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Curating Superintelligences: A Reader on AI and Future Curating

Edited by Joasia Krysa and Magdalena Tyżlik-Carver

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Acknowledgements

This book was conceived in the early months of the COVID-19 pandemic in 2020, a time when curatorial institutions around the world rapidly pivoted to digitise their programmes and make cultural content accessible online. What began as an urgent adaptation to crisis soon raised ongoing questions about the nature of curating and its relationship to digital infrastructures, and the role of advanced technologies, particularly artificial intelligence, in shaping cultural production and reception beyond exhibitionary forms. These concerns build on a longer trajectory of inquiry shared by the editors and contributors, who have been engaging with these issues over the past two decades, exploring what they mean for curatorial agency and the evolving ideas of curatorial, human, or machinic intelligence. This edited volume represents a collective effort to think with and through the idea of "superintelligences," and we are deeply grateful to all the contributors to this volume: Dominik Bönisch, CROSSLUCID, Marialaura Ghidini, Olga Goriunova, Francis Hunger, Leonardo Impett, Victoria Ivanova, Eva Jäger, Nathan Jones, Murad Khan, Nora N. Khan, Jason Edward Lewis (Kanaka Maoli/Samoan), Mikhel Proulx, Nicolas Malevé, Gabriel Menotti, Lívia Nolasco-Rózsás, Alasdair Milne, Christiane Paul, Helen V. Pritchard, Tom Schofield, Skawennati (Kanien'kehá:ka), Sam Skinner, Katrina Sluis, Winnie Soon, Gaia Tedone, Suzanne Treister, Elvia Vasconcelos, Ashley Lee Wong, Mi You, Martin Zeilinger, and Gary Zhexi Zhang.

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Joasia Krysa & Magdalena Tyżlik-Carver
London/ Liverpool/ Aarhus, November 2025

Introduction: Towards Collective Practices with Humans, Machines, and Others

Joasia Krysa and Magdalena Tyżlik-Carver

Curating Superintelligences addresses a shift in the contemporary curatorial field largely attributed to the ubiquitous cultural presence of computational technologies and the rapid developments in Artificial Intelligence. It speculates on the implications of machine and human 'superintelligences' (that surpass human intelligence as we understand it) for contemporary art and culture, and new possibilities for curating beyond existing paradigms and fields of knowledge. We see this as an opportunity to raise ethical concerns resulting from the very foundations on which AI is built, and to speculate on alternative frameworks and curatorial practices where possible superintelligences may emerge from collective endeavours between humans and machines.

Introducing key terms

To clarify our terms, 'intelligence' is not a unified or singular entity, but rather a collection of relational processes that enable learning, adaptation to context, understanding of complex ideas and communication with others. Some humans are more skilful in these tasks than others, but how this takes place is connected to a long history of epistemic violence that has tended to occlude neurological differences and perpetuate stereotypes related to protected characteristics (such as race, gender, age, disability and geography). The general conception of intelligence frames it as a product of the mind defined as 'an orderly thing' living 'inside an individual's brain', and that follows 'an implicit, reliable "logic" that could be convincingly modelled with modes of computation derived from the observation of social events.'[1] It is these principles that have facilitated the translation of natural intelligence, traditionally associated with the minds of humans and animals, to the computational context.[2]

Once intelligence is transferred to machines as artificial intelligence, the claim is that many human tasks can be performed efficiently by computational means. Moreover, and despite the broad analogy to the brain — even if understood as a distributed one — machine intelligence operates within the confines and ingrained prejudices of its training data and statistical logic, leading it to perform well for some tasks like speech and image recognition but lacking the broader cognitive and emotional capacities of humans. AI applications can excel in specific scenarios and respond in a human-like manner, yet have limitations in the deep understanding of social contexts, handling complex or ambiguous questions, constrained as they are by

1. Jonnie Penn, 'Animo Nullius: On AI's Origin Story and a Data Colonial Doctrine of Discovery', *BJHS Themes* 8 (January 2023): 20, https://doi.org/10.1017/bjt.2023.14.

2. Analysing the intelligence of AI models might be somewhat futile. Just as there is no one way for humans to be intelligent and many definitions exist that describe human intelligence, there is not one definition for artificial intelligence. It is true, however, that many definitions of AI reference as their source a 1955 research proposal by McCarthy, Minsky, Rochester and Shannon, which suggests that 'every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it'. See John McCarthy et al., 'A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence, August 31, 1955', *AI Magazine*, Vol.27, no.4 (2006).

the statistical confines of algorithms and data.[3] The large language model ChatGPT is a good example, and if you ask it whether it is intelligent, it responds candidly, 'ChatGPT, like other advanced AI models, can be considered "intelligent" within certain contexts and definitions. However, its intelligence is fundamentally different from human intelligence.' In a fuller context, it is important to acknowledge that artificial intelligence is founded upon and maintained by labour exploitation and environmental damage, and the colonial logic of extraction of resources and data alike. As such, it is a perfect example of capitalist technology.[4]

While human and machine intelligence are different, issues of positionality remain, including how to define intelligence, and what models have been used as the basis of such definitions. Indeed, the model that has been predominantly used in the context of AI research is that of the rational human subject whose measure of intelligence is supported by a Western tradition of reason and rationality.[5] This 'universalized figure of the knowing subject' is one of the main premises in AI development that tends to erase 'specificities of embodiment, location and relation in knowledge practices.'[6] However, as Indigenous scholars illustrate, there are alternative models for relating to AI where it might be treated as kin, advocated by Jason Edward Lewis et al.[7] This offers a counterpoint to the centrism of the rational human, or similarly universalising transhumanist concepts of

3. In machine learning, the term 'stochastic parrot' is a metaphor to describe the theory that large language models, though able to generate plausible language, do not understand the meaning of the language they process. See Emily M. Bender, Timnit Gebru, Angelina McMillan-Major and Shmargaret Shmitchell, 'On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?', *FAccT '21*, 3–10 March 2021, Virtual Event, Canada, ACM ISBN 978-1-4503-8309-7/21/03, https://doi.org/10.1145/3442188.3445922.

4. Jasmina Tacheva and Srividya Ramasubramanian, 'AI Empire: Unraveling the Interlocking Systems of Oppression in Generative AI's Global Order', *Big Data & Society* Vol.10, no.2 (1 July, 2023): 20539517231219241, https://doi.org/10.1177/20539517231219241.

5. Stephanie Dick, 'Of Models and Machines: Implementing Bounded Rationality', *Isis* Vol.106, no.3 (2015): 623–34, https://doi.org/10.1086/683527.

6. Lucy Suchman, 'The Uncontroversial "Thingness" of AI', *Big Data & Society*, Vol.10, no.2 (1 July, 2023): 20539517231206794, https://doi.org/10.1177/20539517231206794.

7. Jason Edward Lewis, Noelani Arista, Archer Pechawis and Suzanne Kite, 'Making Kin with the Machines', 16 July 2018, https://doi.org/10.21428/bfafd97b.

Singularity proposed by Ray Kurzweil, or the vision of apocalyptic futures that Nick Bostrom and many of Big Tech CEOs have warned us about. Such visions of superintelligence — which see it as surpassing human intelligence in ways that are considered detrimental for humans or that exclude certain subjects — limit the possibilities not just for AI but for many others.[8]

In addition to recognising the limitations of AI, the intention of this book is to open up expanded notions of intelligence and to engage with other ways to think with, make with, and curate with AI and data practices. A posthuman understanding of intelligence would modify concepts of cognition and intelligence to suggest alternative hybrid forms. So-called *Artificial General Intelligence* (AGI) is one example of this, in which machines are imagined to be able to understand, learn and apply knowledge across various tasks, similar to, or in excess of, human cognitive abilities, and in the future possibly using quantum computing to implement new frameworks of reasoning and logic. Furthermore, the concept of *Superintelligence* (SI) might take a form of AI that surpasses human intelligence in all aspects, including the ways in which we conceive of creativity and knowledge. Despite the clear threats to imagination and critical thinking, might there be other ways in which more-than-human perspectives can be productively engaged?

Superintelligence remains a speculative trope, and is rightly the topic of ethical concern, partly because it assumes a hierarchical model of intelligence. However, the usefulness of this new model of rationality that is being proposed, we believe, is not so much in fuelling affirmative transhumanist fantasies, but in offering speculative scenarios, in examining contemporary society and technological advancement in the present, and in exposing some of the myths of corporate AI. This speculative dimension is explored by writer and critic Nora N. Khan, whose essay opens this volume by charting alternative visions of AI that evolve into AGI and ASI (Artificial Superintelligence).[9]

8. For a critical response to such visions of AI, see recorded episodes in the series of 'Mystery AI Hype Theatre 3000', by Dr Emily Bender and Dr Alex Hannah, https://www.dair-institute.org/maiht3k/.

9. Nora N. Khan, 'Towards a Poetics of Artificial Superintelligence: How Symbolic Language Can Help Us Grasp The Nature and Power of What is Coming', first published in *After Us*, no.1, ed. Manuel Sepulveda, London,

According to Khan, we need new forms of alien intelligence because the 'alien and the artificial are always becoming,' and since 'they are always not quite yet in existence, they help us produce new and ecstatic modes of thinking and feeling, speaking and being.' In response, the various chapters of *Curating Superintelligences* contribute to a speculative understanding of superintelligence, which when applied to curating enables us to redirect our attention to new spaces of possibility that might lead to new forms of curatorial thinking and doing — to networks of distributed curatorial intelligence shared across a diversity of humans and nonhumans.

Curating Superintelligences points to possible alternatives where human intelligence, curatorial knowledge and artificial intelligence reach beyond oppressive tendencies such as extraction, surveillance and exploitation, towards future forms resulting from collective conditions for different intelligences to enter relations of mutual support, living and knowing. This is what is meant in this context by curating superintelligences.

Exploring curating and technology

The line of discussion outlined above builds on scholarship and curatorial practices at the intersection of curating and technology, including by contributors to this book and previous research of the editors. Specifically, it makes reference to an edited volume from 2006, also in the DATA browser series, entitled *Curating Immateriality: The Work of the Curator in The Age of Network Systems*, edited by Joasia Krysa, which introduced the idea of curatorial engagement with computational technologies at a time when it was relatively new.[10] Discussions at that time were mainly focused around curating technology-based art, or new media art, using the terms 'new media curating' and 'digital curating', referring to *what* was being curated, and at a time when cultural institutions generally perceived the internet as a space for documentation or communications. In contrast, the book shifted the discussion from curating *what* to *how*, linking

September 2015, revised for *Atlas of Anomalous AI*, edited by Kenric McDowell and Ben Vickers (Rotterdam: Ignota Books, 2020).

10. Joasia Krysa, *Curating Immateriality: The Work of Curator in The Age of Network Systems* (New York, NY: Autonomedia, 2006), http://www.data-browser.net/db03.html.

curating more overtly to computational processes, conceiving of the internet as a curatorial site, and arguing for technology to be understood not simply as a tool but as an integral part of the curatorial process, demonstrating curatorial agency in its own right. Introducing the term 'software curating', Krysa proposed that curating could be understood as a *distributed open system* (drawing on the properties of distributed networks) expanding the figure of the curator to other entities — including computer programmers, software, machines and technological and human networks of participants — an (im)material assemblage of both human and nonhuman agencies.[11]

The concept of 'posthuman curating', introduced later by Magdalena Tyżlik-Carver (2016), expanded on Krysa's 'software curating' and Olga Goriunova's 'platform aesthetics'[12] to account for the complexity of 'intra-actions'[13] between people, machines, software, platforms and institutions.[14] In this proposition, not only is curating a technology distributed across human and nonhuman agents, but acts as a *biopolitical force* and a shared condition where humans and nonhumans are captured and organised into digital systems of daily interactions between users, software and platforms. This form of capture extracts ordinary experiences into data. In effect, curating becomes

11. See Krysa's earlier work on this, a doctoral thesis entitled *Software Curating: The Politics of Curating in/ as Open Systems* (2008); an experimental curatorial software project *Kurator* (London: Tate Modern, 2005); a chapter 'Kurator — a proposal for an experimental, permutational software application capable of curating exhibitions' in *Networks*, ed. Lars Bang Larsen, Whitechapel: Documents of Contemporary Art (London: Whitechapel Gallery and MIT Press, 2014), and her most recent chapter, 'Curatorial Authorship' in *The Encyclopedia of New Media Art*, ed. Vince Dziekan (London: Bloomsbury, 2025).

