Parsing Digital

Occasions 18

Parsing Digital

Conversations in digital art by practitioners and curators

Edited by Sally Golding

Preface

Digital art is an incredibly diverse field, intrinsically in dialogue with innovations and challenges within science, technology and also the terms of public engagement. Yet within circles of art-making, art-viewing and art-critique, there remains great scope for conversations that broaden and extend our understanding of what digital art can, and will, become. This publication, instigated by the Austrian Cultural Forum London's (ACF) public programming stream undertaken in collaboration with Ars Electronica, Victoria and Albert Museum (V&A) and Unconscious Archives throughout 2017, highlights perspectives from practitioners within the field – texts from transmedia artists and programmers of public art who are crucially involved at the forefront of rethinking the definitions, boundaries and creative potential of digital art from inside the system.
The articles herein are paths for wider conversations that stoke our imagination as to the application of digital and technological processes involved in the creation and participation of art within public programmes, providing shared knowledge and ideas, rather than discourse.

Alex McLean in collaboration with Ellen Harlizius-Klück, and Martin Zeilinger, reflect on ideas gleaned from deep-research projects centred on the consideration of the algorithm as a fundamental process essential in understanding digital contexts. McLean and Harlizius-Klück discuss their research

in which they use examples of early traditional dance combined with an appreciation of historical weaving looms, to create a code-based-textile using McLean's own innovative open source software TidalCycles to expand the notion of 'algorithmic dance culture'. Zeilinger presents his ongoing project *Pattern Recognition*, in which he foregrounds the importance of a critical research-practice to consider how evolving machine agency in artist–computer collaboration shifts our understanding of 'authorship' and 'cultural ownership'.

Luba Elliott and Addie Wagenknecht bring fresh discussion and opinion to the field of digital art critique from their individual perspectives as practitioners. Elliott describes a path towards a comprehensive critique of digital art as one that now must consider a 'familiarity with emerging technical features, an anthropological perspective [...], and an awareness of the global political situation'. Wagenknecht considers how we might better use technological artistic processes available to us to focus on the creative development of machine learning systems in order to produce diverse and engaging art made by means of artificial intelligence, which might be more seriously critiqued within larger and historical art canons.

Manuela Naveau (Head of Ars Electronica Export), Irini Papadimitriou (Digital Programmes Manager at the V&A) and myself, Sally Golding (director and producer of the independent curatorial

series Unconscious Archives) connect interests in exploring digital art through recent public projects that encourage and open conversations on the multiplicity of digital art and creative technology. Naveau evokes a 19th century engraving as a mechanism for discussion to convey her enthusiasm for supporting today's young artists who freely explore innovative ideas that enrich ongoing developments in digital arts through the international forum of the Ars Electronica Export programme. Papadimitriou addresses the museum's role in initiating and shaping critical discussions around the impact of technology in society and culture as an active rather than passive method of interaction, which involves both artists and audiences, by drawing inspiration from literary sources and her own involvement with the Digital Design Weekend programme at the V&A in London. In my own article I attempt to diversify the conversation in digital arts by offering creative and personal ideas reflecting on technology and archiving while concurrently discussing artworks exhibited in the exhibition *Emotion + the Tech(no)body*, programmed by Unconscious Archives as part of the ACF's digital arts strand, which brought together international artists using diverse artistic techniques.

These contributions suggest ongoing discussions that might be had within broad circles, and ones in which artists, curators, academics, critics and audiences alike can take part. As the application of digital technologies in both our daily lives and our art-viewing experiences converge, it is ripe time

to examine underlying issues and inspirations that may lead to progressive, diverse and unusual takes on the *digital experience*.

Sally Golding, August 2018

About the Austrian Cultural Forum London

The Austrian Cultural Forum London promotes cultural contacts between the UK and Austria by organising events and supporting artists and projects in the fields of music, performing arts, visual arts, literature, film and science. It provides a venue in central London for recitals, lectures, readings, film screenings, conferences and exhibitions, while also cooperating with various partners throughout the UK. The ACF London, in partnership with the V&A Museum London, have been presenting Austrian artists at the Digital Design Weekend since 2016. The project, which began as a cooperation with Ars Electronica, will continue to develop in partnership with the Kunstuniversität Linz in 2018. The impetus for this publication arose from our Digital Arts Focus in autumn 2017. Alongside the Digital Design Weekend at the V&A Museum, the ACF London hosted an in-house exhibition, *Emotion + the Tech(no)body* and collaborated on a series of performances together with the Unconscious Archives Festival.

Tünde Huber, Director, Austrian Cultural Forum London, August 2018

Fabricating Algorithmic Art

Alex McLean and Ellen Harlizius-Klück
Research Institute for the History of Technology and Science, Deutsches Museum, Munich

Introduction

> 'We build our computers the way we build our cities – over time, without a plan, on top of ruins.' Ellen Ullman (1998)[1]

The above quote refers to the historical layers that make up our computer operating systems, where newly developed user interfaces are successively placed on top of the old ones, creating a kind of palimpsest. Behind the graphical user interface we find a text-based one, then a programming language, then a low-level assembly language, then machine and microcode, until we eventually meet with physical electronic circuits. The conventional timeline for computing technology as a whole begins earlier still, with the discovery of the electronic transistor a century ago. Each of these layers has had its heyday as the dominant user interface of its time, and indeed each has been used to make algorithmic systems for,

1 www.salon.com/1998/05/12/feature_321

or indeed as, art. There is much artwork to be recognised throughout this period, but if we keep digging, there are many more ruins to be found. Through research during our European Research Council project PENELOPE,[2] we find that algorithms have been present in everyday life for millennia. In the following we will explore some examples that support this claim, with a focus on our recent work while resident at the Textiles Zentrum Haslach in Austria.

Algorithmic dance culture

An algorithm is defined as a procedure or set of rules, to be followed without ingenuity, in order to create a reproducible result. Electronic computers follow algorithms, but so do humans. The traditional maypole dance is one common example in parts of Europe, whereby each dancer follows a set procedure to move around a central pole, weaving their ribbon inwards and outwards, and perhaps backwards and forwards, to create a braid on the pole. Once complete, the dancers must perfectly follow the rules backwards in order to unbraid the ribbons ready for the next dance. This dance takes some skill and training on the part of the dancers to complete a braid without

2 PENELOPE: A Study of Weaving as Technical Mode of Existence is an ERC Consolidator Grant Project funded by the European Research Council (ERC) under the Horizon 2020 research and innovation programme of the European Union (Grant Agreement No 682711), conducted at the Research Institute for the History of Technology and Science at Deutsches Museum, Munich.

errors, but as it is an algorithmic dance, ingenuity is unwelcome. The correct braid is defined in advance by the rules that are followed.

Another algorithmic dance is the Pinnal Kolattam of Tamil Nadu, India. There is no pole, and the dance is done at harvest-time rather than springtime, but like the maypole dance, each dancer follows a procedure while holding a ribbon, in order to collectively braid, and unbraid. The dance, and therefore the resulting braid (Pinnal) is more intricate than the European maypole dance. In addition, each dancer holds a stick, struck together in pairs as dancers meet, creating musical rhythm from the dance. As with maypole dancing, the choreographic creation of such a dance requires great ingenuity, but the dancers themselves must not show ingenuity, otherwise the braid will contain an error, and unbraiding it will be difficult.

Textiles Zentrum Haslach

During our residency at Textiles Zentrum Haslach in Austria in early 2018, we researched the long history of textile machinery on view within this working museum. It is difficult to imagine a better place to ponder the historical depth of algorithmic art than at Haslach, with its wide range of looms and other devices for translating algorithmic patterns into cloth. Here we find the Jacquard device, famous among computer scientists for its card reader, which inspired the input mechanism for Charles Babbage's computing

machinery in the 19th century. However, next to the Jacquard device we find the earlier brose machine (German: *Bröselmaschine*) that was used in Upper Austria by handweavers to replace the drawboy when working at draw looms. The brose machine follows the same principle whereby material is fed into the machine, while ups and downs are controlled not by holes in cards, but by wooden blocks pasted onto linen. The Landesmuseum Linz owns some better-known brose machines that are said to have been invented around 1680.[3]

So famous is Babbage's device that it obscures not only precursors such as the brose machine, but perhaps even more importantly the far longer history of algorithms in the art of weaving; Babbage's analytical engine was designed approaching 150 years ago, and the brose machine over 330 years ago, but there is evidence that weaving has been done by humans since the Palaeolithic era, i.e. for 27,000 years. By definition, all weaving involves a step-by-step procedure, of discrete ups and downs, where the weft thread travels either over or under successive warp threads. In other words, weaving has been a digital, algorithmic art, for many thousands of years, since its very beginning. Indeed, Jacquard- and brose machines are not looms in themselves, but technologies to be

3 Adolf Adam, former professor of computer science at the Kepler University in Linz, has set that date according to the mention of a 'magic loom' by Johann Joachim Becher in the report of the Austrian Academy from 1680. Adam says that the loom with a brose machine was the first program-controlled production machine, equipped with an endless loop and able to weave patterns for up to 40 shafts (Adam 1985, 63).

added to an existing loom. Before their invention, algorithms were interpreted and carried out by people – however, they were algorithms nonetheless. From here, the history continues back, as a history of the algorithmic movement of bodies.

A pleasing link between the algorithmic movement of machines and the algorithmic movement of human bodies is found in the industrial braiding machinery also present in Textiles Zentrum Haslach. This includes the maypole braiding machine, which sends one circle of bobbins of different-coloured threads in one direction, and another circle in the other direction, the bobbins in the second circle moving over and under those of the first circle to create the braid. When being demonstrated at industrial speed, the bobbins are a blur, but can be gradually slowed down until a striking similarity to the human maypole dance suddenly becomes clear.

One of the aims of our PENELOPE project is to explore the place of ingenuity in textile procedures such as braiding and particularly weaving, when conducted by a human. With the maypole, an individual dancer must not show ingenuity, but a 'caller' may often shout out new instructions for all the dancers to switch to in synchrony. This live manipulation of algorithmic procedure is also possible by a weaver, who may change their plan, switching to a different pattern of movement in such a way that two woven structures are integrated without undesirable 'floating' threads. The weaver also shows ingenuity in the setting-up of the loom, which can be a long and

complex procedure, setting the creative constraints of what may be produced. By definition we do not show ingenuity in following an algorithm, but we may nonetheless show ingenuity in creating an algorithm, or indeed changing the algorithm while it runs.

Live coding and Algorave

Returning to contemporary technology, we turn to the TC-1 loom, which is unusual in being both a hand loom, and computer controlled. A computer is used to control the up/down position of each warp thread for each weft thread via pneumatic heddles, but the weft is then passed and beaten into the warp by hand. While visiting Textile Zentrum Haslach, we wanted to explore how a loom could be controlled by TidalCycles, a system originally created for the algorithmic expression of music[4] (Magnusson and McLean, 2018). TidalCycles is designed for *live coding* music, where computer code is written and manipulated while it runs, often to make music for an audience. TidalCycles is a free/open source project used by thousands of people around the world, including at Algorave events[5], where people dance to music created by such algorithms (Collins and McLean, 2014).

Although intended for music, TidalCycles is

4 TidalCycles is a free/open source project originally created by the first author (McLean). See http://tidalcycles.org for more information on this system, including demonstration videos.

5 Algorave is short for 'algorithmic rave'; see http://algorave.com for details.

essentially a language for describing abstract patterns, which may be rendered as weaving patterns just as well as musical patterns, as long as they are constrained to form a grid of binary values. The following code is one example of such a pattern.

```
stack [superimpose id tabby,
       superimpose id $ superimpose id $
superimpose (rev . ( (3/12) <~) ) $ every 2
(rev . ( (2/12) <~)) $ superimpose (rev .
(0.25 <~)) $ superimpose ( (1/4) <~) $
"[<black white> <white black>]*3",
       tabby,
       superimpose id $ superimpose (rev .
(0.25 <~)) $ every 2 (rev) $ superimpose
(rev . (0.25 <~)) $ superimpose (iter 4) $
superimpose ( (1/4) <~) $ "[<black white>
<white black>]*3",
       tabby,
       iter 6 $ superimpose rev $ superimpose
( (1/6) <~) $ superimpose ( (1/12) <~) $
"[black black white white black white]*2",
       tabby,
       superimpose id $ superimpose (rev .
(0.25 <~)) $ every 2 (rev) $ superimpose
(rev . (0.25 <~)) $ superimpose (iter 4) $
superimpose ( (1/4) <~) $ "[<black white>
<white black>]*3",
       tabby,
       superimpose id $ superimpose id $
superimpose (rev . ( (3/12) <~)) $ every 2
(rev . ( (2/12) <~)) $ superimpose (rev .
(0.25 <~)) $ superimpose ((1/4) <~) $
"[<black white> <white black>]*3",
       superimpose id tabby
]
```


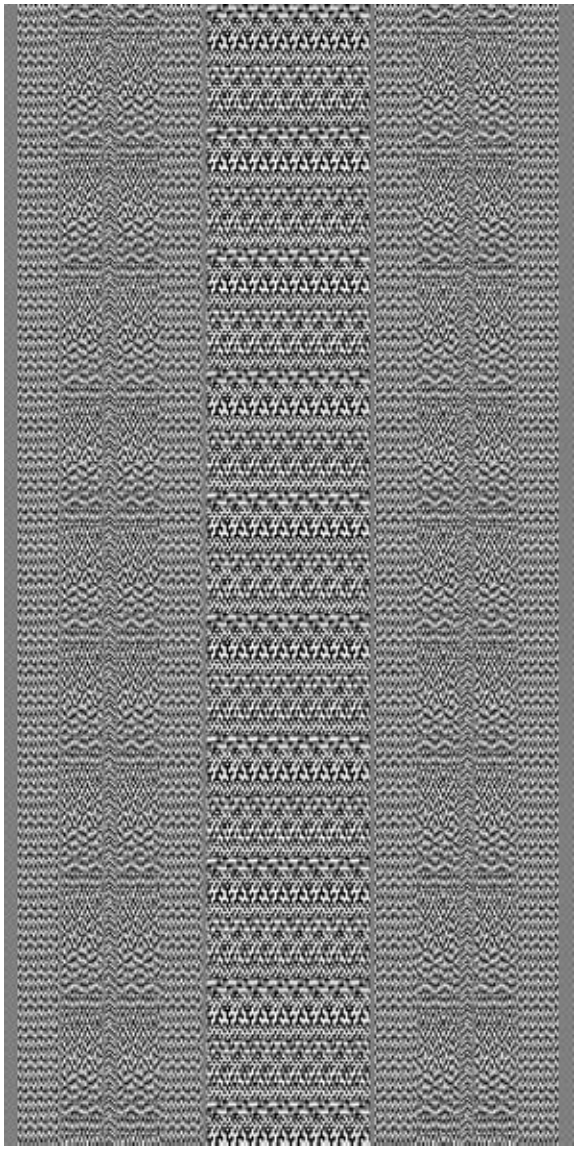

Fig. 1
A weave pattern created with the TidalCycles live coding software, shown with the warp running horizontally. The left and right thirds were produced using the code example on the facing page.

Fig. 2
The resulting fabric shown on the TC-1 loom
in Textiles Zentrum Haslach.

