragments of different records that had the widest possible variety of music on them, from classical to Tin Pan Alley and disco.⁸

Manipulating and deliberately damaging old and more recent recording media became very popular in sound art and experimental music around the year 2000. In the 1990s there was even an entire genre based on the sound of malfunctioning media, known as 'glitch'. In that genre, musicians used errors in digital music codes and the resultant clicking, cracking and stuttering as musical material. These musicians came from the experimental fringe of the techno scene, such as the German group Oval, but also from the world of contemporary composition.

The composer **Nicolas Collins**, for example, wrote a series of compositions for manipulated CD players between 1992 (*Broken Light*) and 2002 (*English Music*). To do so, Collins removed the 'mute pin' from the CD players: the part that ensures that the non-musical information that the laser in a CD player reads (e.g. the track numbers and titles) is not converted to sound. Collins' 'unmuted CD player' does use that information, with the result that all kinds of unexpected sounds are heard when the CD is on pause or when it jumps to the next track. It is impossible to predict when these sounds will occur and what they will sound like. Along with the new sounds 'hidden' in the technology, Collins thus discovered a new way of incorporating the element of chance into his compositions.⁹



Christian Marclay plays his turntable, Roulette, New York, 1987

Fluxus artist Milan Knížák manipulates records for the Fluxus pavilion at the Venice Biennale van Venetië, 1990
(c) Marie Knížáková

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- 7 Caleb Kelly's *Cracked Media: The sound of malfunction* (Cambridge, Mass: MIT Press, 2009) was an important source of inspiration for the compilation of this section.
 - 8 Caleb Kelly, *Cracked Media: The sound of malfunction* (Cambridge, Mass: MIT Press, 2009), 150-151, 162
 - 9 Nicolas Collins, "Hacking the CD player", 2009, <https://www.nicolascollins.com/texts/cdhacking.pdf> (6/3/2020)

Mediation versus 'liveness'

The examples discussed above draw attention to the mediating role of sound recordings. Live performances are often presented as an ideal pendant to recorded music, but that ideal is also called into question. Multimedia artist **Terre Thaemlitz** does so, for example, in a series of piano adaptations of existing technopop from the 1970s, entitled *Rubato Series* (around 2000). The works were composed with the help of computer programs and then digitally reprocessed to such an extent that they cannot really be performed in real time any more. Nonetheless, Thaemlitz does perform them live. To do so, he installs a grand piano on stage with an array of computers, a digital keyboard, cables, microphones etc., thus making some of the 'digital wizardry' visible.¹⁰



Terre Thaemlitz speelt Die Robotor Rubato

It looks as though the performer is playing all these technological instruments herself, but when she places her hands in her lap at the points that sound the most spontaneous, the audience starts to have its doubts and people even voice their suspicions about the illusion of what is being created live on stage. Thus Thaemlitz is not so much showcasing the act of making music in this series, but rather the listeners and their expectations of a live performance.

The whole audible world

We have not yet discussed what might be the most crucial creative possibility of recording technology, which is how it turned the entire world of sound into material for artists. As far back as the beginning of the 20th century, people were experimenting with sound recordings from the real world, for example in the tape compositions by **Halim El-Dabh** (1944) and, not much later, the 'musique concrète' of **Pierre Schaeffer** (1948). From then on, countless musical practices would bring sounds from the real world into the concert hall: in the form of field recordings, telephone lines, samples and much more. However it would be impossible to discuss all of them within the scope of this article. For composers today, the 'soundscape of the world' is a source of sound as self-evident as musical instruments and electronics. Various contemporary artists pay particular attention in their work to the sounds from that soundscape and also to the social meaning and listening attitudes that these sounds imply. This is true, for example, of **Joanna Bailie**'s poetic interweaving of field recordings and acoustic instruments (in the series *Artificial Environments*) or **Lawrence Abu Hamdan**'s audio investigations into shootings in Israel or questionings of asylum seekers in the Netherlands (which are not used merely as material for sound installations, but also as evidence in court cases concerning human rights abuses).