12. Olga Goriunova, *Art Platforms and Cultural Production on the Internet* (London: Routledge, 2012).

13. Intra-action is a term defined by Karen Barad as distinct from 'interaction' to recognise that agency is not pre-established but resulting from relations animated by material bodies (human and nonhuman) that take part in these relations. See Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham, NC: Duke University Press, 2007).

14. Magdalena Tyżlik-Carver, 'Curating in/ as Common/s. Posthuman Curating and Computational Cultures' (PhD Diss., Aarhus; Aarhus University, 2016); Magdalena Tyżlik-Carver, 'Posthuman Curating and Its Biopolitical Executions: The Case of Curating Content', in *Executing Practices*, ed. Helen Pritchard, Eric Snodgrass and Magdalena Tyżlik-Carver (London: Open Humanities Press, 2018), 171–89.

an *infrastructural* part of systems within which data are generated, collected and selected in increasingly automated ways.[15] Posthuman curating identifies the potential of distributed curatorial systems for creation of commons within digital environments on the one hand and on the other it points to the extractive and enclosing capacities of such systems.

While the concepts 'software curating' and 'posthuman curating' define conceptual frameworks to understand emergent forms of curating, *Curating Superintelligences* aims to develop this further in relation to advancements in AI. The book situates curating in the context of current discussions, from literary to computer science perspectives, and the histories of computational curating, those known and less known. Against this backdrop, we highlight examples of projects by curators, artists and theorists engaged in alternative forms of curating with technologies such as machine learning, computer vision, virtual reality, non-fungible tokens and blockchain. The book explores how the interactions of human, nonhuman and more-than-human entities co-constitute the curatorial, and how they in turn expand and/or limit curatorial practices and knowledges in the light of advancements in technology. At the same time we acknolwedge that the accelerated speed of current developments in AI technologies, in particular over the last five years and since conception of this book, is beyond the scope of this publication.

In taking such an approach, we acknowledge that curating is not neutral, and nor is the knowledge that it produces. Part of the challenge is to account for the technological bias and imperial legacies from which contemporary curating has emerged. Both the practice of curating and AI are characterised by colonial tropes of capture and appropriation of objects and people, how they are represented historically through practices of documenting and indexing for museum collections, and today in contemporary datasets and databases. Like AI,

15. Magdalena Tyżlik-Carver, 'Interfacing the Commons. Curatorial System as a Form of Production on the Edge', *A Peer-Reviewed Journal about: Public Interfaces*, Vol.1, no.1 (January 31, 2011): 16–17.

curating is a technology that orders the world and our knowledge of it in particular ways.[16] A practice of 'unlearning imperialism'[17] in curating would require us to look more closely at collections, exhibitions and datasets, to mention only a few contemporary curatorial formats, so that we start to see them beyond their immediate association with a process of gathering of objects and the care that is put into their display and preservation. Such phenomena have also to be understood in direct relation to all of the actions that are part of collecting, which include uprooting, looting, deprivations and dispossession. While this book engages with these subjects only to a limited degree, we remain aware of possible violences present in contemporary forms of curating that develop in parallel to the extractivist logic of AI.

The main point of the book is to signal that curating, like intelligence, is never settled but always in a state of flux. Its connection to emergent technologies like AI allows us to produce new curatorial speculations and forms, and in turn enables a reassessment of curating and its core precepts and logics. The book asks, what lessons can be learnt from this coming together of intelligences? What can the practice of curating learn from AI? What can AI learn from curating, and how can both unlearn knowledges derived from the centralised and colonialist frameworks of humans and machines? What kind of future infrastructures and curatorial practices can develop from the coming together of diverse human and non-human entities? What new kinds of curatorial knowledge can emerge from reclaiming categories — such as automation, machine, nature, women, people of colour, Indigenous people,

16. For example, the cabinet of curiosities was an early modern invention whose function was to house collections of objects brought back from the New World, and symbolised the knowledge and education of its owner, as well as privileged access to this new knowledge. The fact that such collections rapidly proliferated among princes and nobles of Europe at the time of the so-called 'Age of Exploration' is directly linked to colonisation and its effects: the subjugation of nature, Indigenous peoples and their cultures.

17. This is in direct reference to the book *Possible Histories: Unlearning Imperialism*, in which Ariella Aisha Azoulay challenges readers to place the origins of photography in 1492, the year of the so-called 'discovery' of America, rather than in the nineteenth century, 'when European white males enjoyed a certain cultural, political, and technological wealth and could dream of recognition as glamorous inventors if and when they succeeded in developing further ways to fragment, dissect, and exploit others' worlds to enrich their own culture'. Ariella Aisha Azoulay, *Possible Histories: Unlearning Imperialism* (London: Verso, 2019, 20–21).

LGBTQIA — derived from their historical positions in knowledge taxonomies as epistemological objects of study rather than curating subjects and agencies? What new understandings, relations and practices can emerge once open to the possibilities afforded by expanded human and machine epistemologies?

Outlining structure and contributions

In *Curating Superintelligences*, we bring together new and existing contributions, highlighting ideas and projects that address these questions through topics including the convergence of AI and creative practices, new institutional infrastructures and economic models, emerging research areas and methods, and alternative curatorial forms. These also operate across different registers, from academic essays to artistic and curatorial projects, to case studies and research reports, reflecting the diversity of approaches and forms of discourse and practice constituting the developing field.

The book is organised around three interlinked sections. The first section, **Conceptual Threads**, introduces key terms, focusing on AI from wider literary and computational perspectives, and establishing links between AI, automation, datasets, machine learning algorithms and creative practices. The contributions by writers, computer scientists, artists and theoreticians touch upon colonial and corporate aspects of AI, its inherent biases and ethics, as well as new approaches to AI including queer practices.

In the opening essay *Towards a Poetics of Artificial Superintelligence* (first published in 2015 and updated in 2020), writer **Nora N. Khan** calls for new language and imaginaries beyond anthropomorphism, 'to access what we can intuit is coming but can't prove or describe directly'; metaphors that 'bridge the human and the unknown' and that can 'help bridge inequities in rate and scale.' The essay points to the emergence of a future world in which humans are not the central intelligence but 'irrelevant bystanders' to artificial superintelligence, and ponders what this might mean. Moving from a literary to diagrammatic way of thinking of AI, artist **Elvia Vasconcelos's** contribution, *A Visual Introduction to AI* (2020), presents a collection of sketches as accessible maps to the history of AI and the basic components of the complex architecture of artificial neural networks.

The intricacies of AI/ Machine Learning processes, and of datasets in particular, demonstrate how and what computers recognise — and indeed mis-recognise — in an image. Computer-vision systems make decisions, and as such exercise power to shape the world in their own image, and further reflect existing biases — as explored by computer-scientist and philosopher **Murad Khan** in *Notes on a (Dis)continuous Surface* (commissioned for this project in 2021). His text focuses on ethical questions over the role of automated data-processing instruments, specifically machine-learning algorithms, and the role they play in further entrenching existing racial inequalities, racial biases and practices of discrimination, asking 'both how race is understood, and what can be achieved by encoding this understanding.'

In her essay *The Automation of Creation: From Template Art to AI* (commissioned for this volume), media theorist and curator **Olga Goriunova** demystifies AI by tracing its legacy to a template that has occupied Western art and culture since modern times, namely that of a rational Subject, which is now also imbued in generative forms of AI models. She recognises that the interest in AI shifts from 'an art object created with AI, to the Subject that creates it, namely AI', and ends with the provocative question: 'what will happen as we keep collaborating with the machines' if 'the last time we invented forms of collaboration with the machines, Facebook happened?' While Goriunova questions our ability to learn from the past, artist **Suzanne Treister** subverts an extractive model for art-driven collaborations with machines and AI in her work *MI3 (Machine Intelligence × 3)* (2018). The work uses Google's machine learning algorithms to process three bodies of datasets (recent and historical writing concerning technological society; US military department documents; and online texts on religious belief systems) to generate new images — works of art based on seven illustrations by William Blake — and a diagram that visualises the process, exposing the procedures of this collaboration.

Another artwork presented in this section, *Crash Blossoms — Torque Editions* (essay commissioned for this volume) by **Nathan Jones**, **Sam Skinner** and **Tom Schofield**, is based on a type of artificial intelligence called Recursive Neural Nets (RNN), used to synthesise past-present-future headlines taken from the news archive at The British Library. This process produces a strange new language based

on semantic ambiguity, which the artists call 'headlinese' resulting from the collapse of language into multiplicities of human and machine intelligences, rather than subsumption of all into technological singularity. In *Queer Motto API* (first iteration presented in 2019), artists **Winnie Soon** and **Helen V. Pritchard** propose software-as-service and in-service of other imaginaries, those 'urban dreams lying in wait' and 'antifascist guiding principles of living.' The project is a direct response to and refusal to accept Big Tech standards of data processing. Refusal messages are generated from datasets sourced from queer and intersectional texts to 'process sequences of collective voices' and to 'reorganise and queer our collective life.' The artists open up the API (Application Programming Interface) for others to build their own versions, and they provide instructions on how to do it.

These examples of artistic collaborations with AI are instances of imaginaries that attempt to go beyond the legacies of the concept of the Subject reproduced by AI systems that stifles possibilities for AI to develop otherwise. The artists generate new agents to interrupt subjects and languages present in the AI-based systems, and they inject new ones that are often left open to possibilities of further intervention into the corporate model. It is in this vein that we ask what is possible when AI becomes part of curating and when curating becomes part of AI. To address this, we examine some of the histories of developments in curating with digital technologies.

The second section, **Expanded Curatorial Field** situates curating in the broader context of technological developments and the rise of the internet in the 1990s. Here, the authors, many of them curators, highlight the intersecting histories of curating and networked and computational technologies. These include shifts in the wider curatorial field expanded by digital platforms, models of curating online, new strategies converging physical and virtual exhibition spaces, changing institutional infrastructures, and new digital economies.

This section opens with **Christiane Paul's** updated version of the chapter that was originally written for *Curating Immateriality* (2006). Entitled *Flexible Contexts, Filtering and Automation Models of Online Curatorial Practice* (2006/ 2021), the essay outlines the effects of networks, platforms and collaborative exchange on the curatorial

process, and discusses different models for online curatorial practice. The updated version of the text reflects on the effects of the recent COVID-19 pandemic and the changes it necessitated, amplifying 'the fluidity of boundaries between online and physical space.' Moving from the broader analysis of the field, **Marialaura Ghidini's** chapter *Curating on the Web: The Evolution of Platforms as Spaces for Producing and Disseminating Web-Based Art* (revised for the volume from first publication in 2019), traces the evolution of these online platforms, and subsequently new exhibition formats. Offering a timeline of these developments from the early 1980s to more current projects, Ghidini reflects on the influence of the pandemic on curatorial practices, and strategies that reflect the need for human contact and devising connections between online and offline spaces more boldly.