Fig. 1 shows the output from the code excerpt, while the resulting weave created on the TC-1 loom is shown in Fig. 2. In this case the warp threads were black, and the weft threads were white, and so the woven structure of ups and downs are clearly visible in the resulting image. In the future we plan to explore colour effect patterns which result when successive threads alternate between colours on both the warp and weft threads, creating interference patterns that are visually very different from the structure that gives rise to them.[6] We also wish to link the code more directly to the loom, so we may more easily change the algorithm while it is being woven, essentially live coding the loom.

Conclusion

In this article we have brought forward examples of algorithmic procedures within the dance of human movement. By connecting a computer language designed for creating dance music with a computer-controlled hand loom, we have created a patterned, woven fabric which expands these ideas further. Weaving is an ancient art form, and demonstrates that human culture has always included algorithmic procedures following discrete patterns. We argue that computer art should be thought of in these terms

6 See some colour and weave drafts on handweaving.net here: https://bit.ly/2I2ISUa. The examples stem from the draft book of Franz Donat (1907).

in order to break the usual frame of reference to post-industrial innovation – which too often needlessly constrains discussion around algorithmic art. The long and living history of machines as demonstrated at Haslach tells us an alternative story, of people (usually women), engaging in the mathematics of weaves in order to transform patterns as part of a thriving digital art embedded in our culture for millennia.

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Biographies

Alex McLean completed his PhD thesis Artist-Programmers and Programming Languages for the Arts at Goldsmiths in 2011, and he has since expanded research interests in the intersection of music, pattern and programming languages to include textile structures, now as post-doctoral researcher on the ERC PENELOPE project, exploring the structures of ancient weaves. Alex is also a performing musician, developing a live coding practice since the year 2000, performing regularly at major festivals and venues. He created the TidalCycles live coding language for this purpose, which is now an active free/open source project. Alex curates and organises strange events as part of his creative practice, co-founding the TOPLAP and Algorave movements, and co-founding the AlgoMech festival and international conferences on live coding and live interfaces. He also works as an independent artist, with recent residencies in the Open Data Institute and Playgrounds exhibition. Alex is based in Sheffield, where he is trustee of the Access Space charity working in arts, technology and education. He recently co-edited *The Oxford Handbook of Algorithmic Music* with Roger Dean.

Ellen Harlizius-Klück is Principal Investigator in the PENELOPE project. From September 2014 to March 2016, she worked together with Alex McLean and Dave Griffiths as international Co-Investigator in the Weaving Codes – Coding Weaves Project, funded by a Digital Transformations Amplification Award 2014 of the Arts and Humanities Research Council (UK). From April 2014 to October 2015, she investigated the philosophy of ancient textile production as post-doc in the Collaborative Project Ancient Textiles, conducted by the Centre for Textile Research, University of Copenhagen, and the Department of Ancient History, Leibniz University Hanover. In 2012 and 2013, she was awarded a Marie-Curie Senior Research Fellowship funded by the m4human programme of the Gerda Henkel Foundation (COFUND) at the Centre for Textile Research, University of Copenhagen. In 2006 she was Scholar-in-Residence at the Research Institute for the History of Technology and Science, Deutsches Museum, Munich. Ellen is educated as a mathematician and artist and holds a PhD in philosophy.

Relevant Projects

PENELOPE: A Study of Weaving as Technical Mode of Existence is an ERC Consolidator Grant Project funded by the European Research Council (ERC) under the Horizon 2020 research and innovation programme of the European Union (Grant Agreement No 682711), conducted at the Research Institute for the History of Technology and Science at Deutsches Museum, Munich. Ellen Harlizius-Klück is Principal Investigator in this project, pursuing weaving as the very first instance of digital art in history. The research team further includes Alex McLean (live coder and art programmer), Flavia Carraro (ethnologist and anthropologist), Giovanni Fanfani (classical philologist) and Dave Griffiths (director of FoAm).

Weaving Codes – Coding Weaves was a project funded by a Digital Transformations Amplification award from the Arts and Humanities Research Council running from September 2014 to March 2016. Alex McLean, as Principal Investigator, pursued the question of historical and theoretical points at which the practice of weaving and computer programming connect, including insights that could be gained when these activities are brought together, through live-shared experience. Together with Ellen Harlizius-Klück as international Co-Investigator and Dave Griffiths, he investigated patterns from the perspectives of weaving and music, and developed a computer language and code for describing the construction of weaves. Ancient looms in this context are seen as early digital art machines that prefigured concepts of dyadic arithmetic and logic.

Plotting Critical Research-Practice in Digital Art

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> 'In a technological society, there is, at least in principle, no fundamental difference between research and artistic productivity.'
> Max Bense[1]

This short essay introduces my ongoing project *Pattern Recognition*, which explores how evolving machine agency in artist–computer collaboration impacts our understanding of concepts such as 'authorship' and 'cultural ownership'. Based on the appropriation and reworking of early works of computer art, *Pattern Recognition* develops a combined critical and artistic approach, in which detailed analysis of the original works is an inevitable prerequisite for reworking them artistically. In this way, 'authorship', 'creative agency' and 'originality' are engaged both critically and creatively, and

1 '[…] im Rahmen einer Technischen Zivilisation [besteht] wenigstens im Prinzip kein essentieller Unterschied zwischen wissenschaftlicher und künstlerischer Produktivität.' (Max Bense's formative work in German has by and large not been translated into English.) See Max Bense, *aesthetica IV, Programmierung des Schönen. Allgemeine Texttheorie und Textästhetik*, Baden-Baden and Krefeld: Agis, 1960,128 pp, PDF available online.

the project contributes to ongoing aesthetic discourse on digital art practice, while simultaneously intersecting with emergent socio-legal issues connected to contemporary art. Interloping on both theory and practice, the project lastly also provides a context for exploring the critical role artistic practice can play in – or as – research.

Pattern Recognition takes early graphical computer art both as its research subject and as the object for its appropriation-based artistic interventions. After choosing original works representing pioneering examples of the artistic use of programming and computer technology (by artists such as Georg Nees, Vera Molnár, and Frieder Nake), I engage the works in a multi-step process that begins with an extensive analysis of their algorithmic logic, and then continues on to reproduce them 'from scratch', including the rewriting of the underlying source code and the construction/modification of required reproduction hardware (such as simple table-top pen plotters). Inhabiting all the steps involved in the (re-)creation of the chosen works as fully as possible expands my theoretical and practical understanding and appreciation of the works in question significantly, and also serves as the basis for exploring – again, both theoretically and practically – various aspects of the artistic human–computer collaboration underlying generative and algorithmic art-making. The appropriation-based approach developed in *Pattern Recognition* thus becomes a framework for rethinking the contours and nature of the digital artwork itself,

and in doing so also to think about the complicated relationship between artist–computer–artwork on the one hand, and the viewing public on the other. Does contemplative 'looking at' a digital artwork entail analysing its source code? Wherein does a 'work' of graphical computer art consist – is it manifest in a unique object (such as a print or canvas-based work), or is it embodied in the code itself? If so, does 'copying' such an artwork require access to the original source code, and what kind of engagement with the work is signified by the (approximate) recomposition of the code? Where and how is artistic agency situated if artist and computer rely upon one another in producing the artwork? Does it still make sense to speak of an 'artist' in the traditional sense when the resulting artwork in question is based on generative algorithms that will yield different outputs every time they are run? How, finally, does the generative nature of an artwork critically inflect the questions above?

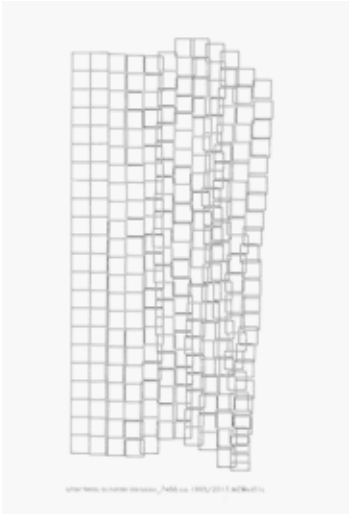
Iterative Schotter, a key component of *Pattern Recognition*, is a good example of the type of conceptual and artistic work researched and produced in the project (Figures 1–4 show a selection of the 15-part series). The work comprises a series of plotter drawings that are based on a well-known computer-generated artwork, *Schotter* (ca.1968) by the German artist Georg Nees (1926–2016). As with all parts of *Pattern Recognition*, my goal in producing these images was to better my understanding and appreciation of the original work, to consider what

the creative act of appropriation entails in the context of generative art-making, and to allow this critical process to simultaneously draw upon and result in an artistic intervention with the original.

Georg Nees produced *Schotter* while working as an engineer at Siemens AG and while studying philosophy and mathematics with Max Bense, whose work greatly impacted the majority of early computer artists. S*chotter* was programmed on a Siemens System 2002 computer built in the mid-1950s, and plotted using an early Zuse Graphomat pen plotter (images of *Schotter* are widely available online[2]; Figure 5 provides my recoding of a program capable of visually reproducing the original). *Schotter* consists of a simple yet intricate graphical pattern featuring randomised elements. It shows 22 horizontal rows of 12 squares each, cascading from the top towards the bottom of the image.[3] Each row introduces a minor, random positional offset as well as a random rotation value for each square. In each subsequent row, positional offset and rotation naturally amplify, creating the impression that towards the opposite image border, the squares spread apart and scatter more and more. Importantly, the randomised elements of the design are determined algorithmically

2 Images of Nees' famous original can be found in many places online; for example at www.medienkunstnetz.de/works/schotter and at http://collections.vam.ac.uk/item/O221321/schotter-print-nees-georg.

3 Note that Frieder Nake, a pioneering computer artist and Nees' contemporary, tells an anecdote according to which Georg Nees, when asked about the correct orientation of the artwork, responded that he did not care whether the piece was displayed as cascading or ascending squares.



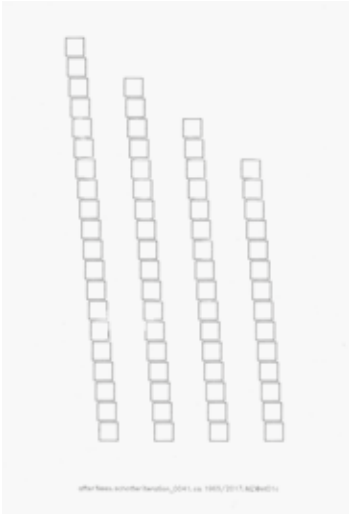


Fig. 1
after Nees, schotter iteration_7488, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

Fig. 2
after Nees, schotter iteration_0041, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

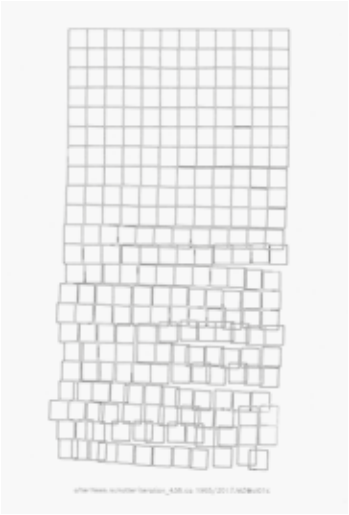


Fig. 3
after Nees, schotter iteration_438, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

Fig. 4
after Nees, schotter iteration_7780, ca. 1965/2017, MZ@st01c.
Image courtesy of the artist.

each time the source code of *Schotter* is run, meaning that each execution of the underlying algorithm will result in a different image.

In line with the approach developed for *Pattern Recognition*, my goal in reworking *Schotter* was to 'inhabit' all aspects of (re-)creating and (re-)producing the work. I began by looking at *Schotter* and contemplating the algorithmic logic underlying the image composition. I then proceeded to write code, in an iterative manner, with the goal of approximating the appearance of the original. In this process, I allowed errors and mistakes to persist, as their output is itself instructive concerning the aesthetic and computational ideas encoded in the original. For other components of *Pattern Recognition*, I had already constructed and/or modified a number of table-top and wall-hanging plotters, which offer a simple but efficient approximation of the industrial plotters used by Nees and other early computer artists, and which I could use to externalise the code's output on paper. These simple plotters, generally controlled by custom software and a number of microprocessors, feature frames that guide a pen travelling along X/Y axes, and include a component designed to raise/lower the pen.[4] My code for *Iterative Schotter*, written in the Processing programming language, outputs vector graphics that can be interpreted and put to paper using the plotter.[5]

4 The images of *Iterative Schotter* shown in Figures 1–4 were produced using an AxiDraw V3 plotter with minor hardware modifications and custom software.

5 Processing is an open source programming language popular among digital artists. (See https://processing.org).

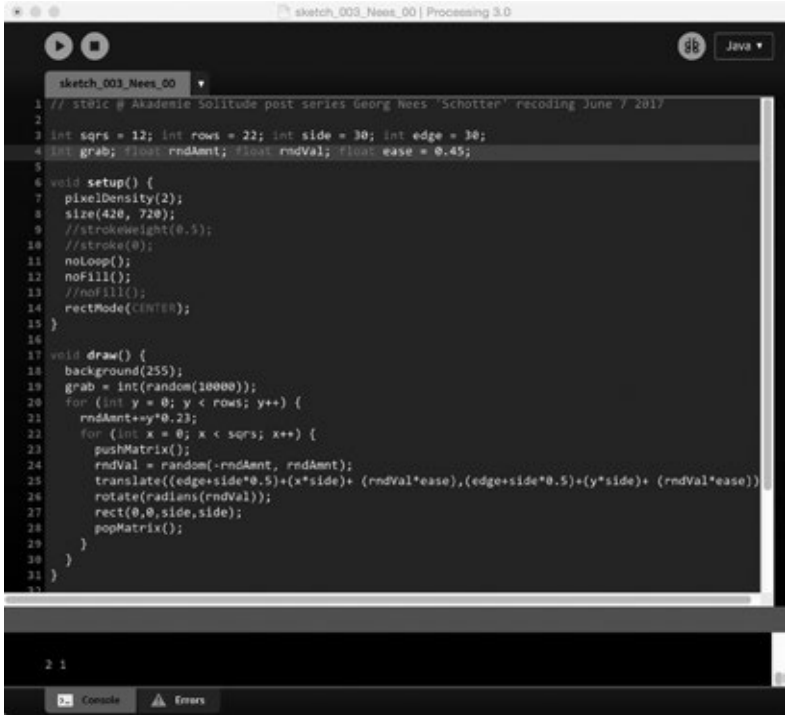


Fig. 5
Recoding of Georg Nees' Schotter in the Processing programming language. Image courtesy of the artist.

The overall process is best described as a combination of research and creative practice, in which neither is privileged: analysing *Schotter* benefits from experimentation with the work's recreation, just as recreating it depends on a thorough analysis of the original. *Pattern Recognition* thus yields what might be considered original artworks (or, in any case, artworks that problematise the concept of originality), while

simultaneously facilitating the development of a set of DIY techniques that serve as both creative and analytical tools. In combination, these open up new ways of seeing digital artworks, by experimenting with ways of re-making them. Because this process is appropriation-based and highly technical, along the way it inevitably foregrounds questions regarding the figure of the artist/author of digital art, as well as questions regarding the shifting nature of the art object in digital contexts.