10 Terre Thaemlitz, "Operating in musical economies of compromise (or . . . When do I get paid for writing this?)," in: *Organized Sound* 6, no. 3 (2001): 183.

MICROPHONES AND SPEAKERS

From virtual sound sources to instruments and performers

The question of the value and meaning of the live event that is key to Thaemlitz' performances of the *Rubato Series* ties into the concern that some electronic music composers were already wrestling with in the second half of the 20th century. When music was played exclusively through speakers, the concert experience was very different. That is why some composers went in search of ways to add some kind of live performance to the lifelessness of speakers. For example, **Pierre Schaeffer** had Jacques Poullin design a 'pupitre d'espace' with which the conductor could control the sound coming from the four speakers in the concert hall live with his or her movements.¹¹ Conversely, the composer **Éliane Radigue** wanted precisely to avoid any sense of spatialisation in performances of her pieces for tape, from 1970 onwards: the speakers were intended to create an all-encompassing immersion tank of sound.¹²

The speaker orchestras that have been developed in all kinds of music institutions from the 1980s to the present day offer far-reaching possibilities in these terms. Speaker orchestras such as *BEAST* (Birmingham University, UK) and *Acousmonium* (Groupe de recherches musicales, France) have just under a hundred speakers each. They make it possible to sculpt sounds in fine detail when they are projected into a space. The speaker orchestra *Wave Field Synthesis* (operational since 2008) even enables artists to create virtual acoustic environments that – depending on the listener's location – can evoke the illusion of the presence of a sound source at any point in the space. The actual sound medium, the speaker itself, is hidden.¹³ This results in a particularly virtual listening experience.

Speaker Park, **Jon Pigott** and **Roar Sletteland**'s speaker orchestra that featured at the Norwegian music festival Borealis in 2019, does the opposite: Pigott and Sletteland have created a listening environment with 24 speakers they built themselves, each of which is acoustically and visually unique. The listeners walk around the space, making their own exploration of their visual presence and differences in sound.¹⁴



Pierre Schaeffer and the pupitre d'espace



Speaker Park of Jon Pigott and Roar Sletteland at Borealis Festival 2019 in Bergen

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- 11 Sanden, *Liveness in Modern Music: Musicians, technology, and the perception of Performance*, 99-100.
 - 12 Cathy van Eck, *Between Air and Electricity: Microphones and Loudspeakers as Musical Instruments* (New York, London: Bloomsbury Academic, 2017), 134.
 - 13 Ibid., 22.
 - 14 "Speaker Park Premier", 15 March 2019, <http://wrap.hdu.no/Archive/Entries/2019/3/speaker-park-premier.html> (6/3/2020)

Just as we saw in the examples with recordings, speakers can also be creatively 'misused' to make their presence heard. This was an important goal in the work of the Dutch composer **Dick Raaijmakers**. In the installations for his *Drie ideofonen* (1971), he reveals the 'true voice' of speakers by making them speak without any audio input: the speaker broadcasts sounds generated by the mechanism of the speaker itself. ¹⁶

Another way of exposing the nature of speakers is by making it literally possible to feel the way they work: the movement with which they create vibrations in the air. In **Lynn Pook's** installation *Organ* from 2018, for example, you have to touch the speakers with your whole body in order to 'hear' them. These are not the typical hard, black objects, but soft fabric sculptures designed especially for this purpose, which transmit Pook's sounds using 'tactile transducers'. The latter are speakers with no membrane whose physical vibrations are transferred and amplified by the fabric of the speakers. When you touch the vibrating sculptures, you do not perceive the sound vibrations as sound in the air, but through the bones in your body. Pook has been using this principle in her installations since 2003, calling these compositions her 'audio-tactile works'. ¹⁷ **Simon Løffler's** composition *c* from 2013 also makes use of the perception of sound through the bones. He wrote an extremely quiet score for three glockenspiels. The sound vibrations are transferred by means of 'tactile transducers' to a wooden stick that the audience have to bite down on – really! – to be able to perceive the glockenspiel music¹⁸, using a technique derived from an elementary type of hearing aid.