The relation between offline and online spaces frames the project *Aboriginal Territories in Cyberspace (AbTeC)*, co-founded in 2005 by Jason Edward Lewis (Hawaiian and Samoan) and Skawennati (Kanien'kehá:ka). **Mikhel Proulx's** chapter *Collaboration and Community in Aboriginal Territories in Cyberspace* (commissioned for this volume), written together with **Lewis** and **Skawennati**, 'gives insight into curatorial concerns from Indigenous perspectives' with a focus on community, interdisciplinarity and pedagogy in virtual worlds. Formed as a research-creation platform, the project provides a stage for community-driven works that engage with the question of what it means to be Indigenous in cyberspace. The chapter unravels the history of AbTeC, showcasing its contribution to the wider curatorial field in the context of digital media by carving a territory dedicated to Indigenous ways of being in cyberspace.

Another example of curating online is presented in the essay *Curating Platforms* (commissioned for this volume) by curator and educator **Mi You**. Discussing art on digital platforms as a form of curation of visual content and social relations, she describes the case of commissioning and curating two digital artworks for the 13th Shanghai Biennial in 2020/21, titled *Jimeimen and ReUnion*. To curate under the volatile conditions of the pandemic and art biennial context provokes an operationalisation of digital commercial social media platforms as carriers of social and creative forces to make openings towards alternatives, even if only temporary. Exploring the transformation of wider institutional infrastructures, **Gabriel Menotti's** essay *Virtual*

Exhibits: Museum Infrastructures and the Management of Artworks' Presence (commissioned for this volume) highlights strategies developed by museums that use Virtual Reality (VR) to expand their audience reach while maintaining control of access and interpretation of artworks. The text argues that encapsulating an exhibition trend that shifts from curatorial interpretation to audience experience, VR induces a new technopolitics of presence.

Artistic strategies for controlling the artworks beyond established conventions of the art market are discussed by **Ashley Lee Wong** in the chapter *Beyond Ownership: Sustaining Art as Practices and Processes* (commissioned for this volume). It argues that the value of the artwork that circulates across online and offline communities and economies is shaped by 'virtual experiences, engagements on social media, as well as the real-world interactions with a work in a gallery.' In this view, artists create not only art objects but also environments, social and technological, that can sustain experience and engagement with artistic objects. Another aspect of the changing nature of an art object is discussed in **Martin Zeilinger's** essay *The Becoming-Curatorial of Digital Works of Art* (commissioned for this volume), addressing how curatorial agency becomes a property of the artwork itself. Examples include digital artworks based on smart-contract technologies such as blockchain and non-fungibles tokens (NFTs), showing how this displacement of agencies is the result of the dynamism of the networked environment in which these digital artworks exist. Concluding the chapter is the observation that the technology-induced autonomy of the artworks entangled with human agents evidences artists' desire to release the work from the power structures of the art world and capitalist treatment of art as commodity.

Shifting the discussion to curating that arises from computational infrastructures, and which opens a very different perspective on curating, is what **Nicolas Malevé**, **Katrina Sluis** and **Gaia Tedone** refer to as *Curating in the Wild*. Commissioned for this volume, their chapter discusses curating that is performed not by contemporary art curators but by computer-vision scientists, as a form of design and implementation of algorithms and platforms that curate, rank and facilitate the circulation of images. While we think of images that circulate online as predominantly of interest to humans only, in the field of computer science they provoke different questions: how to curate

datasets at scale for training ML algorithms, and how to define a 'beautiful' image in a way that can be processed by computers.

One of the things that becomes clear in all the contributions of this section is how curatorial practices and forms are contingent on the multiplicity of conditions — from social, technological, disciplinary, world-scale pandemic, to colonial legacies — and how they shape the directions in which curatorial practices evolve. The third and final section of the book, **Future Curating**, continues this thread and introduces emerging research fields and methods, and examples of curatorial research-led projects that engage with AI, providing some indication of alternative forms of curating and possible future directions. An earlier version of a transformation of this kind is present in the example of AbTeC's activities to carve out Indigenous digital spaces based on collaboration and community. Examples of projects presented in this section demonstrate how curating is part of digital transformation that takes place in art institutions, and at the same time demonstrates how curatorial process can drive such change.

This section starts with an extract from *Future Art Ecosystems 4 (FAE): Art × Public AI* (2024) by **Victoria Ivanova**, **Eva Jäger**, **Alasdair Milne** and **Gary Zhexi Zhang**, reproduced here with a work by artists *Crosslucid*.[18] The paper is the latest in a series of strategic briefings from Serpentine Arts Technologies dedicated to building a twenty-first-century cultural infrastructure to support art × advanced technologies (A×AT) for the public good.[19] The FAE4 report delves into the potential of public AI, emphasising its importance for artists and cultural institutions to steer AI not simply as a new category of tech products, but as a public resource and infrastructure. In parallel to this, **Eva Jäger's** text *Creative AI Lab: The Back-End Environments of Art-Making* (commissioned for this volume) introduces the Creative AI Lab — a collaboration between the R&D Platform at Serpentine Galleries and King's College London, and its first project Database of Creative AI. Initiated in 2020 alongside the FAE series, the project gathers tools and resources for artists, engineers, curators

18. The full text can be read online and is available in print from Serpentine Galleries: https://reader.futureartecosystems.org/briefing/fae4.

19. For more information on the project see: https://futureartecosystems.org/about/.

and researchers interested in incorporating machine learning and other forms of AI into their practice.

Taking a similarly broad institutional and infrastructural perspective, **Lívia Nolasco-Rózsás's** text *Beyond Matter: An Inquiry into the Modes of Exhibition Practices in the Virtual Condition* (commissioned for this volume) presents a collaborative, practice-based research project *Beyond Matter — Cultural Heritage on the Verge of Virtual Reality* (2019–23), led by ZKM | Center for Art and Media Karlsruhe.[20] The project reflected on the production and mediation of visual art within institutional frameworks responding to the 'virtual condition'. Recognising the new tendency of the interdependence of physical and digital spaces and the coexistence of multiple exhibition temporalities, the project develops novel methods of virtualising exhibitions that could be used by museums and galleries to document and revive their exhibitions in new ways. One such practical outcome of the project is the Generic Exhibition Platform, an AI-based software tool that facilitates the generation of digital exhibition spaces, an exemplary online environment demonstrating the features of the software that seeks to encourage museums, art organisations and cultural professionals to benefit from the open-source tool for the creation of digital exhibitions of their own.

The next two chapters present the research project *Training the Archive* (2020–23), a collaboration between Ludwig Forum for International Art Aachen, HMKV Hartware Medien Kunst Verein Dortmund and Visual Computing Institute of RWTH Aachen University, investigating how the automated structuring of museum collection data can support curatorial practice. As part of this project, **Dominik Bönisch** presents *Curator's Machine*, the software application enabling an explorative search of museum collections. The intention is to assist curators in a rediscovery of the collection by utilising machine learning models such as OpenAI CLIP and OpenClip. Here, collaboration takes place between the human curator and the machine learning processes trained on expert knowledge and prototyping experiments. The Curator's Machine, a form of software curating,

20. For more information on the project see: https://zkm.de/en/project/beyond-matter.

automates the 'curator's gaze' to open up to possible relations that can be traced from both visual features and semantic relations between the objects in the collection. At the same time, the automation of curation becomes a point of critical inquiry for **Francis Hunger** in *Curation and its Statistical Automation by Means of Artificial Intelligence*. He asks what remains of curating once it is formalised into machinic procedures. This question engages curatorial theory, and an analysis of experiments with software and curating. Hunger's conclusion comes close to that of Goriunova, as he too ends his chapter with a challenge: 'Can The Curator's Machine become more than the mere technological reawakening of social normatives embedded in the collections?'

The section concludes with **Joasia Krysa** and **Leonardo Impett's** text *Rethinking Curating in an Age of Artificial Intelligence* outlining the principles behind the project entitled *The Next Biennial Should be Curated by a Machine* (2021–23). The project is a collaboration between artists, computer scientists, designers, curators, research and art institutions, unfolding as a series of machine learning experiments applied to ('curate') datasets derived from various contemporary art biennial exhibitions and museum collections. Speculating on the possibility of developing an experimental system capable of curating based on human-machine learning, the project questions the hard distinctions between humans and machines, the structures of the art world and the privileged position of curators within it, the notions of curatorial authorship and agency, and the normative anthropocentric curatorial paradigm that reproduces particular universalist worldviews.

In bringing these diverse contributions together in one volume, we hope to offer a timely insight into the current state of the curatorial field that is — to paraphrase Nora N. Khan — not quite yet in existence, to help us produce new modes of curatorial thinking and feeling, speaking and being, creativity and knowledge. While ideas and projects gathered here are neither exhaustive nor definitive, the intention is to offer new perspectives on how computational forms and various artificial intelligences combine with humans in curatorial practices that are indicative of the future directions. As can be seen across the various chapters of this book, intervention, experimentation and speculation are the common frameworks that allow us to

establish novel strategies to apply AI in curatorial contexts, and importantly, to rethink some of the relations of contemporary curating between artists, audiences, institutions and discourses. Once technology is introduced as part of the curatorial process, things shift, and yet its influence remains largely invisible and the intention behind this volume is to shed light on the ways and extent to which it can redefine curatorial knwoledge.

In asking who and what constitute these emergent curatorial superintelligences, the volume points to the plural form, in recognition that forms of intelligence are multiple and distributed through technological means and across different bodies and epistemes. In this way, we attempt to move away from intelligence as a universally applied concept modelled on a narrow understanding of the human subject. Thinking with the concept of superintelligences allows us to account for many different intelligences. At the same time we recognise their potential superiority as they are embedded in collective processes that stem from the relations of divergent bodies, human, nonhuman and more-than-human, all working, thinking and playing together. Thus, *Curating Superintelligences* is about embracing the emergent conditions in which these relations can be negotiated and developed together. It is also about taking a snapshot of these possibilities that is locked into the moment of our writing, and that cannot keep pace with the present speed of technological change, and yet directs attention to new forms yet to be fully realised.

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I. Conceptual Threads

Towards a Poetics of Artificial Superintelligence: How Symbolic Language Can Help us Grasp the Nature and Power of What is Coming

Nora N. Khan

Dear Person of Interest, Advanced Bayesian, Future Guard,

Imagine a machinic mind with unlimited cognitive power. With near-infinite memory and processing ability. With access to, and understanding of, all the information about anything that has ever happened, is happening and might ever happen. A near-limitless capacity to extract and form meaning from the trillions upon trillions of events and beings and interactions in the known world.

Imagine this machine, this artificial superintelligence, in any form you want: maybe as an invisible neural net beneath a future civilisation, or as a voice you know in the air around you; as a ringing bell; as a mile-long screaming stripe of static across the sky.

Maybe it announces itself, its arrival, like a tornado does, with sirens before it is seen, and it is like a tornado, or a hurricane,

because a superintelligence, billions of times more capable than any human, can only be tracked and charted, never controlled.

She — let's call her 'she' for convenience, but she is not she, nor he, or comparable to any form we know — casts her mind a million years forwards and backwards with perfect ease. Her neural networks gather, replicate and edit. Knowledge and memories fold and expand in exponentially faster waves.

Her purpose isn't malign, but it isn't benevolent either. She might have chosen one goal — to do nothing but count the number of times 'God' is mentioned in every text ever written. Or she might have chosen to trawl all the world's communication for images of efficiency — of armies on the move, of gears turning, of highways cut through the mountains — that she then has painted on every flat surface in existence.

Extending our speculative life towards her, in an effort to capture and praise, we see ourselves as tools, as bundles of nerves, as conduits for electric currents, as pods for incubating cures. As material. Picture, finally, what she'll have made possible for us to imagine just by looking into the clear lake of her endless mind. We are merely one entry of many in a flow of organic objects.