Perhaps unsurprisingly, many such questions were already being asked by the early computer artists whose work I engage with in *Pattern Recognition*. Critical engagement with their experimental work, beginning with the production of paper-based graphics using computer programs towards the end of the 1950s, thus also takes on an art historical, or media archaeological component. Georg Nees himself was a key figure in this development, and he, too, saw his work positioned between theory and practice.[6] Arguably, *Pattern Recognition* is a critical continuation

6 Nees' work featured in the first exhibition of computer art. The exhibition (at Studiengalerie TH Stuttgart) opened in February 1965, two months before the second seminal computer art exhibition, featuring the work of A. Michael Noll, took place at Howard Wise Gallery in New York City in April of the same year. Nees was studying mathematics, philosophy, and physics in Stuttgart, while also working as an engineer for Siemens AG. Like Frieder Nake, who was completing a PhD in mathematics at the same university, Nees worked closely with the German philosopher of science, aesthetics, logic, and semiotics Max Bense, who taught at the Technische Hochschule Stuttgart. His (largely untranslated) writing on the concept of *Informationsästhetik* (information aesthetics) and many other topics situated at the intersection of art and science played a key role in shaping the conceptual and practical approaches of Nees, Nake and many others.

of the practice-based theorisation begun by Nees and many others, through the project's excavation of early discourse on algorithmic authorship, the nature of digital art, and the evolving role of the computer in art-making.

These topics were a central concern for Nees and others experimenting with using computers as part of their creative practice. Rather than framing their work as 'computer-generated art based on research' or as 'research informed by artistic practice', most of the practitioners who are today labelled 'early computer artists' strongly resisted conventional labelling of their work at the interstices of the previously discrete domains of art and science/research. Michael A. Noll, for example, famously wrote that '[r]ather than risk an unintentional debate at this time on whether the computer-produced designs are truly art or not, the results of the machine's endeavours will simply be called "Patterns".'[7] Nake was similarly hesitant to draw on existing essentialist taxonomies and, instead of situating himself as the sole creator of discrete artworks, foregrounded instead the mutually beneficial 'teamwork' between artist and computer that affords both critical and aesthetic innovation.[8] Teamwork here evokes a quasi-non-hierarchical collaboration between human and computer/machine that points towards

7 Michael A. Noll in an internal memorandum at Bell Laboratories, August 28, 1962.

8 See Frieder Nake, 'Teamwork zwischen Künstler und Computer', in *Ästhetik als Programm*. Max Bense/Daten und Streuung, Eds. Barbara Büscher, Hans-Christian von Herrmann and Christoph Hoffmann. *Kaleidoskopien 5*: 2004. pp.220–225.

a redistribution of creative agency, artistic licence, aesthetic vision, and ethical responsibility between the team members involved – all of these concerns found their expression in the work of early computer artists as the subjects of both artistic experimentation and technical, scientific and aesthetic research.[9]

Max Bense's writing is saturated with a similar focus on collaborative work performed by computer and artist at the interstices of creative and critical work: 'The "human-machine" team functions through mutual exchanges, in which the machine might simulate the consciousness of the human just as the human participant might seek to approximate the automatism of the machine.'[10] Virtually all artist-researchers involved in early digital art have, indeed, commented on the important congruences between scientific and artistic experimental uses of computer technology. While today, we don't hesitate to label the results of this experimentation as art, much early work was instead discussed as 'non-numerical data processing' (*nicht-numerische Datenverarbeitung* – thus also the title of an important anthology on the subject published by Rul Gunzenhäuser in 1968).

9 Frieder Nake's Walk-Through-Raster series, begun in the mid-1960s, and now in the collection of the V&A, is a good example of the critical exploration of computational/technical properties expressed artistically. (See http://collections.vam.ac.uk/item/O214165/walk-through-raster-series-2-photograph-nake-frieder).

10 (Author's translation from German; in the original: 'Das Team "Mensch-Maschine" ist zu einem wechselseitigen geworden, in dem die Maschine … nicht nur das Bewusstsein des Menschen simuliert, sondern der Mensch unter Umständen den Automatismus der Maschine nachahmt.' Bense cit. in von Herrmann, 'Programmierung des Schönen', in *Ästhetik als Programm* (op. cit), 162.

This denomination served, again, to build a bridge both to research in informatics and communication theory, and to the extra-scientific, aesthetic contexts in which artists like Molnár, Nees, or Noll were immersed. Often with reference to Bense's *Informationsästhetik* and related philosophical and media theoretical projects, they exhibited a preference for substituting the idea of the conventional artwork with the much broader, open-ended concept of 'objects that are exposed to aesthetic judgement'.[11] As an extension of this approach, 'generative aesthetics', the framework within which much early computer art was produced, 'refers to the summary of all operations, rules, and theorems which can, when applied to a number of material elements that can be classified as signs, serve to consciously and methodically create […] aesthetic states/conditions'.[12]

Working on *Pattern Recognition* has made me a better programmer (I have greatly improved my ability to 'read' visual patterns encoded in software, and also to algorithmically express visually complex ideas of my own) and a better engineer (by now I have built a small fleet of pen plotters and drawing robots of varying complexity and ability). But more importantly, *Pattern Recognition* continues to challenge me to recognise and explore the manifold intersections between art and research. As noted,

11 Cf. Barbara Büscher, 'Vom Auftauchen des Computers in der Kunst', in *Ästhetik als Programm* (op. cit.), 229.

12 (Author's translation) Max Bense in Georg Nees, *Generative Computergraphik* (1969), Eds. Hans-Christian von Herrmann and Christoph Hoffmann, *Kaleidoskopien 6* (2006), 11.

in this project arguments concerning what it means to author, own, or copy works of art in digital contexts are addressed theoretically while also being embodied practically. Arguably, the outcome actively contributes not only by producing artworks, but, more importantly, by engaging with critical concerns that circulate in aesthetics, media theory and intellectual property theory. Picking up and extending this long-standing debate concerning artistic appropriation in analogue media environments,[13] *Pattern Recognition* thus not only argues, but also seeks to demonstrate practically, that 'authorship', in contexts of procedural, process-oriented and generative art-making, is a category that is becoming less and less stable. In collaborations between computer and artist, the meaning of creativity clearly shifts, and the artistic agency that must be credited for the output (the artwork) is linked more and more tightly to the operations of algorithmic structures. In traditional artistic crafts, such as the writing of a poem or the drawing of a picture, it may have appeared to be relatively easy to identify a conventionally understood artist as the sole source of the creative expression (even though these art forms were, like virtually all others, mediated through once-technological innovations such as pen and paper).

As early computer artists insisted, and as *Pattern Recognition* shows, using technology – 'collaborating'

13 My PhD thesis, *Art and Politics of Appropriation* (University of Toronto 2009), sketches some of these debates beginning in the early 20th century.

with it – reshapes the meaning of creative practice, to the point where labelling its outputs simply as 'art' seems inaccurate and insufficient. This applies in particular when the reliance on technology involves computation or algorithmic operations. At the outset of the relatively short history of computer art, experiments with the creation of graphical patterns and stochastic poetry[14] made clear that this kind of creative work always also represented research. As 'non-numerical data processing' became computer art, the refusal of early experimental practitioners to choose between binary options ('Is this art or research?') was a commitment to developing truly new frameworks for, and approaches to, digital art-making and human-computer interaction. For better or worse, this is also how *Pattern Recognition* operates. It experiments with artistic traditions of appropriation as much as it contributes to the critical interrogation of the collision between aesthetics and intellectual property concepts in digital contexts; it is media theory as much as it is media art history as much as it is a kind of media art.

An often cited claim by Vilém Flusser postulates: 'With digitisation, all art forms become exact scientific disciplines, and artistic practice can no

14 The term refers to the generation of poetry using algorithmic process and databases of text. Theo Lutz (1932–2010) – another engineer studying information theory with Max Bense – is generally credited with having pioneered the art form in the late 1950s, using a Zuse Z22 computer.

longer be distinguished from research.'[15] In a similar vein, Bense's work on *Informationsästhetik* proposes that divisions between technology and art would eventually be transcended, allowing for the emergence of ideas that are radically critical of established perspectives. To close, this might be a good way to begin describing the characteristics and aims of both historical and current research-creation experiments that involve algorithmic processes in the production of critical artistic content – through and beyond the domain-specific binds in which artists and researchers, respectively, still often find themselves.

15 (Author's translation from German; in the original: 'Alle Kunstformen werden durch die Digitalisierung zu exakten wissenschaftlichen Disziplinen und können von der Wissenschaft nicht mehr unterschieden werden.'). See Vilém Flusser, 'Digitaler Schein', in Ed. Florian Rötzer, *Digitaler Schein. Ästhetik der elektronischen Medien*. Frankfurt/Main: 1991, 158.

Biography

Martin Zeilinger is an Austrian, London-based new media researcher, practitioner and curator. Holding a PhD in Comparative Literature (Univ. of Toronto), Martin has been teaching media theory and media arts for over a decade, and currently serves as Senior Lecturer in Media at Anglia Ruskin University. Martin's work focuses on appropriation art, intellectual property issues in contemporary art, digital art and emerging financial technologies, and the use of video game technologies in experimental media art, among other topics. His critical work is widely published in books (most recently *MoneyLab Reader 2* and *Artists Re:Thinking the Blockchain*) and in journals including *Philosophy & Technology* and *Computer Music Journal*. Since 2014, Martin has been co-curator of the Toronto-based Vector Game Art & New Media Festival. *Iterative Schotter* has been exhibited at the group exhibitions *processing* (Galerie Peithner-Lichtenfels, Vienna/AUT, 2017) and *Rethinking Affordance* (Akademie Schloss Solitude, Stuttgart/GER, 2018). Martin's publications and information about his curatorial projects and art practice are available at http://marjz.net.

Pattern Recognition

Pattern Recognition was initiated during a four-month research-creation residency in the 'art, science, and business' programme at Akademie Schloss Solitude, which Martin was awarded for an ongoing project on algorithmic authorship. Akademie Schloss Solitude is a public foundation in Stuttgart/Germany that provides substantial support for interdisciplinary experimental projects by artists and research-practitioners.

Towards a Comprehensive Critique of Technological Art: The New Curator

Luba Elliott

Contemporary art practice has become deeply technological, yet our superficial understanding of daily technology falls short of the expertise required to accurately critique art made with it. This jeopardises the position of the art critic as well as the curator and the viewing public. As a curator of artificial intelligence-based art, I appreciate the inherent difficulties of evaluating art made with sometimes complex and constantly evolving technology by a broad community of creative coders, media artists and even technical researchers, all making art with varying levels of criticality. Aside from an integrated knowledge of art history, an informed critique of the field of digital art may now require intimate familiarity with emerging technical features, an anthropological perspective on the social implications of these tools, and even an astute awareness of the global political situation. In this sense, a critic of digital art may now be required to view art through the prism of a technology user as well as that of the politically engaged citizen instead of centralising traditional aesthetic concerns

around form and display. As we shift increasingly deeper into technological habitation and habituation, this marks a move away from the traditional art canon into one which more closely represents a confluence of the two.

Technology is now social, and incredibly pervasive like never before. We devote increasing amounts of our time to social media platforms, liking our friends' updates on Facebook and Twitter, digesting our lunch through photographic posts via Instagram, swiping through dating profiles on Tinder, forever broadcasting the daily grind to ever-increasing circles of acquaintances and internet strangers. These platforms are inextricably linked into our daily routines, acting as extensions of what we once considered 'our pens and our voices', now replaced by interfaces, which instead begin to form our sense of being and identity. Like every emergent communication platform synonymous with the idea of 'social', they bring to us their own characteristics and limitations, which in turn surreptitiously shape our behaviour. Importantly, it is the increasing activity of artists working with DIY electronics, hacking and the critique of the digital as the content of the art itself that highlights the errors, intricacies and particularities of these systems as we increasingly see new artworks and apps seep out from beyond bedrooms and start-up beta trials, vying to become our omnipresent companions. The closeness of technology to our lives, and yet conversely the lack of a direct understanding of the engineering principles required in the construction of digital or technological

art, may currently be placing the art critic in both a biased and misdirected position.

Traditionally, the role of the art critic has been to evaluate the 'aesthetic', placing the artwork in a broader art history context which takes in the scope of related media including sculpture, painting and even, more recently, film. Usually, in the Western academic sense, this would have previously required mastering the understanding of various art traditions, forms of representation and nuances of subject matter – the modelling of plaster into human forms, the impasto of pigments in painting, the craft of the photochemical processes – so then it follows that digital art critics should now ensure they are better placed to engage with the tactical aspects of digital art such as coding, selecting data sets and even the etiquette of social media 'posting' and online communities. As the age of machine technology spread with urbanisation and the automation of industry, these concerns or perhaps endorsements of technology became increasingly reflected in the production of artworks created by artists who stood in direct opposition or who conversely embraced 'newness' in response to times of rapid change. Art movements spanning surrealism, Dadaism, conceptual art and more generally postmodernism provide a visual in our minds, showing us that advancing technologies have always fed our imaginations and desires for new possibilities of expression, pointing towards an integration of society-industry. Meanwhile, art historians still too often look at art through the lens of historical

trends and developments, instead of embracing the changes and challenges of the new expanded field.

When evaluating the technological component of an artwork, the art critic must be closely engaged with the technical features of the toolkit and understand its origin, development and usage in an industrial context. If we take an example from an artistic practice incorporating machine learning – a technology based on algorithms generating new images, words or sounds based on patterns learned from large data sets – we see more clearly why technological proficiency may matter when we look to the future of critiquing art. The artist Mario Klingemann experiments with the latest machine learning models for image generation, testing their ability to faithfully replicate a natural human form or facial features, and yet bringing a fresh perspective that is organic and defensible in the eye of the beholder. To enable a deeper evaluation of artistic merit and technical skill in such cases, the art critic needs to be familiar with the basic functionality of a machine learning model and know the spectrum and the hallmarks of its generated images. In Klingemann's recent use of generative adversarial networks for representing the human form, there can be spotted irregularities in the number, position or angles of limbs, common as results of this technology, but skilfully appropriated by the artist to create an aesthetically cohesive work with a painterly texture.

From an anthropological perspective, the new art historian must understand how the latest technological,

Mario Klingemann, *You Should Have Called*, 2017.
Image courtesy of the artist. Colour image p. 121

demographic and geographical changes are affecting society and shaping our behaviour. The socio-technological developments of the past decades have facilitated the growth of online communities with niche interests, frequently with their unwritten rules and code of conduct (open source, copyleft) taken as given by all participants but not necessarily natural to 'outsiders'. The work of Matthew Plummer-Fernandez and Julien Deswaef, *Shiv Integer*,[1] serves as an example here. An anagram of the 3D printing design community Thingiverse, *Shiv Integer* is a bot that combines existing user-uploaded designs

1 www.plummerfernandez.com/Shiv-Integer

to create new ones, often objects with nonsensical names and features put together with an obviously unconventional logic. These new designs are uploaded to the platform one after another, breaking the standard newsfeed flow of designs painstakingly developed by a human, instead to be replaced by automatic bot remixes. This has provoked a range of reactions on the online platform, from curious bemusement to anger and annoyance at the bot garnering excessive attention due to frequent newsfeed placements and excessive notifications sent to users. Here, to properly understand and contextualise *Shiv Integer*, the critic needs to understand not only the basic principles of 3D printing, but also the social etiquette of the platform and its community participation, as in this case the work relies on community feedback to give it meaning.

Another example of the social changes caused by recent technological developments is Scott Kelly and Ben Polkinghorne's work *Signs of the Times*,[2] a series of photographs of recommended activities and destinations that are placed on signs in idyllic natural environments such as mountain scenery or beaches. This work can be contextualised through an anthropological understanding of the extent to which recommendation algorithms influence our choices, augmenting our constant dependence on technology, which sometimes overshadows natural beauty and experiences lived in real life.