Ideofoon 3, Dick Raaijmakers
at the festival Dag in Den Branding 2015
in Den Haag

Organ, Lynn Pook

Performance c, Simon Løffler

In the embodied listening experiences that Pook and Løffler create, both aim to connect people directly with each other and with sounds. To bring that connecting experience about, they act almost as engineers. They write music for an unusual collection of instruments in the form of technological systems they have designed themselves.

15 Van Eck's, *Between Air and Electricity: Microphones and Loudspeakers as Musical Instruments* was an important source of inspiration for this section.

16 A technical description of *Drie ideofonen* can be found in *ibid.*, 20-21

17 "Audio-tactile work," <http://www.lynnpook.net/english/audiotactile.htm> (6/3/2020)

18 Borealis, "Simon Løffler's 'C'", 2016, <https://vimeo.com/157506808> (6/3/2020)

Spaces and objects as performers

Following the pioneering work of composers such as David Tudor, Alvin Lucier and the Sonic Arts Union around 1970, building these unusual instruments or systems became a crucial aspect of contemporary musical practice. Besides speakers, these systems also give a voice to objects and the space, which serve as musical instruments or, in some cases, even act like 'performers'.

In his series *Audible Ecosystems*, **Agostino di Scipio** turns the space into a performer. The starting point of these works, which tread the line between installations and concert pieces, is to create a self-regulating stream of sound using the interaction between the environment, listeners, microphones and speakers. In *Audible Ecosystem no. 3, Background Noise Study* (2005) microphones capture background noise from the auditorium. These sound signals are analysed and processed by a computer and then sent back out into the auditorium by a speaker, at which point they are recaptured by the microphones and the entire process can repeat itself infinitely. Everything that changes in the auditorium – the listeners' movements, but also the fabric of the clothes they are wearing and so on – will influence the sound of the piece. In that sense, Di Scipio created an ecosystem: all the elements are connected and influence the system.¹⁹

Cathy van Eck turns objects and natural phenomena into instruments and performers. She describes her artistic practice as 'performative sound art', in which she does not only compose sound but also relationships between everyday objects, human performers and sound.²⁰

Music Stands (2011) is a 'choreographic duet' in sound for a performer and music stands. Contact microphones and speakers are attached to the music stands that generate acoustic feedback. The sound can be varied by folding the music stands in all kinds of ways.



Cathy van Eck met *Music Stands*
tijdens OurEars van Nadar Ensemble op Darmstadt
Summer Course 2018

Similarly in *Breeze*, an interactive sound installation from 2015, van Eck plays with the silent musical role of music stands. Five stands are used not to hold scores, but large, crumpled sheets of paper. A fan makes the paper rustle, but if listeners come closer, the music stands will also start 'singing'. Depending on the listener's position (which is measured by sensors), speakers on the music stands transmit different sounds: metallic drone tones, but also whispering if you come close enough. The installation plays with the relationship between what we see and hear: there seems to be a connection between the movements of the listeners, the music stands and the audible sounds, but what exactly that relationship is remains hidden.²¹