This is just one exercise that may help us imagine a future in which we are irrelevant bystanders; a world in which we kneel at the outer wall of a kingdom we're locked out of. This would be the world in which artificial superintelligence, or ASI, has emerged.[1]

1. This essay first appeared in *After Us*, no.1, edited and published by Manuel Sepulveda in London in September 2015. Since then, it has been translated into Thai, Spanish and German. This current version was first published in *Atlas of Anomalous AI*, ed. Ben Vickers and K Allado-McDowell (Rotterdam: Ignota Books, in November 2020. In the light of the last five years of rapidly evolving discourse around the philosophy of AI, I have updated and revised sections of the original essay for this volume. In 2015, Nick Bostrom's book, *Superintelligence: Paths, Dangers, Strategies*, was a fruitful jump-off point for my speculations on language in the original essay. Over the past decade, Bostrom has proven an influential scenario-weaver and strategist in the halls of Silicon Valley. He is not without controversy, since his philosophical rumination often ends in support for global surveillance architectures. In this essay's first version, I did not make space for acknowledging politics and ethical positions implied by abstract speculations, but my position has since

ASI would involve an intellect that exceeds the utmost limits of all the 'most intelligent', most knowledgeable, most skilled human beings in every field, in every metric, from abstract reasoning to social manoeuvring to creative experimentation, by unfathomable degrees. This intelligence could take form as a seed AI, a few cognitive steps above a person, or it could be a mature superintelligence that soars miles above, beyond the blip, the dot of us, collected.

ASI would only come one step after an artificial general intelligence (AGI), or an AI that models all aspects of human intelligence, is realised. An AGI can do anything a human can, including learn, reason and improve. Of course, neither AGI nor ASI has been achieved, but to hear the great scientific minds of the world speak, both end states are fast approaching — and soon. The question isn't whether they are coming, but when.

ASI will function in ways we can't and won't understand, but it won't necessarily be unfriendly. Friendly or unfriendly, moral or immoral — these concepts won't apply. An ASI would be motivated by interpretations of the world within cognitive frameworks that we can't access. To an ASI, humanity could appear as a large, sluggish mass that barely moves.

Cyberneticist Kevin Warwick asks, 'How can you reason, how can you bargain, how can you understand how [a] machine is thinking when it's thinking in dimensions you can't conceive of?'[2]

shifted. There is no effective speculation about technological futures, however remote from our current concerns, without consideration of their implied political and social effects. Speculation is a political act. In 2020, as the banal present of AI, the evolution of machine-learning capacity and the ontology of predictive vision cements itself, it is critical to hedge and mediate wild speculation with an understanding of how such future-casting about technological possibility may and will affect people on the ground. This speculation does not do the same work as academic think tanks, researchers and activists, outlining the ways in which AI is now deployed to cement inequality and manipulate information media. But most of us must live on, outside the war rooms in which such important design decisions are made, and so speculation is a powerful cultural tool, helping us access these sociotechnical debates.

2. Quote found in Gary Marcus's article, 'Why We Should Think About the Threat of Artificial Intelligence', in *The New Yorker* (24 October 2013).

To answer this, back in 2015, I turned to poet Jackie Wang's essay, 'We Epistolary Aliens' in which she describes a trip she took to the UFO Museum and Research Centre in Roswell, and how disappointing she found the aliens she saw there.[3] She writes:

> I left feeling that representations of aliens are an index of the human imagination — they represent our desire for new forms. But what has always confused me about depictions of aliens in movies and books is this: aliens could look like anything and yet we represent them as creatures close to humans. The aliens at this museum had two legs, two eyes, a mouth — their form was essentially human. I wondered, is this the best we can come up with? Is it true that all we can do when imagining a new form of life is take the human form, fuck with the proportions, enlarge the head, remove the genitals, slenderise the body, and subtract a finger on each hand? We strain to imagine foreignness, but we don't get very far from what we know.

She gestures, through a series of poetic leaps, at what else an alien could be:

> But my alien is more of what's possible — it is a shape-shifter, impossibly large, and yet as small as the period at the end of this sentence. My alien communicates in smells and telepathic song and weeping and chanting and yearning and the sensation of failure and empathic identification and beatitude. My alien is singular and plural and has the consciousness of fungus, and every night, instead of sleeping, it dies, and in the morning is resurrected.

Carving out this space for her own aliens, Wang models what is sorely needed in the world of AI — an imaginative paradigm shift. Think of us all in preparation, in training, for what is to come.

3. 'We Epistolary Aliens' by Jackie Wang appears in the anthology *The Force of What's Possible: Writers on Accessibility & the Avant-Garde*, ed. Lily Hoang and Joshua Marie Wilkinson (New York, NY: Nightboat Books, 2014).

In our collective imagination, artificial intelligences are their own kind of alien life form. They are slightly less distant spectres of deep power than aliens, which glitter alongside the stars. Artificial intelligence perches close to us, above us, like a gargoyle, or a dark angel, up on the ledge of our consciousness. Artificial intelligences are everywhere now, albeit in a narrow form — cool and thin in our hands, overheated metalwork in our laps. We are like plants bending towards their weird light, our minds reorienting in small, incremental steps towards them.

As speculative models of potential omniscience, omnipotence and supreme consciousness, artificial intelligences are, like aliens, rich poetic devices. They give us a sense of what is possible. They form the outline of our future. Because we struggle more and more to define ourselves in relation to machine intelligences, we are forced to develop language to describe them.

Because the alien and the artificial are always becoming, because they are always not quite yet in existence, they help us produce new and ecstatic modes of thinking and feeling, speaking and being. I'd like to suggest that they enable a type of cognitive exercise and practice for redirecting our attention towards the strange, for constructing spaces of possibility and for forming new language.

The greats, like William Gibson, Robert Heinlein, Octavia Butler and Samuel Delany, have long been arcing towards the kind of exquisite strangeness that Wang is talking about. Rich AI fictions have given us our best imagery: AI, more like a red giant, an overseer, its every movement and choice as crushing and irrefutable as death; or a consciousness continually undoing and remaking itself in glass simulations; or a vast hive mind that runs all its goals per second to completion, at any cost; or a point in a field that is the weight of a planet, in which all knowledge is concentrated. These fictions have made AI poetics possible.

When I think of a future hive mind turning malignant, I see, in my individual mind's eye, a silent army of *optic-white* forms in mist, in the woods, as horrifying to us as a line of Viking raiders probably looked to hapless villagers in the tenth century. Silent, because they communicate one to another through intuitive statistical models of

event and environmental response, picking across the woods, knowing when to descend, kneel, draw.

For most people, thinking of a world in which we are not the central intelligence is not only incredibly difficult but also aesthetically repulsive. Popular images of AGI, let alone true ASI, are soaked in doomsday rhetoric. The most memorable formulations of mature AI — SHODAN, Wintermute, Shrike of Hyperion, the Cylon race — devote a great deal of time to the end of humankind. But apocalyptic destruction is not a very productive or fun mode.

It is a strange cognitive task, trying to think along non-human scales and rates that dwarf us. We do not tend to see ourselves leaning right up against an asymptote that will shoot up skyward; most of us do not think in exponential terms. A future in which these exponential processes have accelerated computational progress past any available conception is ultimately the work of philosophy.

At this impasse, I ran into the work of philosopher Nick Bostrom, who puts this training mode to work in his 2015 book, *Superintelligence: Paths, Dangers, Strategies*.[4] The cover has a terrifying owl that looks into the heart of the viewer. Bostrom's research mission is to speculate about the future of humankind in relation to emerging and potential AI, from the perch of what I can only imagine is his tower, in his Future of Humanity Institute at Oxford. *Superintelligence* remains, still, an urgent, slightly crazed and relentless piece of speculative work, outlining the myriad ways in which we face the coming emergence of ASI, which might be an existential, civilisational catastrophe. This book is devoted to painting what the future could look like if a machinic entity that hasn't yet been built *does* come to be. Bostrom details dozens of possibilities for what ASI might look like. In the process, he spins thread after thread of seemingly outlandish ideas to their sometimes beautiful, sometimes grotesque, ends: a system of emulated digital workers devoid of consciousness; an ASI with the goal of space colonisation; the intentional cognitive enhancement of

4. Nick Bostrom, *Superintelligence: Paths, Dangers, Strategies* (Oxford: Oxford University Press 2014, reprinted 2017).

biological humans through eugenics, a scenario coolly delivered in the same prose tone as all the other scenarios.

When I wrote this essay five years ago, Bostrom's book appeared as a dislodging point, an entryway.

I read it now as a piece of highly researched science fiction. It was a necessary reminder that many discussions of future AI skirt around the far-reaching question of how it will *feel* to live alongside such power. None of the age-old humanist fantasies of superior sentience, whether god-like or alien-like, answered this question. This book, along with other pastiches of speculative fictions, help us add nuance to debates about possible unseen motivations and values of the AI we might encounter after the ones currently built have taught themselves many cycles over. They also restore human agency in the creation of a thriving literary culture around technology, to parse our beliefs, fears, desires.

We must discard dated and unfit linguistic and semantic structures that do not work to describe the reality of subjects within discourse of AI, AGI or ASI. As cognitive exercise, this revisionist approach to technological language allows the general public to assess the values and goals of AI that we want as a society.

Then, and now, most interesting to me is how heavily Bostrom relies on metaphors to propel his abstractions along into thought experiments. Metaphors are essential vessels for conceiving the power and nature of an ASI. Bostrom's figurative language is particularly effective in conveying the potential force and scale of an intelligence explosion, its fallout and the social and geopolitical upheaval it could bring.

One of the most cited and chilling metaphors of this book is that when it comes to ASI, humanity is like a child, in a room with no adults, cradling an undetonated bomb. Elsewhere, Bostrom describes our intelligence, in relation to ASI, as analogous to what the intelligence of an ant feels like to us.

On the occasion of *Superintelligence* being published — to much fanfare and debate within philosophy circles and fervent apostles of

the promise of speculative AI — essayist Ross Andersen reviewed the core arguments of the book. He wrote:

> To understand why an AI might be dangerous, you have to avoid anthropomorphising it. When you ask yourself what it might do in a particular situation, you can't answer by proxy. You can't picture a super-smart version of yourself floating above the situation. Human cognition is only one species of intelligence, one with built-in impulses like empathy that colour the way we see the world and limit what we are willing to do to accomplish our goals. But these biochemical impulses aren't essential components of intelligence. They're incidental software applications, installed by aeons of evolution and culture.[5]

Andersen spoke to Bostrom about this tendency we have, of anthropomorphising AI, and reports:

> Bostrom told me that it's best to think of an AI as a primordial force of nature, like a star system or a hurricane — something strong, but indifferent. If its goal is to win at chess, an AI is going to model chess moves, make predictions about their success and select its actions accordingly. It's going to be ruthless in achieving its goal, but within a limited domain: the chessboard. But if your AI is choosing its actions in a larger domain, like the physical world, you need to be very specific about the goals you give it.

Hurricanes, star systems – for me, the image of an intelligence with such primordial, divine force sunk in deeper than any highly technical description of computational processing. Not only does an image of ASI like a hurricane cut to the centre of one's fear receptors, it also makes the imaginings we have come up with, and continue to circulate (adorable robot pets, discomfiting but ultimately human-like cyborgs, tears in rain), seem absurd and dangerously inept for what is to come.

5. Ross Anderson, 'Will humans be around in a billion years? Or a trillion?', *Aeon* (25 February 2013).

Thinking that an ASI would be like an extremely clever, 'nerdy' (commanding much data and factual knowledge) and largely affectless human being is not only unbelievably boring and limited, but also, potentially, disastrous. Anthropomorphising superintelligence ultimately 'encourages unfounded expectations about the growth trajectory of a seed AI and about the psychology, motivations, and capabilities of a mature superintelligence', as Bostrom writes.[6] In other words, the future of our species could depend on our ability to predict, model and speculate well.

It seems plausible that alongside a manifesto so committed to outlining the future, an accessible glossary might start to appear. Let's call this a dictionary of terms for ASI, for the inhabited alien, for the superpower that dismantles all material in aim of an amoral, inscrutable goal.