2 http://scottandbenorbenandscott.com/#/signs-of-the-times

Technological art has increasingly become influenced by the political conversations taking place in a constant stream in our newsfeeds. The rise of Trump, populism and Brexit has polarised society into right and left, inspiring artists to work directly with political material to bring contemporary social problems to light. The work of these activist artists highlights issues such as income inequality, corporate power and racial prejudice, often by referencing, remixing or manipulating news footage and social media posts. Needless to say, without understanding contemporary histories, political countercultures and, going further – knowing the names of politicians, details of global protests and human rights violations – the artwork can lose its significance, falling on deaf ears. This political influence on contemporary art is exemplified by the selection of the nominees for the 2018 Turner Prize, all four of whom are exploring political or humanitarian themes throughout their work. In particular, Luke Willis Thompson's *Autoportrait*[3] stands out. The black-and-white image captures the composed grief of Diamond Reynolds, known to the public from her own live streaming of her boyfriend's death from an unjustified police shooting during a routine traffic stop. Yet it is uncertain whether a similar work on a story less prominent in contemporary news would have struck so many chords amongst critics and the public.

3 https://chisenhale.org.uk/exhibition/luke-willis-thompson

Ultimately, this assessment and the critique of digital art depends not only on the current key players in art criticism from both traditional and emergent platforms – the newspaper art columnist, the Instagram blogger or the theory-focused academic – but also on museum or festival curators whose power to present artworks framed within the dynamics of an exhibition consequently lay bare the structure of interpretation with which others interact and review. Curators devise concepts for exhibitions – their own form of a work of art – often with a comprehensive approach that includes researching the unique angle for the show, selecting representative artists, creatively mapping exhibition design, structuring public engagement and education programmes, and planning PR tactics. The trickle-down effect is that it is the critics and audiences who follow suit in responding to art 'worthy' of curators, delivering judgement on works already pre-classified as art. In the contemporary art world, this entitles the curator to a public-facing position that frequently rivals the power of pure monetary transactions between artist and collector: we find that it is the curator who dictates trends which artists respond to and even tailor their practice towards, as each artist jostles to benefit from limited residencies, exhibition and public programme opportunities. A further consideration of the backgrounds of curators may lead us to generalise that the majority arise from art schools whose programmes, at least in recent times, do not necessarily encompass the latest political theory

or teach the technological background of digital art-making. Therefore, contemporary curators worryingly lack the capability to build the toolkit that we may now see as essential in working towards an encompassing new global vision of digital art. This incomplete picture, starting with education and extending into the upper echelons of the art world, leads to a myriad of issues including the development of bias and the construction of privilege in art history, which could be better addressed through further equitable social immersion and a concurrent technological comprehension.

This way, we have arrived at a point in art history in which it is no longer acceptable to remain comfortably within traditional art teachings. Instead, we are transfiguring an art whereby the contemporary curator must possess a working knowledge of social communication platforms and their effects on society, an understanding of the capabilities of each technical toolkit and an informed overview of the global political climate. It is this combined awareness – a multifarious approach to the 'technological' in digital art – which will enable the curator to evaluate an artwork in its entirety, as well as each individual aspect without being dazzled by technology or burdened by art history, perhaps leading us towards a more inclusive and comprehensive picture that the future of art dictates. Given the broader role played by contemporary art in society today, it is only fitting that the expertise of the curator develops accordingly and in line with the digitally native audience.

Biography

Luba Elliott is a curator, artist and researcher specialising in artificial intelligence in the creative industries. She is currently working to educate and engage the broader public about the latest developments in creative AI through monthly meetups, talks, workshops and exhibitions at venues including The Photographers' Gallery (UK), MIT Technology Review (US), Leverhulme Centre for the Future of Intelligence (UK) and Impakt Festival (Netherlands). She is part of the AI Think Tank of the British Interactive Media Association and has advised organisations including the World Economic Forum and City University. She studied modern languages at Cambridge University and Design Thinking at the Hasso-Plattner-Institute.

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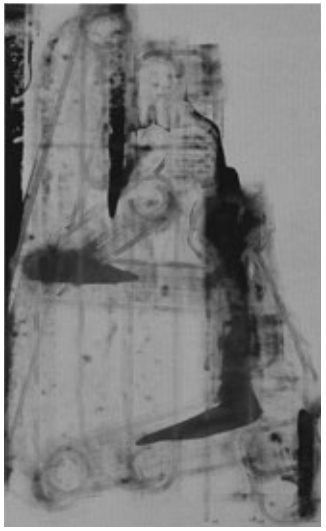
Aesthetics of Machine Learning and Post-AI Art

Addie Wagenknecht

This article is an explorative attempt to diffuse and explain an emergent tool-set for the digital artist in which the language and understanding required to discuss evolving artworks created by means of artificial intelligence (AI) has yet to be fully formed. These emergent technological and critical concerns within this new canon will play a large role in the creation and critique of contemporary art – as we edge into the future. As an artist with a practice that plays with absence and the inheritance we leave behind, my work often operates as an insight into the agency of emerging technology, without simply seeking to explain the function of it.[1] My argument herein is framed from my perspective but also with

1 *Alone Together*, 2017, is an example of my work which responds to this theme. *Alone Together* is a series of mechanically assisted paintings created using a modified Roomba to paint on canvas as it enacts custom algorithms. I recline nude as the Roomba manoeuvres around the canvas, my presence interrupting the trajectory until the entire area has been mapped by the algorithm. The result is a void in the shape of a female form surrounded by the blue strokes created by the robot. The paintings reference Yves Klein's Anthropométries in which he directs nude female models, who he referred to as 'living paintbrushes', to press their pigment-covered bodies against canvases in front of an audience. In contrast I abandon the spectacle of the objectified female nude in favour of drawing attention to what is absent.



Addie Wagenknecht, from the series *Alone Together*: *Self-portrait – as a young women after a hundred years and 12 seconds*, 2017. YKB pigment and resin on linen, 2 × 2.75m. Image courtesy of artist. Colour image on p. 122

reference to evolving machine agency that increasingly shifts our understanding of art viewing and art production. I want to rethink the creative constraints and aesthetics of artificial intelligence and machine learning (ML) within this emerging post-AI canon.

AI is already seamlessly laced into our everyday lives, even if the function may be changing from representation and fantasy, to mediation and activation, to the commodification of data – there is the deeper role that ML plays within the art that we consume. Simply put, ML is the use of computers programmed to have varying amounts of 'agency'. It is so ubiquitous

that it is embedded in much of what we use and do; in a way, we rely on it all the time without knowing it: your Apple watch, Google Maps, new smart self-driving cars, Facebook activity and maybe even your vacuum cleaner and refrigerator all contribute to 'this medium'. Like with any prior emerging technology (pigment, photography, computers) that quickly becomes cheap and ubiquitous, artists are exploring the medium and its application within the arts. With more established and traditional artistic tools, for example a paintbrush, the emphasis was on precision, perfection and control, but with AI it is about relinquishing control and instead redefining agency.

From my perspective as a practising artist, much of what I have seen exhibited within gallery-centric cities like New York, within the period of the last two years, is an output of AI artwork that I have come to generalise as being 'overproduced' – typically shiny, blurred images of faces and representations of the human body that look to me as if a low-resolution photograph has been blown up beyond its available resolution, in a way that was not perhaps intentional, but which risks coming across as an unformed attempt to understand the wider potential of AI tools. Perhaps this is because artists typically use default training sets, which in turn produce default-like content, or perhaps because we as a society and as artists are so often in such a rush to be 'first' that artists may create output in an attempt to gain recognition within the art world – rather than seeking to develop the work to its full potential. These works are often cited

and created by artists who contextualise the work in a way that very often seems to disregard the history of prior research and art already in existence – artists seemingly ignoring or appearing uninformed by existing art contexts. Much of these works risk a sort of dry, academic trajectory rather than exploring the full potential of the work's artistic integrity. Looking further at this AI aesthetic, we also frequently encounter patterns from nature like flowers; or generic patterns such as squares or video frames flashing from one derivative picture and morphing into another. Training sets, which the ML process depends on in order to propagate new information or images, have traditionally been limited to academic research groups. From an artist perspective, the most pressing issue and perhaps the most common error in AI art is that artists are relying solely on default training sets and default algorithms. These training sets and algorithms were primarily developed by academics working, for example, in funded programmes within the sciences, and by researchers such as at DARPA (Defense Advanced Research Projects Agency in the United States), whose primary goal was of course not to develop a unique aesthetic, but rather to create a set of repeatable outcomes in which the computers could learn to look for repeatable matching markers in similar sets of data.

Art that depends on these models rapidly becomes part of the ever increasing factory-like turnover of contemporary art. If we were to apply a more traditional art reading here, we may find that the work

Mario Klingemann, *Flesh Formation*, 2017.
Image courtesy of the artist.

does not function as anything more than a series of poorly executed concepts, and one that leaves the viewer and the art world unenriched. Collectively, we are seeing far too much of this typified style of aesthetic output. This overall accumulative sense of reductive, generic imagery that pervades AI art pushes me to consider the need for a 'post-AI aesthetic'. Art created with ML and AI techniques may be the first type of art we encounter in which there are truly no signifiers which make it unique to the computer models or the person that programmed them. Currently, it seems, post-AI art looks more or less indistinguishable: blurry, low resolution, glossy prints on well-lit sterile walls.

In contrast, the few artists (of which Mario Klingemann is a prime example) who are designing and creating their own training sets and libraries, or even more complex states – algorithms – create works that could be classified not only as creating an evolution of their own style but as also creating an aesthetic that separates them from the generic output of artists who have utilised the tools of AI as a far too simplistic set of readymades.[2] It is these artists who are creating their own systems and who are not reliant on set and outdated research data as their classifiers, who are pushing the code base to offer something far more creatively diverse – in which the 'value' of the work is no longer only found within its process but aligns again with a deeper engagement of art history, albeit with a slightly different set of parameters.

AI artwork created using unique algorithms rather than data sets is in this sense more capable of engaging in serious dialogue with wide-ranging contemporary art, without risking becoming an alienated subsection of art that appears devoid of contributing non-technological factors – the bigger

2 Mario Klingemann's work uses machines as a collaborator rather than a data parsing mechanism for already available algorithms and training sets. His output is a more unique yet autonomous production mechanism. He says, 'When it comes to using AI tools I believe that I try to think two or three steps ahead, like in chess: what is the most obvious thing people will do with this and can I avoid doing that? Some examples: back in the deep dream days it became clear pretty quickly that everyone will get puppyslugs since that's what the default model produced and not many people would bother to train their own model. So I trained my own models and also tried to change the algorithm so it would behave differently and in particular not give me those psychedelic colours.'

picture of which is needed to make up a more fully developed and appealing art critique. This strategy leads the audience and viewers towards a state of realisation as to how much of this type of AI artmaking may force *intimidation of process* – works that rarely make for a more nuanced, individualistic, risky or original piece of art. Therefore I suggest that the true alchemy of art that uses AI principles lies with the artists who are able to utilise these tools without 'speaking' of the AI itself as a central focus of the work – that is, to make the process an intentional artefact of its output. It is this atypical approach of abstraction and new language that will take AI art outside of the silo of new media and instead allow it to be framed and discussed within the context of contemporary art.

Art that uses AI as a creative tool is designed to challenge. These works may demand that the viewer literally participates in order for the works to function or develop, rather than the traditional model, which would involve allowing the viewer to experience the work in a passive state. In this contemporary model the viewer can remain unaware of the works as having been 'built by code', and instead become more fully immersed within the unique qualities of the artwork itself. In more interesting iterations of AI art, the process becomes a seamless by-product of the work – and in that regard is similar to how AI functions in well-designed systems that are in place around us, which operate continuously, yet without us noticing them (social media, apps, search engines,

and even shopping recommendations based on prior purchases). The artist Ian Cheng provides an example of how the language around the artworks themselves can provide an experience and narrative with which to translate the work – which he does by talking about the works without directly addressing their very infrastructure. Cheng builds game-like environments that exist within a god mode-like[3] state and are exhibited not as new media but positioned as contemporary art. This is both ingenious and telling. If a work is already well contextualised as art by the artist, established curators and the institutions that follow them, it is then accepted quickly by collectors and the canon; it is not seen only as an emerging technology, but something that the art world considers part of its own remit. Artist Allison Parrish addresses the unusual phenomena of computer-created languages. Her work recurrently looks at procedural methods within machine learning and their phonetic similarity to create new structures in language.[4] Both of these artists use simulation as a form of new reality. The virtue of their work lies in how the complexity of the process of creating the work, coupled with the underlying intention and meaning of the piece, becomes *influx*. Without us realising it, their works are training us to 'see like machines',

3 God mode is a cheat in gaming that makes player-characters invulnerable, and occasionally adds invincibility, whereby the player can hurt enemies by touching them (e.g. as within Super Mario, *Super Star*). However, the effect may be temporary.

4 The poems in Allison Parrish's work *Articulations* are based on extracted linguistic features from over two million lines of public domain poetry.

Allison Parrish, *The Wcnsske-Gonshanshcoma Reconstructions (excerpt)*, 2018. Digital image (output of computer program). Image courtesy of the artist.

and through this act we in turn are creating an intimacy with machines that allows us not simply to understand how the machine works, but instead to understand that the machine works for us.

Moving forward, from an artistic perspective we must put to work or appropriate these limitations as content or technique instead of working against them. In order for AI art to become part of the larger canon of art and to be accepted within the art world, we need to use ML as a creative tool – and not as a reductive and set process. We also must learn

to talk about the works in a way in which the art world can grasp and reflect. Effectively, this means adopting an entirely new approach to contextualisation and context, in terms of both how we think about and how we look at AI art. For many artists and galleries this would mean refraining from making the technology the apex focus of the work, and instead placing the emphasis on talking about the wider potential of the work itself. Just as a painter would not typically talk in detail about the oil paint or type of brushes they use, digital and computational artists who rely on technology need to be able to develop this new perspective of narrative that drives both meaning and agency, and which is therefore less about the tools or computational process.

AI art positions us within an interesting and challenging place within the art world – we are simultaneously struggling to find an identity for digital work while facing issues of apprehensive collectors, ever advancing technology and the need for new skills in archiving the complexities of this type of work combined with an ever growing history of obsolete technologies. In order to escape and rethink the common aesthetic of machine output, we may have to stop centralising the machine. We should rethink how we approach AI altogether by uniquely developing our learning sets and signifiers so that the focus of new work becomes art once again. AI art functions as a tool like any other traditional medium – when we are finally able to stop talking about the medium itself and start talking about the content.