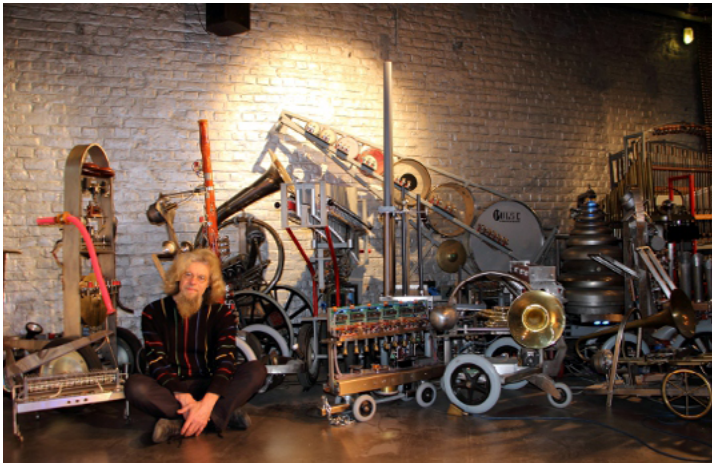
From Van Eck's music-making objects, it is only a small step to musical robots. Pianos that play themselves and automated flutes have been cropping up in Western art music since the late 18th

19 Agostino Di Scipio, "Listening to Yourself through the Otherself: On Background Noise Study and other works," *Organised Sound* 16, no. 2 (2011).

20 <http://www.cathyvaneck.net/> (6/3/2020)

21 "Breeze," <https://iscm.org/catalogue/works/van-eck-cathy-breeze> (6/3/2020)

century. Today there are several robot orchestras around the world. One of them is the *Logos Robot Orchestra*, founded in 1990 by **Godfried-Willem Raes** of the Logos Foundation in Ghent. The orchestra consists of instruments related to organs, wind, percussion and string instruments. They can perform existing music, but original compositions have also been written for them. The reason for this robot orchestra's existence returns us to the problem of 'liveness' that we discussed earlier, which also played a role in the development of the speaker orchestras. The founders of the Logos orchestra believe that the virtual sounds of speakers undermine a crucial element of the concert phenomenon, namely embodied music-making. However the robots are visible on stage and make music in a manner that is almost embodied. In this way, Logos aims to restore the gestures and sounds of a performer, thus acting as a counterweight to the increasing virtuality of music.²²



Godfried-Willem Raes and his Logos Robot Orchestra

ALGORITHMS AND INTELLIGENT MACHINES

When machines compose, improvise and curate

The robot orchestras and Di Scipio and Van Eck's music-making installations raise questions about the relationship between humans and machines. What does it mean to listen to 'soulless' performers? Is music an exclusively human affair? And what exactly is the role of humans in a musical practice where the role of technology is ever increasing? In our present-day, 'post-human' society, humans and machines, subjects and objects, the artificial and the natural, the virtual and the real, 'minds' and 'non-minds' are thoroughly intertwined.²³ This situation has evoked both terrifying visions of the future and acclaimed fantasies of progress, all based on the idea that humans can be replaced by intelligent machines. Just consider the typical science fiction stories in which super-intelligent robots dominate humanity. In her book *How We Became Posthuman*, the literary scholar Katherine Hayles proposes an alternative in which a dynamic partnership arises between humans and intelligent machines.²⁴ Composers have also embarked upon dynamic partnerships of this kind.

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- 22 Laura Maes, Godfried-Willem Raes, Troy Rogers, "The Man and Machine Robot Orchestra at Logos," *Computer Music Journal* 35 no. 4 (2011), 28.
- 23 Tim Perkis, "Speaking with the Mindless," in *Darmstädter Beiträge zur Neuen Musik: Defragmentation Curating Contemporary Music. Sonderband*, ed. Sylvia Freydank, Michael Rebhahn (Mainz: Schott Music, 2019), 25.
- 24 N. Katherine Hayles, *How we became Posthuman* (Chicago, London: The University of Chicago Press, 1999), 5.