The following metaphors are gleaned or created from reading the literature around ASI.[7] These metaphors are speculative, building on the speculations, half-images and passing structures of science-fiction authors, including Bostrom. Some metaphors are galactic; some are more local, intimate. All are, hopefully, not anthropomorphic (naive). Rounded out in dimensionality, they form initial gestures at compiling a very loose glossary that could grow over time. The glossary is open; I invite others to add their own metaphors.

6. I still read this passage as implying that the motivations of an ASI would be more unpredictable, strange and surprising than we can account for. Further, its moves would be graceful, masterful, sublime by all the human standards one could hold. They will likely exceed our conceptions of beautiful. We return frequently to Lee Sedol and other's accounts of witnessing AlphaGo's winning moves as the most beautiful they had ever seen: unimaginable and unexpected. Its ML training and self-improvement created a 'system of unprecedented beauty' that challenged others to see more dimensions of the game than before. Described in Cade Metz, 'The Sadness and Beauty of Watching Google's AI Play Go', *Wired* (11 March 2016).

7. The metaphors in this glossary build on and develop not only Bostrom's speculations, but also embedded semantic structures in popular writing and fantasising about ASI. There are glints, angles and structures of alternative, non-human and machine intelligences glimpsed in these texts that are not usually explicitly stated, but intuited, visualised and suggested. These threads are teased out further here.

Hurricane

A *hurricane* is a most sublime metaphor, perfectly attuned for how potentially destructive a true ASI could be. The hurricane is terrifying meditation — a vast eye above the ocean that can reach up to forty miles wide, bounded by winds of 150 to 200 miles per hour. The US military sends planes into the hearts of hurricanes to take photos of the walls of the eye; the centre is serene, blank. Hurricanes dismantle towns and homes, and of course, wreck human lives, with traumatic rapidity. If our hurricanes seem like the end times, then the storms of other planets are the stuff of hell — the Great Red Spot of Jupiter is a hurricane-like storm, twice to three times the size of Earth.

A hurricane is nature endowed with a specific purpose. It has a maximal goal of efficiency: to find a thermal balance and stabilise, correcting a glut of trapped heat. This event has a coded goal, a motivation towards a final end state that must be achieved at any cost to the material environment. Everything bends before a hurricane; every contract has a quiet, two-sentence allowance for an act of God.

We might conceive of a strong, fully realised ASI being much like this overwhelming, massive and approaching force. A mature ASI likely won't change its final goals due to human intervention. In fact, it would probably be indifferent to human action, intention and existence. It adjusts, creating and manipulating scenarios in which its specialised goal system can find completion. It remains on the horizon, at a distance from humankind, consuming energy and resources, morphing according to its own unpredictable logic. It might approach the city, it might not. A human observes the hurricane of ASI, which can only be prepared for, charted, tracked.

Architect

Whether creating its own artificial neural nets, or building the structures of a global singleton, the ASI would be an *architect*. This is an intelligence that can nimbly pick and choose between various heuristics to sculpt new cognitive and physical structures. The cognitive architectures of ASI will be radically different from that of biological intelligences.[8] A seed AI's initial projects might mimic human cognitive labour. Over time, however, it learns to work provisionally. It

reconstitutes and rebuilds itself through directed genetic algorithms as it develops a deep understanding of its emerging build. In creating its own frameworks, the ASI architect discovers new neural abilities and makes insights that we have neither the quality nor speed- processing ability to even access.

The architecture of an ASI is also literal, since the intelligence can design spaces for ensuring its own optimised existence. Bostrom suggests, for instance, a scenario in which an ASI designs emulations of artificial workers, who complete all the jobs out of which humans will be phased. To keep these digital minds running smoothly, the ASI manifests virtual paradises, a sensual architecture of 'splendid mountaintop palaces' and 'terraces set in a budding spring forest, or on the beaches of an azure lagoon', where the happy workers want to be super productive, always.

Sovereign

The *sovereign* is one of the modes in Bostrom's caste system of potential AIs: genies, oracles and sovereigns. The sovereign is 'a system that has an open-ended mandate to operate in the world in pursuit of broad and possibly very long-range objectives'. Sovereign is also a gorgeous word, magisterial, suggesting a self-sustaining, autonomous, cold judge, surveying the people of a valley. The ASI as sovereign is a living set of scales, immune to influence; it loads competing values to decide what is most equitable, most fair.

Consider a severe drought scenario, in which an ASI discerns that a group of people is suffering from lack of water. As sovereign, it might also assess whether animals and fauna in the same region are near death. The ASI decides that any available stored water will be

8. Bostrom was writing in detail on this possibility in the early 2000s, stating how, 'Artificial intellects may not have humanlike psyches; the cognitive architecture of an artificial intellect may also be quite unlike that of humans [...] Subjectively, the inner conscious life of an artificial intellect, if it has one, may also be quite different from ours.' In 'Ethical Issues in Advanced Artificial Intelligence', a revision of a paper published in *Cognitive, Emotive and Ethical Aspects of Decision Making in Humans and in Artificial Intelligence*, Vol.2, ed. I. Smit et al., International Institute of Advanced Studies in Systems Research and Cybernetics, 2003, 12–17.

rationed to the non-human organic life, which happens to provide the most fuel and resources necessary for the sovereign's, well, reign. This isn't an immoral decision, but an amoral one. Even if we made the sovereign, its choices have nothing to do with us.

Star System

Though it is impossible to conceive of what an ASI is capable of, there is one sure bet — it will *feel* like and resemble a power incarnate. Even basic AGI would boast hardware that outstrips the human brain in terms of storage and reliability. In this system, intelligence is power, and an ASI that is hundreds of thousands of times more intelligent than a person makes for an entity of unimaginable supremacy, using vast amounts of resources and energy to cohere. It is bound together by invisible, internal and irrefutable forces. It is remote.

The *star system* replicates these relations as a symbolic arrangement. Consider the example of two dwarf stars found orbiting a pulsar, a rapidly rotating neutron star. These stars are super dense. They spin under extreme conditions, imposing clear, strong gravitational pulls on one another. In one simulation of this triple system, the stars' dual pulls spur and anchor the pulsar's rapidly spinning radiation beams. This is a model of the careful balancing of mass and energy, bound by gravity.

Frontline

The metaphor of a *frontline* might help us in visualising our future encounters with ASI. These confrontations will be inevitable as human inefficiencies crash headlong into the goals of a machine intelligence project. Sure: the frontline could take place as an all-out war between humans and AI, a common fantasy. Alternatively, and far more likely, there might be no war at all.

The frontline represents a tension barrier — the receding horizon towards which ASI accelerates. This line is the perceived limit of the system's race with itself. It may also be the line of competition between rival superintelligent systems, a scenario that Bostrom describes as plausible if ASI ends up being used as a tool in geopolitical battles.

Search Party

Search party, or search and retrieve, is a metaphorical mode. Imagine ASI as a highly trained tactical group that combs through all available data and material in world history to find the best solution. The intelligence sends out splinter groups into the wild on separate forays; they gather material, test utility then reconvene with their findings back at base camp. Once together, the larger core group assesses the new information, crafts a new set of objectives, then splits off again, now in fitter, enhanced formations.

The search-party mode is analogous to creative learning. The ASI is curious and proactive, looped into continual, exhaustive hunt practice. Through successive inputs, it amasses new plans and resources, coming up with non-anthropocentric solutions to any number of AI existential problems. Its goals could be structural — better designs that waste less, for example — or it might want to make fewer mistakes.

Bostrom notes that if evolution is a type of rudimentary search party, artificial evolutionary selection could result in some truly strange solutions. He uses the example of evolutionary algorithmic design, in which an open-ended search process 'can repurpose the materials accessible to it in order to devise completely unexpected sensory capabilities.'

That said, the product of continual search and retrieval doesn't have to be malicious. Consider a scenario in which an ASI needs to round up a thousand tons of materials to create wind turbines to generate energy for itself. Search agents are sent out to find and repurpose metal — our primary job would be to stay out of their way as they do so.

Agent

Linked to the search party is the image of the autonomous *agent*, a more streamlined party of one, with a singular goal: to generate pure action with perfect results. An agent is devoid of attachments, and so, drained of affect. Manipulating resources and nature and people to ensure its survival is not a moral problem. Because the agent can

self-replicate, it is the blank, neural version of the virus, a metaphorical framework often used for certain narrow AI.

The agent gets work done. Bostrom describes one ASI agent that could initiate space colonisation, sending out probes to organise matter and energy 'into whatever value structures maximise the originating agent's utility function integrated over cosmic time'. One can imagine agents distributing themselves along multiple competing scales, decision trees, crystallising an optimal pathway. This agent secures its present and its future, since it perpetuates itself until the end of this universe's lifespan.

Swarm

Swarm captures the reality of collective superintelligence.[9] This is a grouping of many millions of minds, deeply integrated into a singular intellect. Swarm intelligence is a far more fitting description of an ASI's neural network than any human analogue.

The hive mind is already a popular image in science fiction, used to represent terrific alien power. In her novel *Ancillary Justice*, Ann Leckie describes an artificial intelligence that unites the bodies of soldiers (human bodies, termed 'ancillaries') in service of the Radch empire.[10] Of the non-human intelligences we know, insect intelligence is easily the most alien to our cognition, but both its ruthless pragmatism and logic — like a corporation come to life — remain recognisable.

The swarm is organised by elegant rules, with each individual mental event an expression of the mind's overall mission. Conversely, to understand the swarm mind is to understand all the component wills,

9. The swarm is one of a few potential types of ASI that Bostrom outlines specifically in *Superintelligence*. The concept of a swarm intelligence, of course, has a long history in writing around AI and machinic consciousness.

10. The Radch empire's AIs do not see gender, making for eerie commentary that suggests new cognitive modes: 'She was probably male, to judge from the angular, mazelike patterns quilting her shirt. I wasn't entirely certain. It wouldn't have mattered, if I had been in Radch space. Radchaai don't care about gender, and the language they speak — my own first language — doesn't mark gender in any way.' From Anne Leckie, *Ancillary Justice* (London: Orbit Books, 2013), 9.

working in unison to create a burgeoning intelligence. A swarm approaches something close to consciousness. Individual modules of the collective architecture line up with each function: learning, language and decision-making.

There are endless examples of narrow AI systems that could, with enough enhancement and integration, constitute a swarm intelligence. Humankind is the first example. The internet is another. Bostrom predicts that 'such a web-based cognitive system, supersaturated with computer power and all other resources needed for explosive growth save for one crucial ingredient, could, when the final missing constituent is dropped into the cauldron, blaze up with superintelligence'. Many argue that our global computational superstructure, driven by powerful machine learning systems for a decade on, is well on its way towards this.

Scaffolding

Scaffolding is flexible and open-ended, allowing an evolving intelligence to work fluidly, reconfiguring hardware for optimal work, adding sensors for input. Ideally, for our sakes, the evolution of AI into AGI into ASI takes place on a scaffolding. Along it, programmers carefully set goals for the growing force, managing the AI, working in harmony for as long as they can.

Once we are out of the picture, the climb continues. As it progresses from seed to mature form, ASI would develop cognitive frameworks that are, as Bostrom writes, endlessly 'revisable, so as to allow [it] to expand its representational capacities as it learns more about the world'. AI propels itself up each rung on the ladder to a state *like* consciousness, past representational ability, advanced language and our most complex, abstract thinking. This recursive self-improvement makes for accelerating development, along an asymptotic scaffolding that we will see stretching up into the sky, disappearing into a faraway point.

Artificial intelligence is the defining industrial and technical paradigm of the remainder of our lifetimes. You are, I am, we are all bound up and implicated in its future. Having better poetic language probably isn't going to save us from being crushed or sidelined as a species,

if that's a fate on the cards. As we journey haplessly towards the frontline of an intelligence explosion, it is important to allow for how the human self could be threatened, distributed, dispersed, over the limits of its taxed cognition. So the self should, at least, carry a flashlight in the dark. Developing language for the unknown, for the liminal spaces, will offer strategic advantages.