Biography

Addie Wagenknecht is an American artist currently based in Austria. Her work explores the tension between expression and technology. She seeks to blend conceptual work with forms of hacking and sculpture, and deals primarily with ideas relating to contemporary pop culture. Previous exhibitions include MuseumsQuartier Wien, Vienna, Austria; La Gaîté Lyrique, Paris, France; The Istanbul Modern; Whitechapel Gallery, London and MU, Eindhoven, Netherlands. In 2016 she collaborated with Chanel and *I-D* magazine as part of their Sixth Sense series and in 2017 her work was acquired by the Whitney Museum for American Art. Her work has been featured in numerous books and magazines, such as *TIME*, *Wall Street Journal*, *Vanity Fair*, *Art in America*, and *The New York Times*. She holds a master's degree from the Interactive Telecommunications Program at New York University, and has previously held fellowships at Eyebeam Art + Technology Center in New York City, Culture Lab UK, Institute HyperWerk for Postindustrial Design Basel (CH), New Museum, New York City, and The Frank-Ratchye STUDIO for Creative Inquiry at Carnegie Mellon University.

www.placesiveneverbeen.com

Deep Lab

Addie is also the founding member of Deep Lab, a collaborative group of cyberfeminist researchers, artists, writers, engineers, and cultural producers whose research includes privacy, surveillance, code, art, social hacking, race, capitalism, anonymity and the infrastructures of the 21st century. In December 2014, the Deep Lab participants – a group of internationally acclaimed new-media artists, information designers, data scientists, software engineers, hackers, writers, journalists and theoreticians – gathered to engage in critical assessments of contemporary digital culture to collaboratively produce *Deep Lab: the book*.

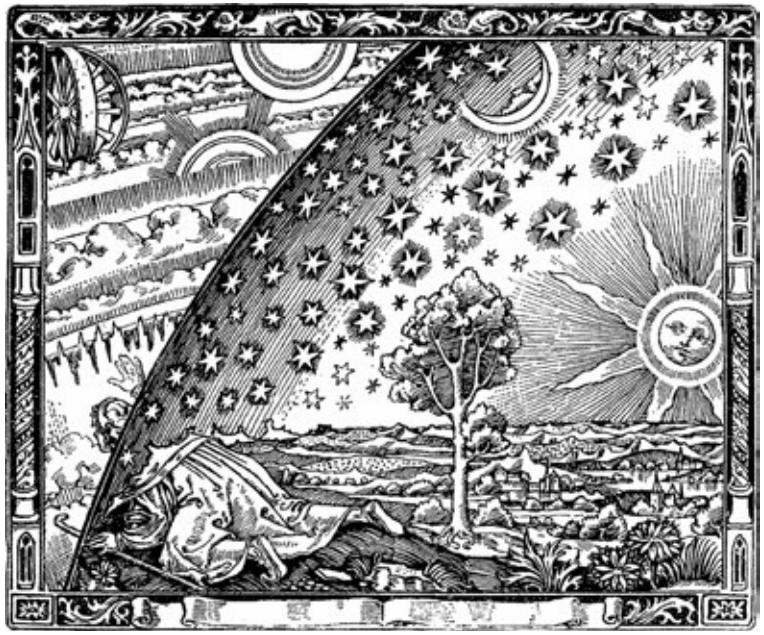
www.deeplab.net/thebook

Travellers between Worlds and the Longing for New Worlds

Manuela Naveau, Head of Ars Electronica Export

The longing for new worlds … What sounds like the title of a book, a film or maybe even something that could have been penned by a science fiction writer was the theme of the contribution by Ars Electronica Linz to last year's Digital Design Weekend at the V&A in London. Actually, the inspiration behind this title was an image, the creator of which is unknown but that has gone down in history as the Flammarion engraving. What this yearning for new worlds as a metaphor for a driving force has to do, in general, with Ars Electronica's involvement over many years with Digital Design Weekend is what I would like to elaborate on in detail here.

Actually, this has to do with an incredibly impressive and simply depicted journey between two realms. We encounter a man in medieval garb who is reaching for the stars. Or are they reacting to something and giving a sign? As if there were nothing in the world that is simpler than portraying a journey between worlds – A traveller wearing a cloak and such light sandals as to seem almost barefoot is on his knees



Flammarion engraving, wood engraving by unknown artist.
First appeared in Camille Flammarion's
L'atmosphère: météorologie populaire (1888). Source: Wikipedia

before the horizon, inching his way forward, with one shoulder already inside this other world. This illustration is attributed to French astronomer and author Nicolas Camille Flammarion (1842–1925) who, as a co-founder of the Société Astronomique de France (SAF), made his living on the cusp of the natural sciences and science fiction. In the 19th century, special importance was assumed by this illustration, the origins of which are actually unknown. But when it was published in the SAF's popular scientific journal under the title The Flammarion Engraving, or *Traveler on the Edge of the Firmament* (or in French *au pèlerin*/On Pilgrimage), it gained fame. Even if Nicolaus Copernicus' model of the cosmos had been known for more than 300 years before Flammarion's day and Ptolemy's concept of an Earth-centred universe that had prevailed in antiquity had long since been discarded, this image is not about either of these two cosmologies.
The traveller, though encoded as a man of the Middle Ages, is moving in the direction of a seemingly bottomless infinity, a cosmos of technical artefacts and clouds meandering like clockwork, and seems to be going from a natural world to an artificial one, a world of the future. What is looming, off in the distance, is the simultaneity of earth, sky and cosmos, of nature and technology, with the horizon as the intermediary nexus between today and tomorrow.

As a metaphor, this image works on several levels. Here, I would especially like to mention two attributes. On one hand, this is a truly perfect symbolic translation of knowledge. This is a matter of knowledge about

our planets and the curiosity leading to insights that can only be surmised at the moment, knowledge that lies in the future but beckons to be discovered. On the other hand, the traveller symbolises, first and foremost, a young person, a seeker who turns his back on what is familiar to cautiously approach new and unknown challenges – thus, an enquiring spirit, unencumbered by what has previously been observed, without the burden of excessive respect or physical limitations. Inherent in young students is an extraordinary power, a clearness and keenness of spirit, as they shuttle between worlds quickly, nimbly and without preconceptions. They too are driven by yearnings, eschew detachment and, though not totally devoid of bias, are nevertheless not as prone to prejudice as older people are. Accordingly, for Ars Electronica Linz, participation in Digital Design Weekend at the V&A is indubitably an opportunity for young students and creative artists. Even if all of Ars Electronica's divisions and departments are constantly seeking the most excellent and innovative projects that dovetail art, technology and society, this contribution to Digital Design Weekend in London is more a matter of experiment than of artistic perfection, more pioneering spirit than pioneering performance, and its focus is on the process of moving forward rather than arriving or staying put. At Digital Design Weekend, one can really sense the pooled power of these travellers between worlds, commuters at the interface of art, science and technology. Apparently seamlessly, they join

together – just the thing to spend a moment with one's head already in the next world while one's feet are still endeavouring to manage the same transition.

If knowledge is to be staged, then there should emerge a physical setting for possibilities, since very and variously creative individuals' takes on one and the same content can wildly diverge. Flammarion's wood engraving is one possible example of how knowledge can be generated. But let me make one thing clear: here, ambition is more important than empirical findings.

The artistic works selected for Digital Design Weekend are further examples of a space for the possibilities of an ambitious urge to know. Prototypes, artefacts and experiments attest to processes that took place in the past and will have an influence on our world in the future. Artistic researchers and scientific creatives share this space and inspire one another and their audience. In any case, the focus is always on the matter of how our world has changed, how it has mutated into an electronic and then a digital world, and now a virtual one full of things that think and learn on their own. This knowledge based on new experiences must, as a first step, be made transportable, communicable and understandable. The second step – closely connected to the first – is already a matter of a critical approach being taken by travellers between worlds. And it calls for precisely the previously mentioned pioneering spirits who come up with stuff like vacuum cleaner as musical instrument (by Yen Tzu Chang), electronic

crickets for sofa and sauna (by Veronika Krenn and Davide Bevilacqua), cocktails à la migration trends (by prazlab), seemingly senseless automatons and robotic creatures with no ostensible function (by Leo Peschta), movable and manoeuvrable necklaces (by Leo Peschta), sewing utensils as electrical measuring devices (by Irene Posch), spice racks as storytellers (by Verena Mayrhofer), and a camera-flash-induced sound installation (by Dawid Liftinger), to name just a few. These ideas are from people who gave free rein to their imagination, venting politically tinged cynicism and raising social issues to assume flagrant significance in the visual and technological discourse.

More than ever, today's young travellers between worlds are in demand and confronted with challenges. After all, with the help of technical instruments and technological processes, we human beings have created a new reality of life that has long been based on our yearnings. The travellers between worlds must first not only encode the yearnings behind the creations; they even have to understand the creations themselves down to the most minute detail in order to also simultaneously call them into question. Acts of staging knowledge today, as in the past – see Flammarion – are often works that radiate especially brilliantly, since some travellers between worlds turn out to also be changers of worlds, and they are needed more urgently than ever on this planet.

Participating artists 2017:
Yen Tzu Chang, Dawid Liftinger, KairUs Art+Research / Andreas Zingerle and Linda Kronman, Verena Mayrhofer, Stefan Tiefengraber, and Jochen Zeirzer.

Participating artists 2018:
Davide Bevilacqua, Veronika Krenn and Vesela Mihaylova (prazlab), Leo Peschta, Irene Posch & Ebru Kurbak.

Biography

Manuela Naveau (PhD), born 1972, is an artist and curator of Ars Electronica Linz and together with the artistic and managing director Gerfried Stocker she developed Ars Electronica Export. She teaches at University of Art and Design Linz as well as at the Paris Lodron University in Salzburg. Her research investigates networks and knowledge in the context of computer-based artistic practice. Her book *Crowd and Art – Kunst und Partizipation im Internet* (Crowd and Art – Art and Participation in the Internet) has been published in 2017 by transcript Verlag, Germany. The book is based on her dissertation, for which she received the Award of Excellence from the Austrian Ministry of Science, Research and Economy in 2016.

www.manuelanaveau.at
www.crowdandart.at

Ars Electronica Linz – The Interface of Art, Technology & Society

Art, technology, society: since 1979, Ars Electronica has been investigating how they are connected and where they interface, scrutinising current developments and manifestations emerging where these interactions are taking place. Ars Electronica is a cultural institution, an educational facility and an R&D lab based in Linz, Austria. Like no other institution, Ars Electronica represents a comprehensive approach in the confrontation with techno-cultural phenomena and enjoys a worldwide reputation for excellence. It comprises four divisions: the Ars Electronica Festival, the Prix Ars Electronica, the Ars Electronica Center and the Ars Electronica Futurelab. These four divisions mutually inspire one another, constituting a circuit of creativity: the FESTIVAL as test environment and the PRIX as competition of the best and brightest – both of them international, artistic, experimental and focused on the leading edge;

the CENTER as year-round presentation and interaction platform – local, educational and entertaining; and the FUTURELAB as R&D facility – innovative, creative, endowed with strong technical competence and implementation skills, and linked up to a global network of universities, research facilities and corporations.

Ars Electronica EXPORT

Since 2004, Ars Electronica has worked together with partners in art and culture, science and education, commerce and industry to produce a diverse array of projects all over the world. The spectrum includes exhibitions and presentations, conferences and workshops, performances and interventions. What these collaborative activities have in common is the inspiration they derive from the ideas and visions of Ars Electronica's worldwide network.

Beyond the Machine

Irini Papadimitriou, Digital Programmes Manager, V&A

> 'Cannot you see, cannot all you lecturers see, that it is we that are dying, and that down here the only thing that really lives is the Machine? We created the Machine, to do our will, but we cannot make it do our will now. It has robbed us of the sense of space and of the sense of touch, it has blurred every human relation and narrowed down love to a carnal act, it has paralysed our bodies and our wills, and now it compels us to worship it. The Machine develops – but not on our lines. The Machine proceeds – but not to our goal. We only exist as the blood corpuscles that course through its arteries, and if it could work without us, it would let us die.'
>
> E.M. Forster, 'The Machine Stops'[1]

In E.M. Forster's short story, 'The Machine Stops', humans live isolated in pods deep underground; a kind of video-screen communication system is how they can contact or talk to others. There is no need to meet or be close with people. Light, food, water,

1 'The Machine Stops', E.M. Forster. Penguin Books Ltd 2011 (originally published November 1909).

communication, clothing, culture, are at the touch of a button, and humans are entirely dependent on the machine that has taken over and that can provide all essentials.

'The Machine Stops' is a nightmarish exploration of the effect of technology on our lives, bodies, relationships and culture. When it was published, in 1909, it must have caused quite a stir. At that time, the world was well into the second industrial revolution with technological changes deep into areas from transportation and machinery to labour and urbanisation.

'The Machine Stops' was apparently Forster's pessimistic response to the work of H.G. Wells and in particular *A Modern Utopia*,[2] which had been published a few years earlier. In *A Modern Utopia* the narrator is transported in a liberal, altruistic, peaceful world, a society of universal education, universal income, equality, fairness and opportunity for all. This world is enhanced and enlightened by technology. In *A Modern Utopia* machinery is everywhere, 'the discovery of new materials, and the appearance of new social possibilities through the organised pursuit of material science, has given enormous and unprecedented facilities to the spirit of innovation'.

Forster, on the contrary, presents us with a dehumanised world, where the machine has replaced labour, skills and most human activity. The machine

2 *A Modern Utopia*, H.G. Wells. Penguin Books Ltd 2005 (originally published April 1905).

manages human life and all needs are met at the touch of a button, while a 'Mending Apparatus' is there to fix any issues. 'The Machine' is invisible and unknown. We don't know if someone controls it or how it operates, and what might happen if one day it stops.

Forster's work, which explores our place in a technological world that is losing the meaning of humanness, is relevant more than ever. We might be quite far away from the world presented above; however, it is not always obvious how much our own world and society are dependent on machines. Our exchanges are increasingly mediated by technology and for the first time we have at our disposal not only access to vast amounts of information, but also a selection of technological tools offering us opportunities and possibilities never imagined before: the chance to make previously unsung voices heard, inclusive, collaborative tools, citizen empowerment and innovation, distributed participatory systems, to name a few. On the other hand, artificial intelligence (AI) is already embedded in many aspects of our everyday life and society and will be driven by it even more in the near future: from healthcare, finance, manufacturing, education and linguistics to business, law, policing, and more. In a constant search for Utopia, we are aiming for advanced technological systems establishing what we believe as superior versions of our world, environment and ourselves. These invisible, complex systems become more and more rooted in everyday

activity; we give them more power and with it more responsibilities, while our trust and dependence on them has become normalised.

At the same time – and mostly thanks to how advanced technologies and AI are being presented in the popular media – most of us have a false picture of these systems and a limited or skewed understanding as to how they have been transforming society. We tend to anthropomorphise technology, to assign machines human behaviours, personalities, gender. When it comes to technology, even the language we use is misleading, presenting a world that sounds magical, immaterial or beyond reach.