The Belgian composer **Serge Verstockt** explores the possibilities of new technologies in his work. From early on, he has been using computers in his composition process. He doubtless adopted this attitude from his studies with the German composer Gottfried Michael Koenig, a pioneer of the development of algorithmic composition systems, in which part of the composition process is automated and choices are partly or entirely left up to a computer program. In Verstockt's later pieces, the computer becomes more than merely a composing companion, and he creates nothing short of virtual universes. For the multimedia work **Screens** (1998/2012), Verstockt worked with the architect Werner Van dermeersch, who designed various virtual spaces in a game editor. As the virtual realities are projected on the stage, improvising musicians interact with them. The musicians determine the route through the virtual spaces with their improvisations, with the result that a free dialogue emerges between them and the virtual computer world.²⁵

George Lewis takes things another step further: in his **Voyager** project that he started in 1986 and is still refining today, he makes computers improvise. The American composer created **Voyager** as an interactive musical environment in which improvising musicians engage in dialogue with a computer-controlled, virtual improvising orchestra. A computer analyses the music that the musicians create and uses the analysis to make its own automatic compositions. However the computer can also improvise without input from musicians. In **Voyager**, therefore, the hierarchy between human and machine is removed.

Lewis seems to be extracting himself entirely from this project as a composer: once the software has been created, he seems to disappear from the composition. Nothing is less true, as Lewis himself makes clear: developing a program is not neutral or objective, after all, but a reflection on the (implicit) intentions and ideas of the makers, as well as the social context in which the program is used.²⁶ (The latter became painfully clear in 2016, when the 'neutral' chatbot Tay Tweets was introduced to Twitter and began spouting dreadful racist comments after a mere 16 hours.) As Lewis puts it, **Voyager** reflects an Afro-American cultural practice, one that can be characterised by too many notes, too many rhythms and too many colours.²⁷ (This background immediately explains why Lewis' program can control 64 asynchronous MIDI channels and thus include that many voices in the improvisation.)



Roscoe Mitchel (left) and George Lewis (right) improvising with "Voyager" at CTM festival 2018, Berlin (c) Marco Microbi

Not all the reactions to **Voyager** are positive. Many people struggle with the idea that the project gives machines the human freedom associated with improvisation.

25 Maarten Quanten, "Screens," <http://www.champdaction.be/nl/screens/> (6/3/2020)

26 George E. Lewis, lecture "Why Do We Want Our Computers to Improvise?", CTM 2018, <https://www.youtube.com/watch?v=wDP8FsJyCaA> (6/3/2020)

27 Ibid., 34-35

intelligence (AI) version of herself. Unlike Lewis' computer program, which can only behave according to its programming (as complex as that may be), artificial neural networks (such as the one Walshe uses) can learn to execute tasks independently. In musical practice, for example, an AI computer can learn to generate music similar to examples it is given. Artificial intelligence of this kind was introduced in 2017 with [DADABOTS](#): it independently generates endless streams of death metal on YouTube. Along the same lines, Walshe has taught an artificial neural network her vocal improvisation style and facial expressions by improvising in front of a web cam for hours. In this way she created an AI doppelganger of herself, with which she improvises on stage in the project [Ultrachunk](#) (2018). Walshe believes that artificial intelligence can offer us unprecedented artistic possibilities if we can transform our aversion to the idea that machines can be creative into fascination.²⁸

Jennifer Walshe improvising
with her AI double
during ASSEMBLY 2018,
Somerset House Studios, London
(c) Anne Tetzlaff

Whether these artistic possibilities will be explored further is difficult to predict, but what is certain is that people within new music are thinking more and more often about 'posthumanity'. The subject was central to the research project Defragmentation – Curating Contemporary Music that was hosted at the Darmstadt Summer Course in 2018, for example. In that context, the [curAltor](#) was presented, a curating computer program. [Nick Collins](#) developed this self-learning machine that can evaluate and rank contemporary classical piano music. Using 100 examples of exemplary musical material, the *curAltor* first learned what contemporary classical piano music is (in other words: what the criteria were for selecting those 100 examples). Then the program began evaluating new examples of music based on their "merit as contemporary classical music".²⁹ As it does so, the *curAltor* appears to fulfil the promise of objectivity and neutrality: after all, the examples used to train the program come from as many female as male composers. So it should be able to make choices unhindered by (subconscious) gender prejudices. But the *curAltor* is more than just a thought experiment. The program could be used to judge music competitions. Thus the role of the curator, along with that of the composer and musician is no longer the sole preserve of human beings.