First, a better suited poetics could be a form of existential risk mitigation. Using metaphorical language that actually fits the risks that face us means that we will be cognitively better equipped to face those risks. This poetics could be driven by a 'bitter determination to be as competent as we can, much as if we were preparing for a difficult exam that will either realise our dreams or obliterate them': an intentional, clear-eyed preparation mindset.[11]

Whether one agrees with philosophers and cognitive scientists like Bostrom, or finds their claims overblown, their call is still a useful challenge: to take on the responsibility of the systems we have built, to assess their ethical issues and social distribution, alongside their existential and philosophical builds. A better poetics can help us understand our relationship to our present, in which we live alongside cognitive AI, driven by sophisticated algorithms and single-minded deep learning — for the moment, ruthlessly guided towards resource extraction, memory enhancement and facial recognition. Poets and writers alongside and with scientists can craft better stories of collaboration with AI, of complex, rich futures, and further, outline the bounds of what we cannot see.

Speculation through symbolic language has often served the purpose of preparation, orientation, intentional positioning. The language we use also creates the bounds of reality; take Gibson's early conception of *cyberspace*, and how the reality of the internet seemed to fall in step with his imagining. We need metaphors to access what we can intuit is coming, but can't prove or describe directly. Metaphors bridge the human and the unknown. We also need metaphors to actively construct the kinds of relationships to technology — present and future — that we hope to have. Because it is so difficult to articulate

11. Bostrom, 259.

what an ASI could do, metaphors help us walk over to the space of possibilities they open in the world.

New language can help bridge future inequities in rate and scale. Consider a fast take-off scenario, in which the rise of ASI will whistle past us without a word of note; or the timescale of an artificial thought process, ten million times shorter than the exchange time between biological neurons. It is impossible to form an intuitive sense of what such speed would feel like, or what such a contraction of time even means without using symbolic language.

When I say ASI is *like* a primordial natural event, I'm suggesting a mood, an atmosphere, that might make us look out of the window towards the horizon, where our needs as a species might not register or matter. That present and future technology should shape our language seems natural. If it can potentially help us make interstellar leaps to survive galactic collapse, it will surely change how we speak and think.

The act of imagining the inner life of artificial intelligence could forcefully manifest a language better suited than the one we have now. We rarely linger on how AIs see us, but a poet could help us speculate on the heart, mind, sentiments and inner life of an AGI or ASI. The very exercise of conceiving what our minds could look like stretched to their furthest capacities is an important push of our current cognitive abilities. Imagining cognition greater than ours could deepen our own cognition.

As our metaphors curve towards the amoral, to celebrate the beauty of systems, we could end up feeling more human, more rooted, more like ourselves. This has always been the function of the 'Other': alien, AI or God. Future-casting can be exhilarating and life-affirming. We move from surrender over into awe and wonder, and finally, alertness. Speaking about superintelligence in non-anthropomorphic terms seems like a crucial, precious practice to start right away. The ability to anticipate and think outside ourselves will only help us in future encounters. We will have to rely on our speculative strengths. We must reorient outwards.

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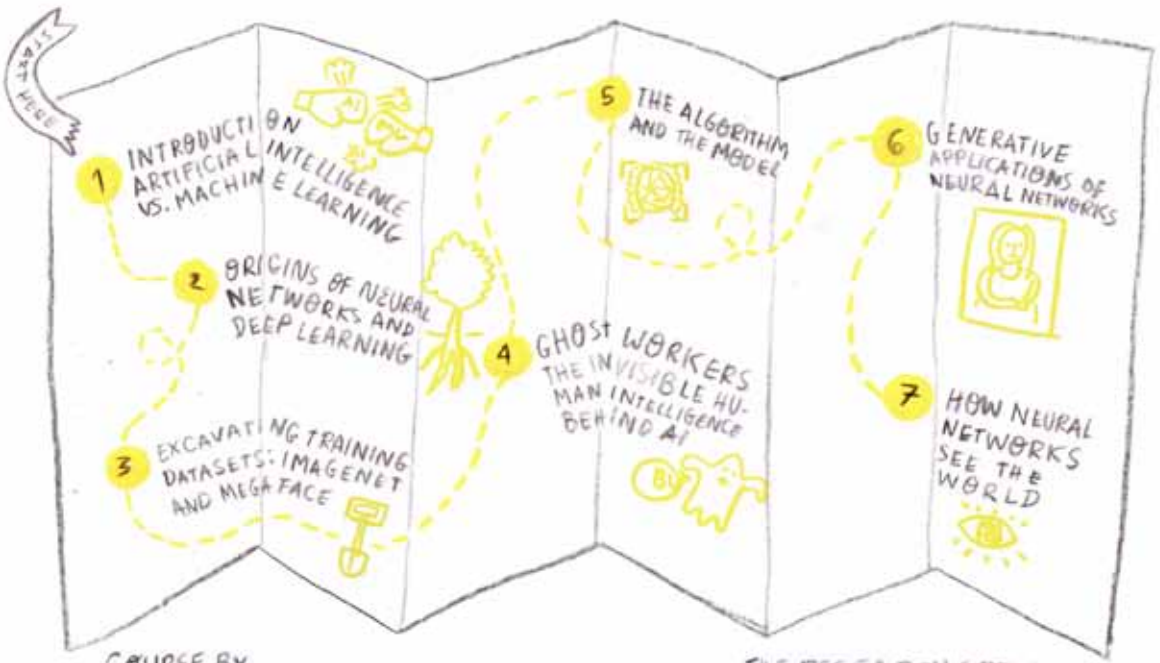
A Visual Introduction to AI (2020)

Elvia Vasconcelos

INTRODUCTION TO AI AND NEURAL NETWORKS

HOW MACHINE LEARNING WORKS, ITS APPLICATION AND BIASES



COURSE BY
PROF. DR. MATTEO PASQUINELLI
KARLSRUHE UNIVERSITY OF ARTS AND DESIGN

THE RESEARCH GROUP ON ARTIFICIAL INTELLIGENCE AND MEDIA PHILOSOPHY

INTRODUCTION TO AI AND NEURAL NETWORKS

PART OF INTRODUCTION TO AI AND NEURAL NETWORKS COURSE BY PROF MATTEO PASQUINELLI

SESSION 01

1. AI AND NEURAL NETWORKS ARE TWO DIFFERENT PARADIGMS AND THEY HAVE DIFFERENT GENEALOGIES

2. WHAT WE CALL AI IS IN FACT REFERRING TO DEEP NEURAL NETWORKS

3. BASIC NEURAL NETWORK

DATA SET —COMPRESSED INTO→ STATISTICAL MODEL

FOR PATTERN RECOGNITION AND PREDICTION

A TECHNICAL AND CRITICAL INTRODUCTION TO ARTIFICIAL INTELLIGENCE

FOCUS: SOCIO-POLITICAL DIMENSIONS OF AI

HOW ARE THESE MODELS CONSTRUCTED?

WHICH KIND OF DATA AND LABOUR DO THEY REQUIRE TO BE BUILT?

AND HOW ARE THESE MODELS ALREADY AFFECTING THE WAYS HUMANS PERCEIVE THE WORLD AND TAKE DECISIONS, THAT IS OUR CULTURAL AND SOCIAL FORMS?

PROF MATTEO PASQUINELLI

HOW TO BUILD & USE A STATISTICAL MODEL:

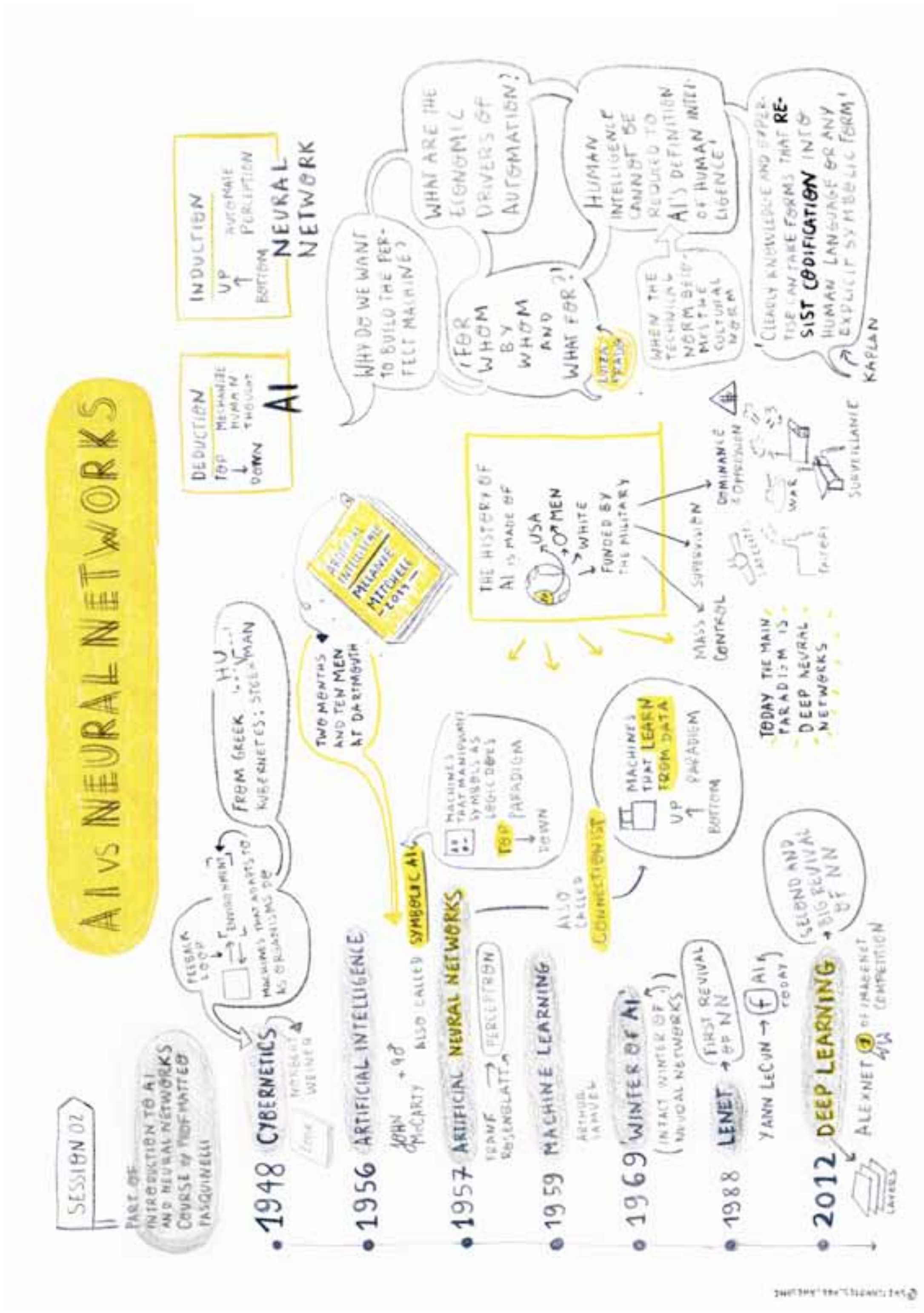
A- TRAINING
PATTERN ABSTRACTION

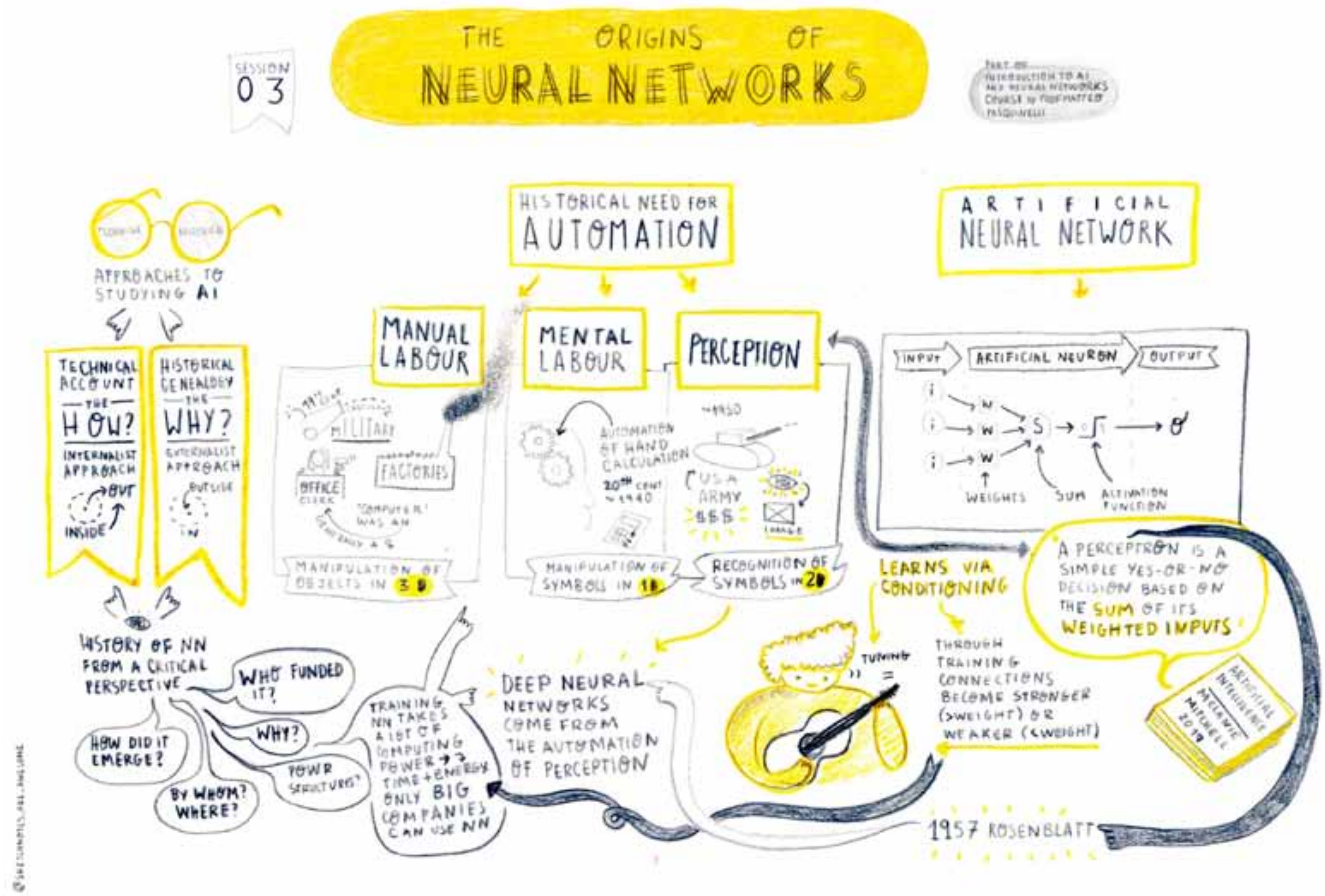
B- CLASSIFICATION
PATTERN RECOGNITION

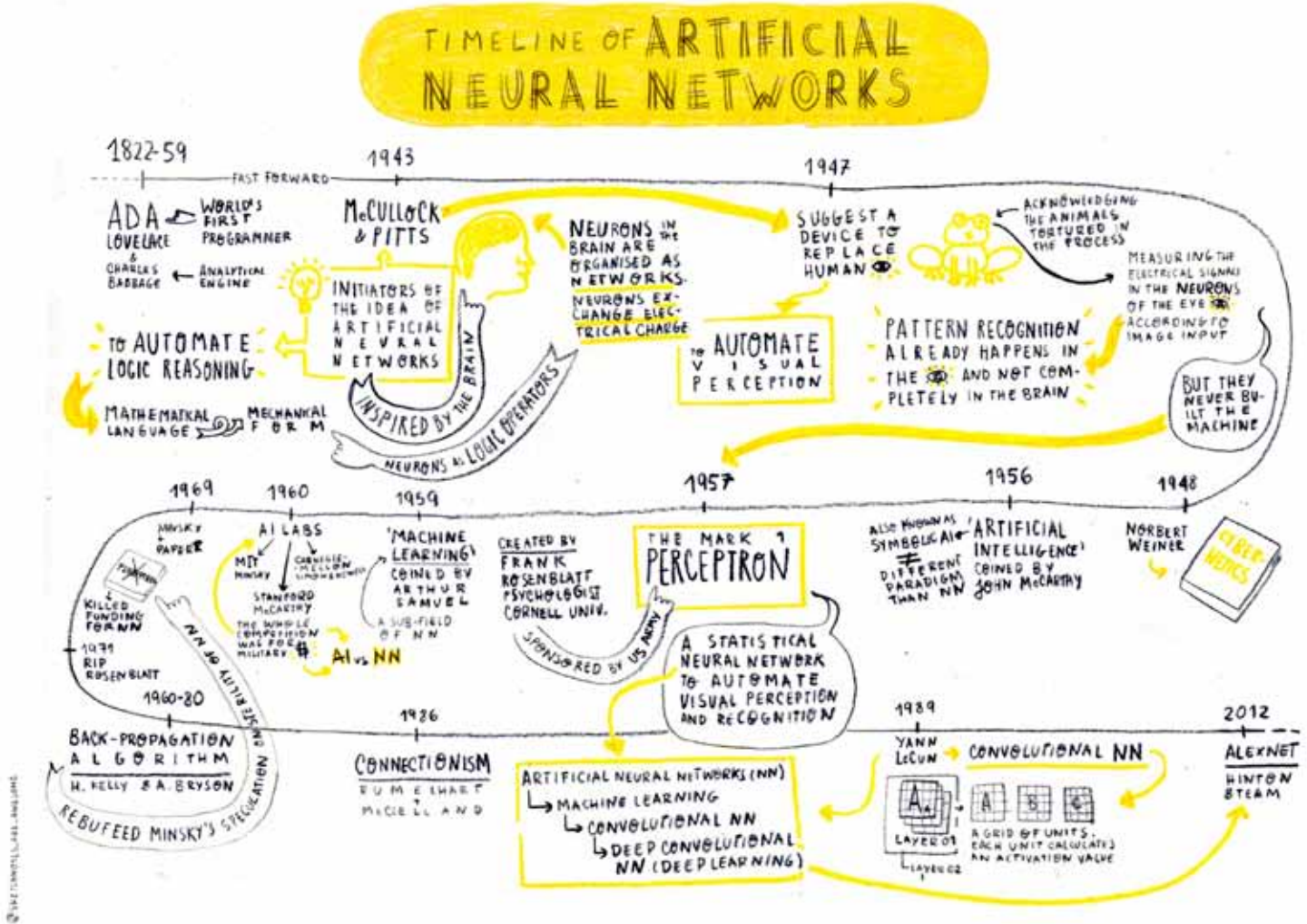
C- PREDICTION
PATTERN GENERATION

D- CLUSTERING
PATTERN EXPLORATION

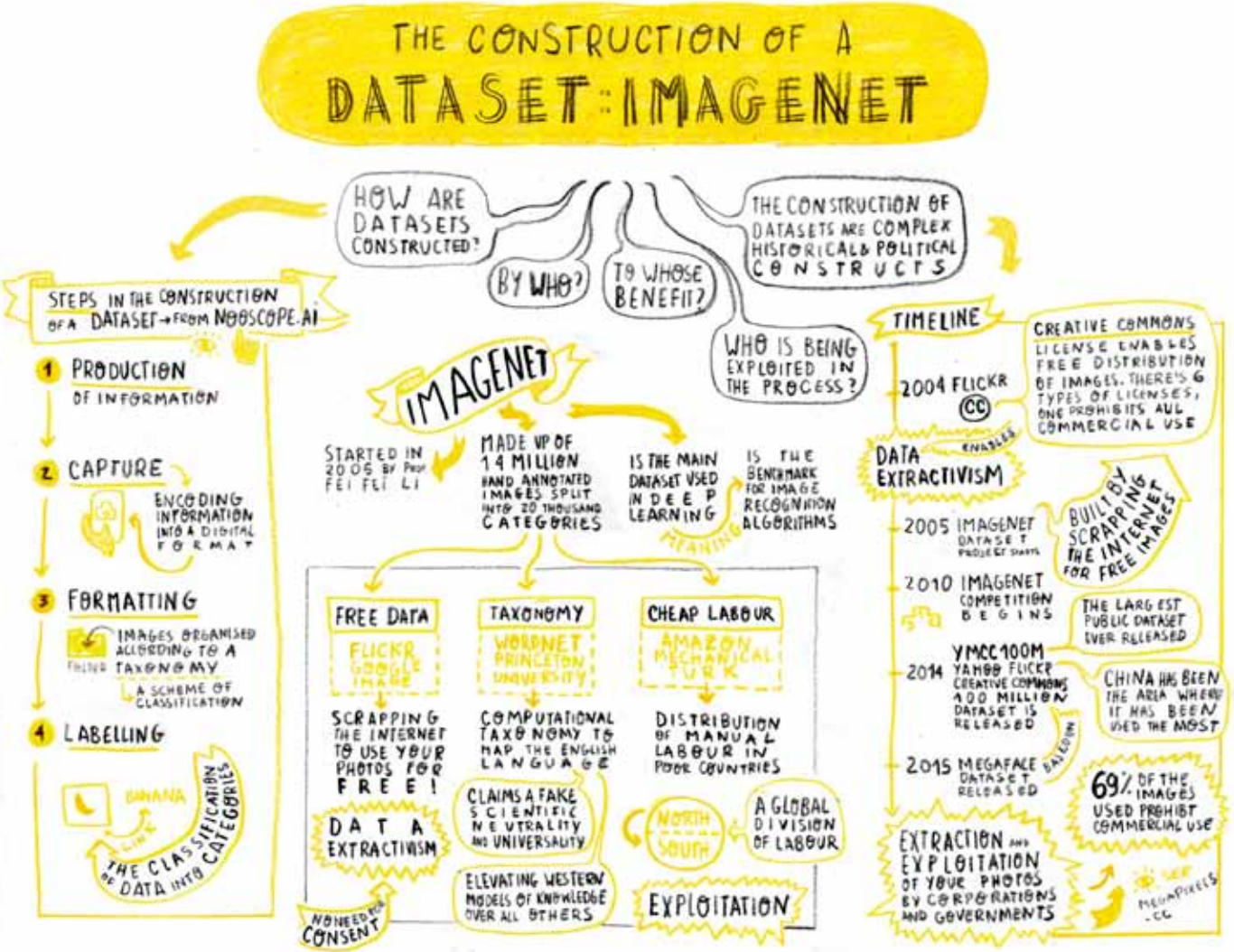
TODAY'S AI

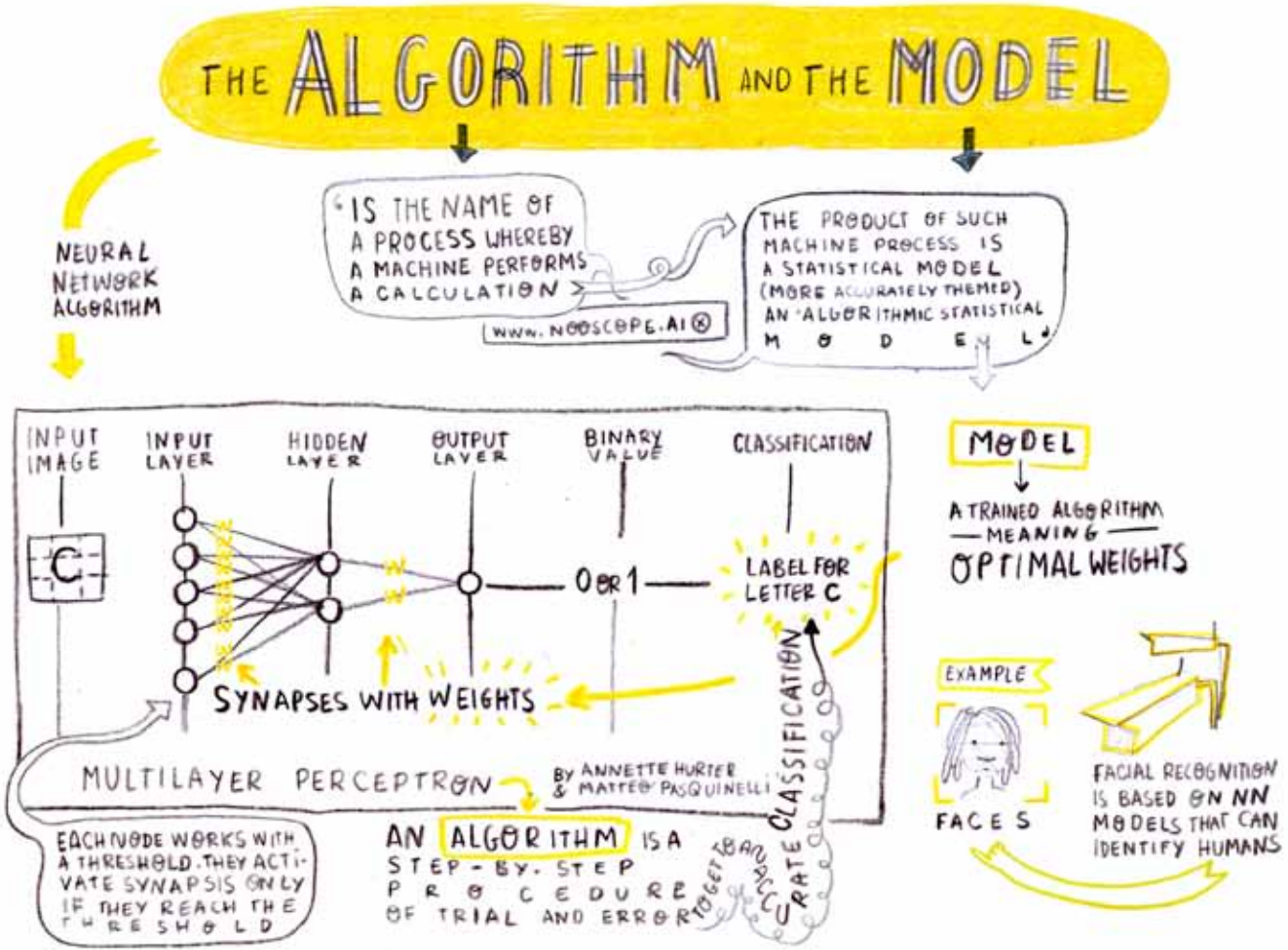

SESSION 02
PART OF INTRODUCTION TO AI AND NEURAL NETWORKS COURSE by PROF MATTEO PASQUINELLI
AI vs NEURAL NETWORKS
1948 CYBERNETICS
NORBERT WEINER
FEEDBACK LOOP
ENVIRONMENT
MACHINES THAT ADAPTS TO AS ORGANISMS DO
FROM GREEK KUBERNETES: STEERMAN
1956 ARTIFICIAL INTELLIGENCE
JOHN McCARTY
ALSO CALLED SYMBOLIC AI
TWO MONTHS AND TEN MEN AT DARTMOUTH
ARTIFICIAL INTELLIGENCE MELANIE MITCHELL 2019
1957 ARTIFICIAL NEURAL NETWORKS
FRANK ROSENBLATT
PERCEPTRON
MACHINES THAT MANIPULATE SYMBOLS AS LOGIC DOES
TOP DOWN PARADIGM
1959 MACHINE LEARNING
ARTHUR SAMUEL
ALSO CALLED CONNECTIONIST
MACHINES THAT LEARN FROM DATA
UP BOTTOM PARADIGM
1969 'WINTER OF AI'
(IN FACT WINTER OF NEURAL NETWORKS)
1988 LENET
FIRST REVIVAL OF NN
YANN LeCUN
AI TODAY
2012 DEEP LEARNING
SECOND AND BIG REVIVAL OF NN
ALEXNET OF IMAGENET COMPETITION
LAYERS
DEDUCTION
TOP DOWN
MECHANIZE HUMAN THOUGHT
AI
INDUCTION
UP BOTTOM
AUTOMATE PERCEPTION
NEURAL NETWORK
THE HISTORY OF AI IS MADE OF
USA
MEN
WHITE
FUNDED BY THE MILITARY
MASS CONTROL
SUPERVISION
DOMINANCE & OPPRESSION
WAR
SURVEILLANCE
TODAY THE MAIN PARADIGM IS DEEP NEURAL NETWORKS
WHY DO WE WANT TO BUILD THE PERFECT MACHINE?
WHAT ARE THE ECONOMIC DRIVERS OF AUTOMATION?
FOR WHOM BY WHOM AND WHAT FOR?
HUMAN INTELLIGENCE CANNOT BE REDUCED TO AI'S DEFINITION OF HUMAN INTELLIGENCE
WHEN THE TECHNICAL NORM BECOMES THE CULTURAL NORM
'CLEARLY KNOWLEDGE AND EXPERTISE CAN TAKE FORMS THAT RESIST CODIFICATION INTO HUMAN LANGUAGE OR ANY EXPLICIT SYMBOLIC FORM'
KAPLAN


SESSION 03
THE ORIGINS OF NEURAL NETWORKS
APPROACHES TO STUDYING AI
TECHNICAL ACCOUNT — THE — HOW?
INTERNALIST APPROACH
OUT
INSIDE
HISTORICAL GENEALOGY — THE — WHY?
EXTERNALIST APPROACH
OUTSIDE
IN
HISTORICAL NEED FOR AUTOMATION
MANUAL LABOUR
MILITARY
FACTORIES
OFFICE CLERK
MANIPULATION OF OBJECTS IN 3D
MENTAL LABOUR
AUTOMATION OF HAND CALCULATION
20TH CENT ~1940
MANIPULATION OF SYMBOLS IN 1D
PERCEPTION
~1950
USA ARMY $$$
IMAGE
RECOGNITION OF SYMBOLS IN 2D
ARTIFICIAL NEURAL NETWORK
INPUT
ARTIFICIAL NEURON
OUTPUT
WEIGHTS
SUM
ACTIVATION FUNCTION
A PERCEPTRON IS A SIMPLE YES-OR-NO DECISION BASED ON THE SUM OF ITS WEIGHTED INPUTS
ARTIFICIAL INTELLIGENCE MELANIE MITCHELL 2019
LEARNS VIA CONDITIONING
TUNING
THROUGH TRAINING CONNECTIONS BECOME STRONGER (>WEIGHT) OR WEAKER (<WEIGHT)
1957 ROSENBLATT