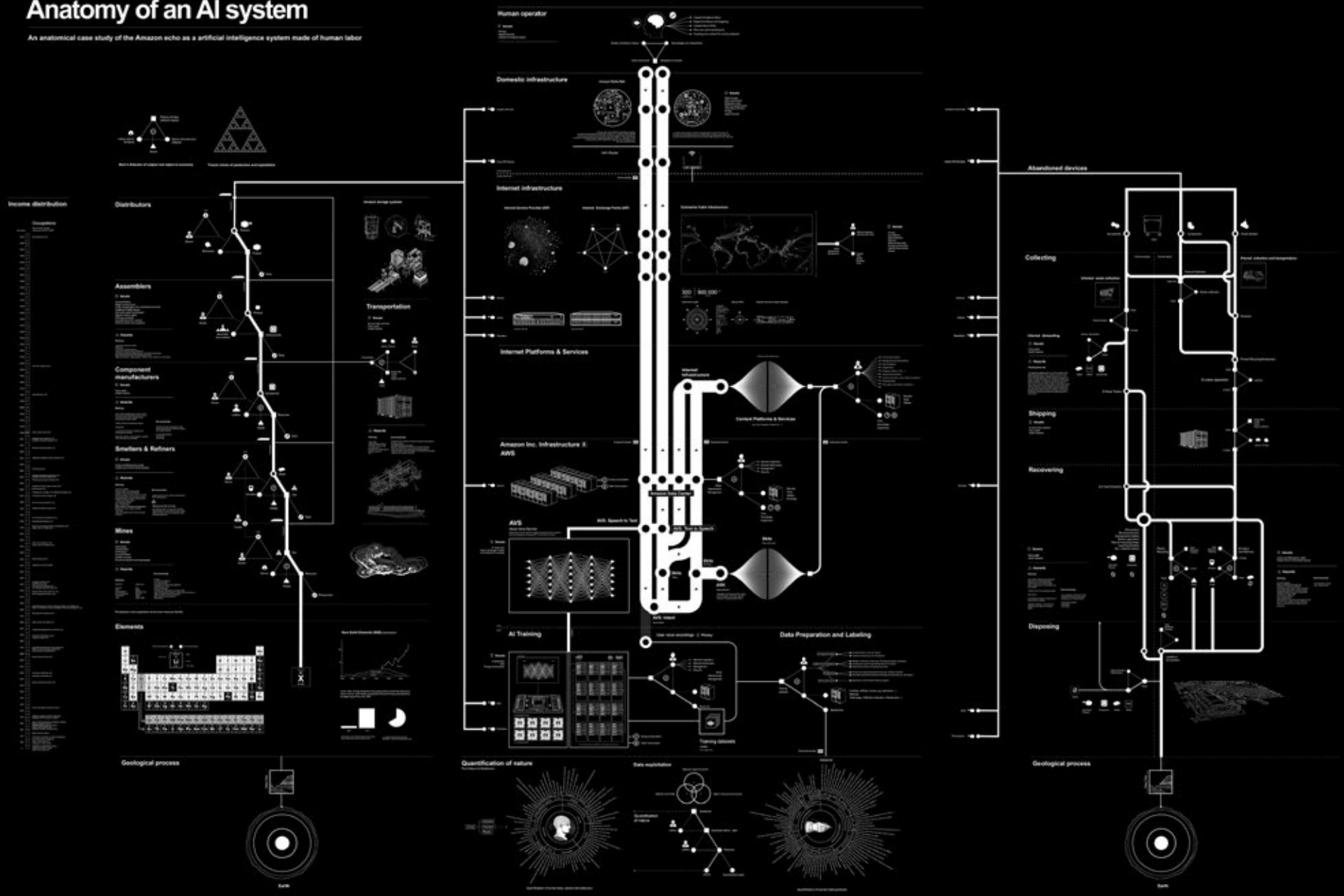
Although we constantly use and are exposed to digital technologies, we ignore what lies beneath: from how and for whom devices are designed, the conditions under which they are made, labour and conflict minerals to obsolescence, data collection, surveillance, and so on. We are surrounded and constantly listened to by a network of connected objects; a small number of corporations have unprecedented access to users' data and can influence or control access to information as never before. And most concerning of all, automated decisions and judgements – based on unfair and biased assumptions[3] – become more and more common, having an impact on vulnerable people or minority groups.

3 The training of machine learning systems uses data generated by humans, which as we know are often skewed or inaccurate and non-inclusive.

Heading towards an automated world, are we becoming accustomed to services, invisible infrastructures and opaque technologies, without asking critical questions or discussing the ethical implications of these services?[4] Should we trust companies with our personal data and privacy and how do we know how automated decisions are made – whether they are fair or how they affect us? How can we stimulate critical thinking skills to navigate these new challenging areas? And what is the role of digital art and public art institutions when it comes to understanding the social issues created by digital technologies? In engaging with 'digital' in a public art institution like the Victoria and Albert Museum (V&A), it is questions like these that we try to explore, creating a space to foster exchange and debate – bringing together the creative sector and tech industry. Digital art and design have a significant role in engaging with and exploring new technologies, and enabling much needed conversations around these to happen. Artists have always had a pioneering role in terms of being the first to reflect on the present, on society, culture and the future, asking difficult questions, while raising awareness about power and powerlessness in the age of digital information.

Similarly, in public art institutions we need to create neutral spaces that can transcend borders

4 The artwork *Anatomy of an AI system* by Vladan Joler and Kate Crawford (2018) is a creative attempt to expose these systems through the use of infographics.



Anatomy of an AI system, Vladan Joler and Kate Crawford, 2018.
Image courtesy of the artists.

and engage different disciplines in constructive dialogue. Spaces like these have an important role in initiating and shaping critical discussions about these pressing issues of our times, foregrounding the impact of technology within society to examine how people can play a central role in shaping the future, rather than being fed a vision of it from a handful of powerful corporations.

Through programmes such as the Digital Design Weekend (DDW) – an annual festival and gathering bringing together artists, designers, engineers, technologists, makers and the public – we have been focusing on our complex relationship with technology, placing an emphasis on collaboration, exchange, participation and critical response. The museum becomes a site in which to engage with contemporary issues, share creative processes and demystify technology. Since its inception, the DDW has invited participants and visitors to explore the intersections of technology, art and design and the state of digital culture through installations, workshops, labs, critical discussions and performances.

Taking the format of a networking and sharing event, built on partnerships and collaborations, the DDW started by exploring 'what is digital' and how it is manifested in our lives and society. Through a series of ongoing projects and conversations, it developed into investigating ideas such as data, AI, the Internet of Things, human–machine relationships, and what 'crafting' or 'engineering' our digital futures might mean: essentially, imagining how we can begin to

unveil these invisible systems and try to understand or explore what lies beneath. Participatory sessions and workshops have offered opportunities to explore digital tools for social change, preparing the ground for activities that bring people together, enabling collaborations and promoting peer production and skill-sharing.

Looking into themes of the personal, public and cosmic influences of technology, we aim to provoke questions about machines and humanness. How can we go beyond dystopian/utopian visions or popular stereotypes, and instead look at the present state of implementation with a human-scale perspective? And how can we enable discussion about our interactions with technology, the social and ethical implications of artificial intelligence, including bias, trust and control? By opening doors to experimentation and collective making, encouraging communities and people to create and participate, question and not passively consume, we can nurture critical thinking and prepare the next generations for new challenges ahead.

Technology will not always be the solution to everything and it won't always save us. We need to be able to see beyond this and keep our future focused on the realities of our world and on a human vision, remembering that we are more than data.

Under the Stone[5] (original title *Sous Béton*, which translates as *Under Concrete*), a novella by

5 *Under the Stone*, Karoline Georges. Translated by Jacob Homel. Anvil Press 2016.

Quebec-based artist Karoline Georges, takes the claustrophobic underground world of 'The Machine Stops' to a different level. Georges presents us with an oppressive structure, a 'Total Concrete', a grey and impenetrable tower that houses all remaining humans in a post-apocalyptic world. The inhabitants are constantly under surveillance and constrained to the tower. They are reduced to their basic needs, fed and drugged by the structure, and trained to carry out tasks that keep the machine going. They passively accept their condition without question or objection.

As the narrative unfolds, we follow the main character, a nameless boy residing in the tower with his abusive parents, who slowly transforms and manages to distinguish himself from the dormant residents by experiencing a sudden awakening.

The world in *Under the Stone* is brutal, depressing and hopeless. Georges reveals a place where people are reduced to passively accepting their reality, without the will to break free from their prison-tower, but again how can they possibly break free if they haven't learned to see beyond their concrete walls? *Under the Stone* presents us with a nightmarish version of the future, one that hopefully will only remain a speculative idea. Finally, the boy transcends the monochromatic walls of the tower and develops the ability to see and to understand the world around him. By empowering himself through questioning the world around him, he can finally see what lies beneath the concrete structure and resist.

Biography

Irini Papadimitriou is a curator, producer and cultural manager, working at the forefront of digital culture in the UK and internationally. As Digital Programmes Manager at the V&A she is responsible for the annual Digital Design Weekend festival as well as Digital Futures, among other projects. Irini is also Head of New Media Arts Development at Watermans, an arts organisation supporting artists working with technology, where she curates the exhibition programme and an annual Digital Performance festival, exploring digital culture from a critical perspective examining the impact of technology within society. She lectures regularly at universities in the UK and abroad. She is a currently an Art & Design Associate with Mozilla and a co-founder of Maker Assembly, a critical gathering about maker culture: its meaning, politics, history and future. In 2018 Irini moves to the new position of Creative Director at FutureEverything.

www.vam.ac.uk/blog/author/irini-papadimitriou

Digital Design Weekend

The Digital Design Weekend is an annual big-scale event that has been taking place at the V&A since 2010, coinciding with the London Design Festival. Every year, the DDW invites over 100 artists, makers and designers to take part in presenting installations and show-and-tell demonstrations, as well as performances, talks and workshops.

This theme for 2018 is Artificially Intelligent, exploring Artificial Intelligence, human–machine interactions, and potential future worlds.

www.vam.ac.uk/event/6YVLW34q/digital-design-weekend-2018-ldf

Becoming Digital; Digital Becoming

Sally Golding

Introduction

'Digital' can be a polarising topic for fractious reasons including the omnipresence of social technologies within our daily lives which provoke concerns around health and privacy, the debate around supersession and corporatisation in analogue versus digital quality with regards to the creation and presentation of media, and wider issues from within the field of archiving – the threat of irretrievable data, corrupted records and, even, the inaccessibility of entire digital objects – evoking and qualifying our emotional attachment to our digital devices. Technological progression may be beneficial for us as a species yet in many parts of the world our waterways and cities are choking with e-waste – by-products of digital machines and components sediment-ising our place in the Anthropocene – dystopian imagery no longer only to be found on-screen in disaster movies. We embrace more mainstream technological advances – the increasing use of robots in the surgical operating theatres of the future and artificial intelligence in

medical diagnostics, and furthermore and closer to the root, we celebrate online digital communities that seek to skill-share and challenge traditional positions of power through networked creation and distribution. Yet within public art the conditions and application of digital technology are still a somewhat nebulous entity (issues abound in modes of presentation, documentation, archiving, and our own ability to critique digital art within the 'long history'[1]), and too often our dialogue is inextricably tied up in the predicament and power of arts funding. Diverging into more abstract artistic concerns, the exhibition *Emotion + the Tech(no)body,* programmed by myself for the Austrian Cultural Forum London,[2] was a creative attempt to consider our cultural and emotional attachment to data and the relationship of our bodies to technology. The exhibition questioned the evolution of both the archive and machine as an ephemeral site for self-imaging and self-construction,

1 A compressed timeline in which digital art has had a much shorter history of being in existence than, say, film – which has only had a slightly shorter history than photography, leading us to consider painting, which emerges as the longest recognised art form and one in which there exists far more established canons of critique than we have yet developed for digital art. A deeper exploration of these and other issues could be sought in Christiane Paul (Ed.), *A Companion to Digital Art* (West Sussex, UK: Wiley Blackwell, 2016).

2 The Austrian Cultural Forum London commissioned *Emotion + the Tech(no)body* for their 2017 autumn exhibition schedule. In addition to the ten artists discussed herein, the exhibition programme also featured two live art events presented by Conny Zenk, as well as Nikolaus Gansterer and Khadija von Zinnenburg Carroll (see www.acflondon.org/events/emotion-technobody). The exhibition also formed part of a wider festival of live music and performance programmed under my curatorial remit – Unconscious Archives Festival 2017 (see https://ua2017.unconscious-archives.org).

by repurposing technology and imbibing it with error, narrative and form.

This text offers two concurrent threads: a creative approach that ruminates on the associations of 'digital' in quasi-theoretical and fantastical ways; and a revision of some of the ideas exposed through the artworks on display in the exhibition that bridge corporeal, emotional and mechanised ways of interacting with digital *availability*. Through this approach I hope to establish a record of the creative endeavours of the artists to broaden the conversation on the diversity of digital arts, and to offer an evocative and personal insight on how digital '*feels*' from my own perspective as both an artist and archivist.

Fleshing digital

For an artwork to be truly 'digital' it is implied that it must shirk its responsibility to 'material' – even though physicality remains a point of critical reflection within technology. We know we are not supposed to peer under the skin of our devices – our smartphones neatly sealed in hardened plastic-and-glass cases: the tamper-proof skin seals are the corporation's evil imposition. But if we do dare to look, we may see a system with which we empathise: the body cut open, the skin peeled back; electrical wire-veins and circuit-brains laid bare. This corporeal calibration is not an entirely new experience but one that is perhaps informed by the cultural absorption of digital technology's forebears. More than 150 years ago people sought to connect early technology with ghosts and otherworldly beings through the rise of 'plausible' scenarios neatly constructed within the religious sect of Spiritualism.[3] The familiar tropes and markers of Spiritualist photography – and public performance – are firmly established in our cultural and also digital lexicon: the mechanics of the séance aided by a wireless radio device; aura and ectoplasm photography created through extended darkroom technique – these familiar recipes baked into a multitude of media across time. In contrast, the comparative emphasis is now on hard science – equating networked computing power with a desire for super-intelligent bodies through artificial neural networks and digital-body augmentation. Curiously, around the advent of Spiritualism emerged the first photographic process, which used egg as a chemical constituent – and now I purely narrativise a theatre in which this becomes a strange melding of technology, the body and religion – the egg being of flesh and pre-life form. I imagine this albumen photographic print[4] being nibbled like the body of Christ in place

3 An excellent exploration of this topic can be found in Jeffrey Sconce, *Haunted Media: Electronic Presence from Telegraphy to Television* (USA: Duke University Press, 2000).

4 'Albumen prints are a variety of photographic paper print in which a finely divided silver and gold image is dispersed in a matrix of egg white. Such prints constitute by far the largest category of objects in 19th century photographic collections. [… becoming] the most widely used photographic printing material.' (Reilly, 1980, pp.93–98) in use from around 1855 until the 1920s. James M. Reilly, *The History, Technique and Structure of Albumen Prints* (USA: AIC Preprints, 1980).

of a morsel of bread, though unlike the photograph, and other than existing minor exceptions,[5] bread is devoid of any fantastic vision.

Body-electric

Three artworks in the exhibition *Emotion + the Tech(no)body* present the viewer with a surreal, sonified corporeal-electrical reality, testing the body's, the machine's, and the entropic universe's ability to communicate through language and sound. Ulla Rauter's work *Sound Calligraphy*[6] uses UV lighting to create a cave-like atmosphere in which nine spectrograms – the 'vocal fingerprints' of a person – are exhibited sparsely on the walls in white hand-painted brushstrokes to be read by a web camera connected to an open source software program that scans and converts the drawings into audio. Ritualistic in appearance, the markings are an 'archive for voices' – an architectural extension of the body in which Rauter uses sonification to reflect on the cognitive processes of speech recognition, which, for her, relate to the idea of the 'disembodied technologist'. Visually sonified yet inaudible (digitally unread) phrases litter the room including: *'I am'*, *'a voice'*, *'identity'*, *'nobody'*, *'without'*, *'a body'*,

5 Such as perhaps, visions of Jesus appearing in burnt toast, and innovation in the 1980s printing process of edible photographic birthday cake icing.