28 Andrew Chung, "Ethnomusicology in the Uncanny Valley: Jennifer Walshe and the age of AI", 27 July 2018, <https://talkingaboutmusicwords.wordpress.com/2018/07/27/ethnomusicology-in-the-uncanny-valley-jennifer-walshe-and-the-age-of-ai/> (6/3/2020)

29 Nick Collins, Björn Gottstein, "The *curAltor*," in Darmstädter Beiträge zur Neuen Musik: Defragmentation Curating Contemporary Music. Sonderband, 69.

WHAT IF THIS ARTICLE HAD BEEN WRITTEN BY AN INTELLIGENT MACHINE?

This article has been largely shaped by my knowledge, experiences, preferences and also my prejudices – that is inevitable, however self-reflexively an author approaches their subject. The examples quoted mainly belong to institutional Western art music, although many innovative experiments are doubtless playing out in less institutional contexts beyond my field of vision and surely deserve a place in this article. Would this overview have been more objective if it had been compiled by a self-learning computer program? The *curAltor* appears to promise that it would. But if we consider George Lewis' insights, we arrive at a different answer. After all, programs reflect the prejudices of their makers and those of the social context in which they are used.

In any case, I hope that the reader has been able to explore several routes in this article that give access to the wide and fascinating topic of music and virtuality. Now it is a matter of exploring the areas away from those routes and the lacunae between them. And there are many such lacunae. I could have devoted an entire article to radio art, an artistic practice that uses the radio waves as a virtual concert hall. Examples of telecommunication art and internet music, composed and performed in the virtual space of the internet, have been discussed extensively by Monika Pasiecznik in her article published earlier, *Interface to the world: on interactive music*. Composers who have turned this virtuality into a theme in their work, such as Stefan Prins and Brigitta Muntendorf, occupied a key place in the previous articles in this series. As said before, the variety of practices with which composers bring the entire audible world into the concert hall have not been given their due in this article. Thanks to the endless streams of information in our globalised world, which also transport all kinds of music, virtual musical exchanges and connections have increased infinitely. Georgina Born discusses this in her fascinating article *On Musical Mediation: Ontology, Technology and Creativity*.³⁰ It is just one way of penetrating further into the labyrinth of music and virtuality.

With thanks to Maarten Quanten and Kobe Van Cauwenberghe for the helpful (virtual) conversations on this subject.

Anna Vermeulen

30 Georgina Born, "On Musical Mediation: Ontology, Technology and Creativity," *twentieth-century music* 2 no. 1 (2005).

COLOFON

The publication *When recordings, speakers and algorithms speak. New music and virtuality.* has been created in the context of the project *3 x nieuw*.

3 x nieuw stands for new music from the twenty-first century, new media and new audiences. The art music from the still young twenty-first century is often designed by a multidisciplinary character: stage direction, light design and scenography conquer the traditional stage and the understanding of the concept 'music theatre' gets a much wider definition than the classical opera. Technology is everywhere: computer programs, video and even social media are part of the artistic resources of composers.

In this hyperdiverse field MATRIX searches for starting points to get a larger audience acquainted with the music that is been written today. We selected four subjects, on which we focus on one by one for two years: new music and video, new music and interactivity, new music and theatre and the virtual concert hall. With customized guest readings and workshops in classrooms and the publication of additional and accessible background information, MATRIX wants to encourage young people and adults to get over their cold feet and wants to open ears and mind to the music of this century.

3 x nieuw is supported by [Cera](#).

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Text

Anna Vermeulen, commissioned by MATRIX [New Music Centre]

Translation

Snapdragon Translations

© 2019 MATRIX [New Music Centre]

Minderbroedersstraat 48

B-3000 Leuven

+32 (0) 16 37 41 62

info@matrix-new-music.be

www.matrix-new-music.be

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