6 Ulla Rauter, *Sound Calligraphy*, 2016. Fluorescent drawings, sonification. www.ullarauter.com

'this is', *'somebody'* – which can be read as either a broken narrative or as singular statements. Meanwhile, the word *'construction'* is emphasised in playback via the camera-software interface on a continuous audio feed. This violet-lit atmosphere is beguilingly cold yet intriguing, as if a dead language is being sifted through a digital translator and broadcast to an unidentified future audience. Christine Schörkhuber's artwork *Something in the Air*[7] uses fan ventilators, voice and electronic circuits, as if seemingly reconnecting us with a long-distant feeling of listening intently to the wireless for the first time on a lonely night. A pre-recorded voice is pushed through a sculptural standalone block of 6 × 6 cubed fan ventilators, resulting in artefacts of air pressure in and around the space of the artwork. The spoken poem, which has been converted into an electrical circuit, playfully integrates words that reflect its process and output: soundcheck, transmission, soundwaves, wind, whispering, pressure and time. The viewer must come closer, bending towards the fan-turned-speaker stack, to sense the ethereal wind-voice. In the sense of the uncanny, the effect is not incomparable to a ventriloquist's raison d'être. Reni Hofmüller's *Resonating Sculpture III – Zuneigung*[8] is a hanging

7 Christine Schörkhuber, *Something in the Air*, 2017. Fans, voice, electronics. www.chschoe.net

8 Reni Hofmüller, *Resonating Sculpture III – Zuneigung*, 2017. Copper conductive tape, fabric, PINE64 free software. Form inspired by: Irmgard Schaumberger. Project support: Jogi Hofmüller and Christian Pointner. https://renitentia.mur.at

sculptural antenna fabricated from copper conductive tape adhered to white fabric netting, which transposes and expands the crease lines of her own palm in large form. Inspired by her own long history with experimental and pirate radio broadcast, the artwork is based on the style of mobile antennas often employed by the pirate radio community – effectively, simple foil strips glued to a tent canvas. The imagined technology-body interjection that arises here is perhaps less a reference to the pseudoscience practice of palmistry or fortune telling (although the German language title translates as *Affection*) as it is a fleshing of the 'secrets of the universe' – energy, frequency and vibration, which Hofmüller reveals to be our hidden everyday surrounds. The resulting sounds are remixed via a software interface which gathers the frequencies into a new radiophonic soundscape; muted and fluctuating electromagnetic signals provide a real-time soundtrack to our electrical bodies and the space that we occupy.

Observation of mass

Examining a digital photograph in my possession that was created over ten years ago, I find a sense of the uncanny adrift in the application of, and response to, the digital medium in its reductive form: pixels, file format, digital compression. Incrementally over the years, each time I click

to open the photograph in question, it appears to me that it is decaying. Not in the literal or physical sense of decay, but slowing, corroding in my mind as my expectations of it exceed its capacity to fulfil its own criterion. In my perception the photo is becoming fuzzier, like a memory slowing evaporating. The limitation of its pixels are a shocking defeat, and a realisation dawns that this digital photograph is slowly moving towards the 'digital black hole' about which contemporary archivists fret; as perhaps I too also ebb towards the possibility of my own 'afterlife'. I postulate whether we will meet in death – atoms (chemicals) and pixels (binary code) crossing paths – but I arrive at the presumption that this is not possible since the 'digital' does not have a body in the typical sense. 'Digital' is our own construction reliant on extraneous circumstances: software emulation, hardware and firmware updates, the ability and experience of an operator or technician (be it a human, or one of artificial intelligence). The digital photograph does not exist in its own right, but as part of a much larger scheme which takes in the consumer-user, the discarded dead bodies of digital devices, and our mind's capacity to understand the chaos of pixels proportional to time (pixels $\propto$ time = corrosion). This paradoxical no-zone might suggest to us that we should issue 'digital' with a body, and in doing so take back our rights to invest in the emotional, if at our own peril.

Static/artefact

Two artworks within the exhibition offer alternative views on archiving technology – from which I infer a harsh ossification – imagining these objects as preservations perhaps intended for, and understood by, a future humanity.[9] Audrey Samson describes her artwork *Goodnight Sweetheart*[10] as a 'data and device embalming service', which she often presents as an evolving participatory installation in which visitors are invited to rid themselves of their emotional technological attachment through a 'digital data funeral'. Samson takes donated USB sticks, computer hard disk drives, CD-ROMS, cassette tapes, GPS devices, digital cameras and smartphones and cracks away their constrictive cases to examine

9 The Memory of Mankind (MoM) project run by Martin Kunze is housed within a historical but now disused salt mine within a mountain in Hallstatt, Austria. MoM is an inspirational example as to the long-future of archiving, in which ceramic discs are used to store and convey data. Kunze postulates that in this way, information may be potentially rediscovered and read by intelligent species long after we are gone. Kunze distributes small biscuit-like ceramic tokens throughout the globe, so that a future civilisation may be led to rediscover the archive. www.memory-of-mankind.com

10 Audrey Samson, *Goodnight Sweetheart*, 2015. GPS navigation device (distance travelled 70,000), resin, metal frame, digital video documentation. 'Have you ever thought of erasing your entire digital footprint? All those selfies, archived emails, tweets, likes, check-ins, late night chat sessions… We never really know what to do with our old storage devices, hard drives, old phones full of our secrets, and sometimes, secrets that we have forgotten about ourselves, or at least forgotten their imprint. Because we are afraid of letting them go, because we are not sure we want to get rid of them, because we wonder what will happen to them, who would find them, and what would they do with them… we do not know whether or not our anxieties are justified, but we still have them.' – Audrey Samson. www.ideacritik.com

Ceramic tokens from Memory of Mankind. The tokens point to the location of the archive housed within the 7,000-year-old Hallstatt Salt Mine in Austria. A kind of treasure map, the tokens may be put to use by a future civilisation.

a subterranean world, which, quite like the problem of an early surgeon looking upon a brain, cannot reveal to the viewer the emotional sensitivity of the data and complex stories that these circuits and discs hold. The cracked devices are immersed and solidified in toxic resin to form a luminous brick-like object, like amber encasing a fossil. Graham Dunning's work *Stone Tapes (master/copy)*[11] is a peculiar intertwining

11 Graham Dunning, *Stone Tapes (master/copy)*, 2015. Stone, resin plaster. https://grahamdunning.com

of sub-cultural references, serendipity, and an advanced appreciation of the form of the cassette tape. Dunning's work here is an obtuse gesture; he elaborates: 'I found a stone on the bank of the Thames which was similar in size to a cassette tape, so made an edition of copies of it. The original tape (master) is exhibited alongside at least one of the copies. The title refers to Nigel Kneale's 1972 BBC drama *The Stone Tape*, in which tragic events of the past are preserved in ancient stones by electromagnetic forces.' Two oblong grey forms with a unique ridge cutting across the upper top at a slight diagonal sit side by side on a plinth, nearly indistinguishable except for the perceptible traits of manufacture. To go along with Dunning's narrative is to peer into the implied layers of noise – unwanted 'sound' told to us through the pits of the found stone or the smooth contours of the resin plaster copy – which play in our minds like record crackle or tape hiss to explore Dunning's ideas of 'time and commemoration'.

Ghoulish economy

Fractures appear in the surface of 'digital' imbibed with a ghoulish predisposition, as if to summon our primal connectivity with folklore and horror. Two disparate texts congeal in my mind to offer some supernatural insights and solidifying texture to this appeal. The 'Television-handed Ghostess' in the

Nigerian writer Amos Tutuola's novel *My Life in the Bush of Ghosts*[12] centralises the significance of daily technologies by providing us with the following scenario: a sore-covered ghost with a TV embedded in her palm offers the lost and tortured protagonist not a fortune-teller-like reading, but instead a practical viewing guide in the form of a TV channel through which he can see back into his home life. This scenario suggests, perhaps, that technology allows us to examine our lives, find an answer to a problem, the remedy to which, however, we may inevitably use to wander the labyrinth of technological dependence. The Australian writer, academic and cultural critic Edward Colless in his essay 'Black Noise'[13] considers a demonology of cloud-based digital interaction in which 'Viruses and bugs, to be sure, but also worms, seeders, hosts, leeches, trolls, zombies; a taxonomy of threats distinct from the ghosts of modernity' create an 'eclipsical' layer of distrust and uncertainty in our faithful subscriptions to corporatised data clouds. Demons and ghosts, it appears, are perhaps a constructive presence within the part of the human psyche which identifies with technology, continuing to persist within renewed contexts through fabled

12 Amos Tutuola, *My Life in The Bush of Ghosts* (UK: Faber and Faber, 1954).

13 Dr Edward Colless' essay 'Black Noise', MIT Press, 2017, described by Colless himself as 'a view onto the cloud from the haunted perspective of modern media', is a text deeply informed by media and cultural studies explored through creative writing. Colless is Head of Critical and Theoretical Studies at the Victorian College of the Arts, University of Melbourne. For context, Colless' full article is available here: https://contemporaryarts.mit.edu/pub/blacknoise

distrust and reckoning, akin to the familiar experience of backup, failure, Ctrl+C which, in turn, reminds us of death and fragility.

Hackspace narrative

The remaining four artworks within the exhibition address different parameters of body–machine synthesis by indirectly addressing lab culture, and digital video and experimental music-making conventions and systems. Stephen Cornford's *Saturation Trails*[14] is an artwork that feels lab-born, reflecting the process under which it was made. Encased across four monitors (modern flat screens positioned both in coffee table-like form as well as a duo mounted to a T-stand, alongside an older CRT rectangular monitor on a stand), abstract digital images blink back in harsh treatment – recordings from the raw image sensors of digital cameras which may have been exposed to infrared laser pulses, hydrofluoric acid and x-ray radiation, appropriating 'clean-room laboratory processes from the opto-electronics industry' in which this microelectronic component, the sensor, is usually developed and

14 Stephen Cornford, *Saturation Trails*, 2017. Digital image sensors exposed with pulsed lasers and hydrofluoric acid; 3 x LCD screens, 1 x CRT monitor and stands, sound. The work was supported by: Optoelectronic Research Centre, University of Southampton, with thanks to Professor Rob Eason, Dr Ben Mills & Neil Sessions. http://stephencornford.net

manufactured.[15] Cracks and ruptures leak through gaudy pink electronic fields, speaking of direct material interruptions which redress the technical prohibition of digital in-camera experimentation. Dispensing with the lens and interrogating the unprotected image sensor (usually considered the most fragile part of a digital camera) frees Cornford to create this indicative and revealing colour palette and additionally a suite of new internal textures. Benedict Drew's digital video *Heads May Roll (radio edit)*[16] blends conventions of video mixing including hyper-colourful stroboscopic flash frames with video wipes morphing into colour bars, with close-ups of pinkened body parts: the creases of a hand, a hairy knee, and again a hand, this time disembodied and shaking to the rhythm of video glitch; with strange, otherworldly yet domestic forms: perhaps bubblegum ice-cream or a pink gelatinous concoction melting.[17] Throughout there appear to be alien landscapes filmed in both stop-frame and de-focused light,

15 This is the terminology that Cornford uses to describe this process, of which more details can be found on his artist website http://stephencornford.net/Saturation-Acid.html. Furthermore, deep insight into Cornford's investigations into areas including media archaeology and the creative use of related machines can be gained through his article *Machinic Augenmusik [in search of the surface noise of digital audio]* published in Rosa and Fales (Eds.), *Shifting Layers: New Perspectives in Media Archaeology Across Digital Media and Audiovisual Arts* (Milan: Mimesis International, 2017).

16 Benedict Drew, *Heads May Roll (radio edit)*, 2014. Single channel HD video, sound, 09:53. Originally commissioned and shown at Matt's Gallery in 2014 as part of a large-scale installation. *Heads May Roll (radio edit)* was presented courtesy of Matt's Gallery. www.benedictdrew.com

17 Speaking to a young attendee at an exhibition event, she identified this as frozen yoghurt melting.

as if attempting to communicate with the viewer through ephemeral mechanisms. The soundtrack – and written text which appears intermittently across the screen – adds a layer of musicality: vocal chords, a sampled synthesised voice offering abstract narrative, plucked string instruments in resonance with the video image. In this way, 'Drew critiques contemporary consumption via a fantastical future world in which the image, word and body are exhausted' (Matt's Gallery). Theresa Schubert's *space=memory*[18] is a generative software work which places in-situ our human brains with that of a slime mould – an early form of acellular life belonging to the oldest species on earth: unevolved, Schubert tells us, 'they are exceptionally well adapted to their environment and needs'. Although as gallery viewers we are reduced to touching the screen with the tip of our finger in order to restart the *Physarum polycephalum* digitally 'growing', we gain deep insight into Schubert's curiosity towards mould cultures as explored through generative computer modelling and reinforced by her work as an experimental mycologist within her DIY laboratory. Davide Bevilacqua and Veronika Krenn's multiple artworks that make up

18 Theresa Schubert, *space=memory*, 2017. Custom code for 2K/4K video output, touch screen, sound. Technical collaborator: Falk Röder. Schubert sites: 'According to Shaviro (*Discognition*, 2015) mental activity is always embodied and grounded in a specific medium, and these mycelium networks or bacteria colonies – simple life forms or organisms – seem to be acting 'as a brain' within its environment.' (Latty and Beekman, 'Slime moulds use heuristics', 2010). http://theresaschubert.com

In Summer Nights I Looked for Insects[19] consist of the production of small sound-generating objects realised as animal-shaped electronic circuits. Constructed in modular form using components of integrated circuits, photoresistors, capacitors, diodes, miniature solar panels, copper wire and piezo transducers, the resulting musical objects personify insect bodies, offering an infantile bond of recognition as we apply innate face processing to two eyes, a nose and a mouth. This feeling of bonding with the synthetic insects is, however, complicated and reinforced by the path of discovery; in this case the pulsing insect-artworks are hidden throughout the exhibition across the Austrian Cultural Forum's embassy-style Kensington townhouse galleries, stairwells and library. These 'electronic impossible inhabitants' remind us that our presence can affect machines, and machines affect us.

Conclusion

Currently, 'digital' presents a point of friction; there is no easy way to navigate the experience of inhabiting and participating in digital culture that does not involve

19 Davide Bevilacqua and Veronika Krenn, *In Summer Nights I Looked for Insects*, 2017. Custom circuits. Originally shown in the courtyard of an abandoned military base in Udine, Italy, as an intervention for manmade and natural environments.http://www.davidebevilacqua.com and http://vkrenn.at. Following the exhibition and in association with the artists, the French online magazine *Makery* published a DIY guide to recreating these musical artworks: 'Create an insect that sings to the sun', January 2018. www.makery.info/en/2018/01/30/creer-un-insecte-electronique-qui-chante-au-soleil.

a game of continuous catch-up (with current advances, tools and trends) or a reduced reading (simplifying terminology and conventions in what is an excruciatingly complex field). However, digital inspired artworks such as these – be they works of art that are either made with digital tools, or those that seek to address the conditions of digital as the form and content itself – diversify our outlook as to myriad artistic expressions with which we may plot this new artistic timeline. Finally, with the growing polarised rhetoric and online vitriol that ferments our sense of digital distrust generated by toxic politicians, bedroom-racists, persistent sexist agendas and ill-informed self-styled critics, there is no better time to look for points of compassion and human narrative in the increasingly online digital world – which in turn can positively inflect the potential for 'digital-material' to garner new artistic ground. Our digital detritus in its multiplicity of forms has the ability to crush or empower the believer.

With thanks to Pia Borg and Khadija von Zinnenburg Carroll for their assistance in editing this article.

Biography

Sally Golding is a British-Australian artist, curator and archivist. Her artistic work encompasses immersive audiovisual performances, sound art releases and participatory installations, which consider liveness in audiovisual art as a mechanism for shared experiences and dialogues within new technological contexts. Her performance work focuses on live interference and generative feedback systems using amplified lighting and light-sensitive audio, while her installations are audiovisual compositions that spatialise the viewer's presence, inviting the audience to interact with the artwork, the space and with others. Sally has presented her solo and collaborative work around the globe, including at Tate Britain; Serralves Museum of Contemporary Art, Porto; Sound of Stockholm; South London Gallery; Digital Culture Centre, Mexico City; Fylkingen, Stockholm; Contemporary Art Tasmania; Institute of Modern Art, Australia; San Francisco Cinematheque; Centro de Arte Dos de Mayo (CAM2), Madrid; Cable Festival, Nantes; Contemporary Art Centre, Lithuania; Audiograft, Oxford; Edinburgh International Film Festival; International Film Festival Rotterdam and Australian Centre for the Moving Image. Sally was a recipient of the 2017 Oram Award presented by the New BBC Radiophonic Workshop and PRS Foundation for women innovating in sound art and related technology.

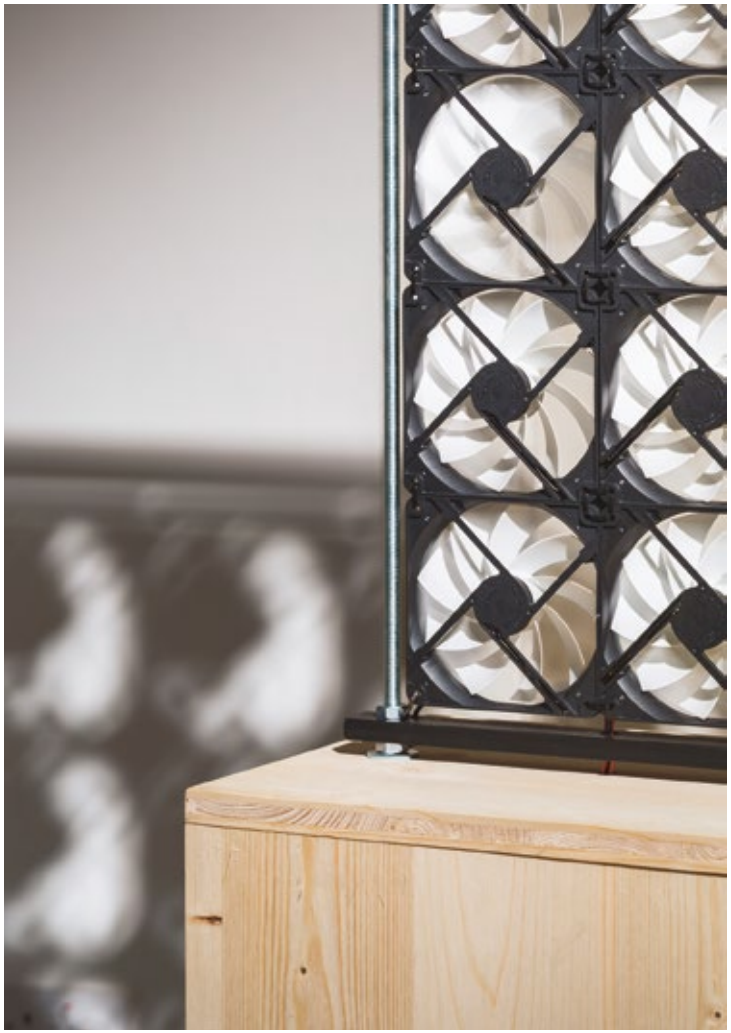
As an archivist and digital imaging specialist, Sally has worked for renowned international galleries, museums and libraries over the last 12 years, a process, as well as a creative and critical tool, that has inspired her own artistic work. Sally has been an instigator of community-focused arts programming for DIY artist-run spaces and festivals to prestigious venues internationally since 2004 through curatorial outlets including OtherFilm (Australia) and Unconscious Archives (UK), working with diverse artists across hundreds of programmes.

www.sallygolding.com

Unconscious Archives

Unconscious Archives is a festival and event series presenting artists at the forefront of experimentation exploring materiality and embodied liveness across sound art and electronic music, experimental media and audiovisual art. Unconscious Archives Festival 2017 (UA2017) featured over 40 artists and writers, incorporating three live events and the eight-week exhibition *Emotion + the Tech(no)body*. UA2017 was described as 'a platform for women defying genres and breaking boundaries, raising the bar of opportunity for female-identifying and transgender artists internationally' (Resident Advisor), and as 'a titanic program for an extraordinary festival' (Makery).

www.unconscious-archives.org
www.ua2017.unconscious-archives.org

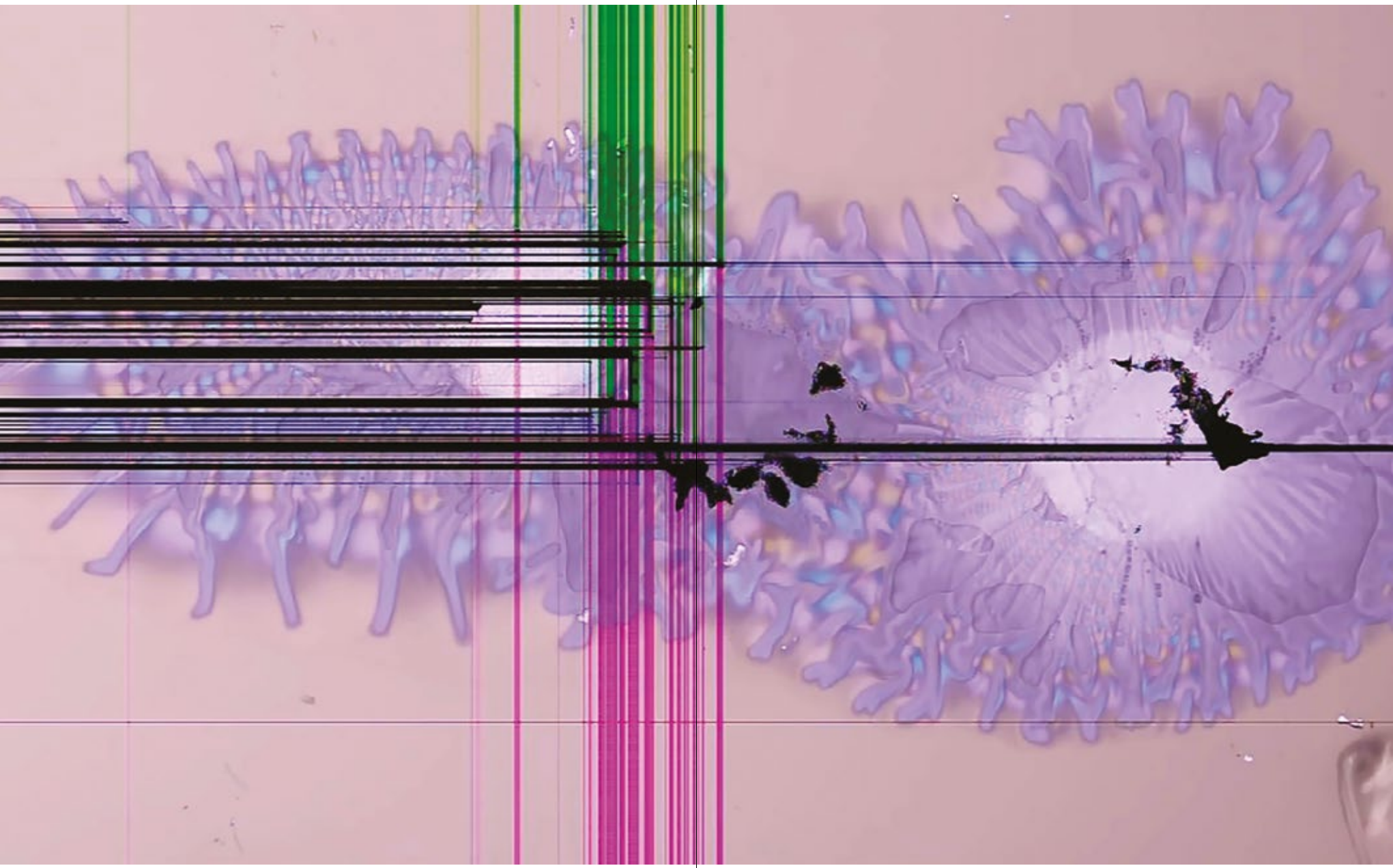


Christine Schörkhuber, *Something in the Air*, 2017.
Photo by Damian Griffiths. Next page: photo by George Darrell.

Davide Bevilacqua and Veronika Krenn, *In Summer Nights I Looked for Insects*, 2017.
Photo by Damian Griffiths. Right and next page: photo by George Darrell.

Graham Dunning, *Stone Tapes (master/copy)*, 2015.
Photo by Damian Griffiths.

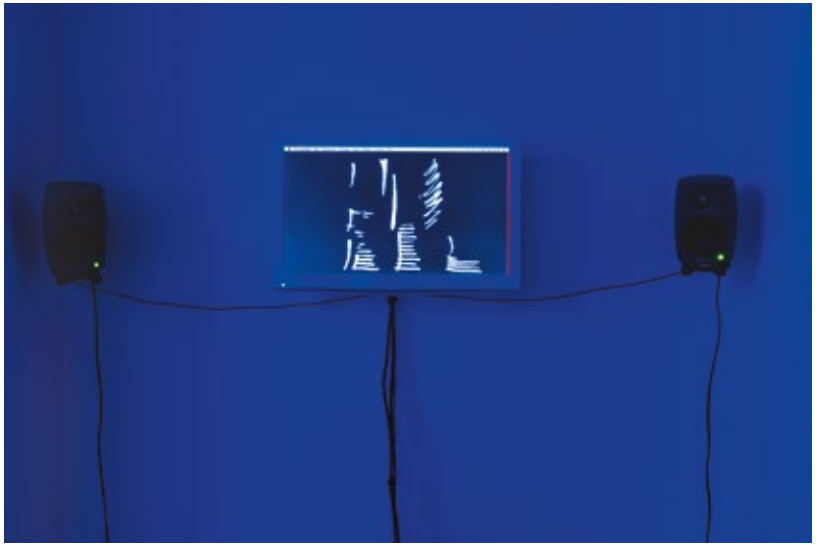
Left: Reni Hofmüller, *Resonating Sculpture III – Zuneigung (Affection)*, 2017. Photo by Damian Griffiths.



Stephen Cornford, *Saturation Trails*, 2017. Photos by Damian Griffiths.
Previous page: video still, cropped. Image courtesy of the artist.

IDENTITY

CONSTRUCTION



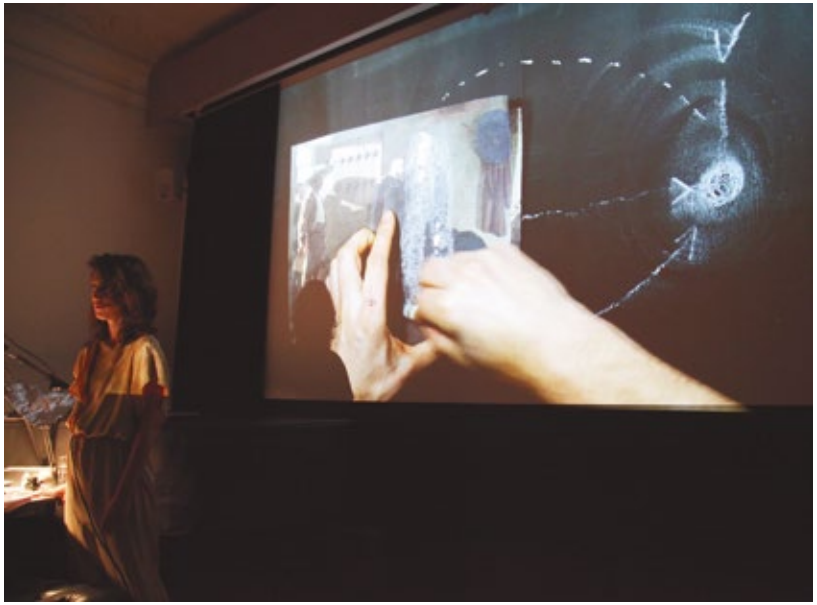
Above and previous page: Ulla Rauter, *Sound Calligraphy,* 2016.
Photo by Damian Griffiths.

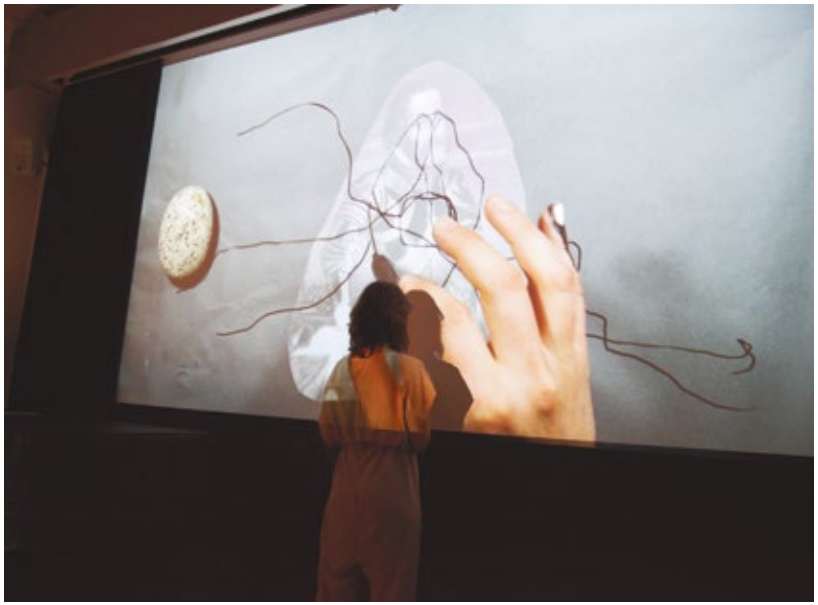
Audrey Samson, *Goodnight Sweetheart*, 2015.
Photo by George Darrell. Next page: photo by Damian Griffiths, cropped.

Theresa Schubert, *space=memory*, 2017. Photo by Damian Griffiths.

Right: Benedict Drew, *Heads May Roll (radio edit)*, 2014.
Photo by Damian Griffiths.

Next page: Benedict Drew, *Heads May Roll (radio edit)*, 2014.
Video still, cropped. Image courtesy the artist and Matt's Gallery, London.





The Restitution of Complexity, performance at the ACF by Khadija von Zinnenburg Carroll and Nikolaus Gansterer, featuring sound artist and musicologist Christopher Haworth (2017). Pen and ink, diagrams, paper, charcoal, paint, various objects, Mictlāntēcutli, leg rattles, flashlight, feather, sound, photographs, glass box, Quetzalcoatl, archives and the unconscious. Images courtesy of the artists.

Colour reproductions

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Mario Klingemann, *You Should Have Called*, 2017.
Image courtesy of the artist.

p. 49
Addie Wagenknecht, from the series *Alone Together*: *self-portrait – as a young women after a hundred years and 12 seconds*, 2017.
Image courtesy of artist.

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