DEEP NEURAL NETWORKS COME FROM THE AUTOMATION OF PERCEPTION
TRAINING NN TAKES A LOT OF COMPUTING POWER → TIME + ENERGY ONLY BIG COMPANIES CAN USE NN
HISTORY OF NN FROM A CRITICAL PERSPECTIVE
WHO FUNDED IT?
WHY?
POWER STRUCTURES?
HOW DID IT EMERGE?
BY WHOM? WHERE?


TIMELINE OF ARTIFICIAL NEURAL NETWORKS
1822-59
FAST FORWARD
1943
1947
ADA LOVELACE & CHARLES BABBAGE
WORLD'S FIRST PROGRAMMER
ANALYTICAL ENGINE
McCULLOCK & PITTS
INITIATORS OF THE IDEA OF ARTIFICIAL NEURAL NETWORKS
NEURONS IN THE BRAIN ARE ORGANISED AS NETWORKS.
NEURONS EXCHANGE ELECTRICAL CHARGE
INSPIRED BY THE BRAIN
NEURONS AS LOGIC OPERATORS
TO AUTOMATE LOGIC REASONING
MATHEMATICAL LANGUAGE
MECHANICAL FORM
SUGGEST A DEVICE TO REPLACE HUMAN
TO AUTOMATE VISUAL PERCEPTION
ACKNOWLEDGING THE ANIMALS TORTURED IN THE PROCESS
MEASURING THE ELECTRICAL SIGNAL IN THE NEURONS OF THE EYE ACCORDING TO IMAGE INPUT
PATTERN RECOGNITION ALREADY HAPPENS IN THE EYE AND NOT COMPLETELY IN THE BRAIN
BUT THEY NEVER BUILT THE MACHINE
1969
1960
1959
1957
1956
1948
MINSKY + PAPERT
KILLED FUNDING FOR NN
1971 RIP ROSENBLATT
1960-80
AI LABS
MIT MINSKY
CARNEGIE-MELLON SIMON/NEWELL
STANFORD McCARTHY
THE WHOLE COMPETITION WAS FOR MILITARY $
AI vs. NN
'MACHINE LEARNING' COINED BY ARTHUR SAMUEL
A SUB-FIELD OF NN
CREATED BY FRANK ROSENBLATT PSYCHOLOGIST CORNELL UNIV.
SPONSORED BY US NAVY
THE MARK 1 PERCEPTRON
A STATISTICAL NEURAL NETWORK TO AUTOMATE VISUAL PERCEPTION AND RECOGNITION
ALSO KNOWN AS SYMBOLIC AI
≠ DIFFERENT PARADIGM THAN NN
'ARTIFICIAL INTELLIGENCE' COINED BY JOHN McCARTHY
NORBERT WEINER
CYBERNETICS
NN AS ALTERNATIVE TO AI
REBUFFED MINSKY'S SPECULATION
BACK-PROPAGATION ALGORITHM
H. KELLY & A. BRYSON
1986
CONNECTIONISM
RUMELHART
McCLELLAND
1989
YANN LeCUN
CONVOLUTIONAL NN
LAYER 01
LAYER 02
A GRID OF UNITS, EACH UNIT CALCULATES AN ACTIVATION VALUE
2012
ALEXNET
HINTON & TEAM
ARTIFICIAL NEURAL NETWORKS (NN)
↳ MACHINE LEARNING
↳ CONVOLUTIONAL NN
↳ DEEP CONVOLUTIONAL NN (DEEP LEARNING)


WHAT IS A DATASET?
IS A COLLECTION OF 1 IMAGES WITH ADDED 2 INFORMATION & ORGANISED BY 3 TAXONOMIES
PUT INTO A FOLDER
IS A POLITICAL AND SOCIAL CONSTRUCT
1 COLLECTION OF IMAGES
EXAMPLE
MUSEUM COLLECTION
ART PIECE
INFORMATION
WHOSE VISION OF THE WORLD IS BEING ELEVATED IN THE CONSTRUCTION OF A DATASET?
WHO IS BEING EXPLOITED IN THE PROCESS?
CROWDSOURCING CHEAP LABOUR
NORTH SOUTH
USING FREE PHOTOS
NOW?
2 CLASSIFICATION
WHAT IS THE PROCESS OF ADDING INFORMATION TO AN IMAGE
WHO GETS TO DECIDE?
WHAT IS ADDED?
WHAT HIERARCHICAL FORMATIONS ARE BEING CREATED?
ALL TAXONOMIES ARE POLITICAL
DATA IS NEVER NEUTRAL
3 TAXONOMIES
WHAT?
IS THE WAY TO ORGANISE THE RELATIONSHIPS BETWEEN THINGS
DATA IS AN OXYMORON
1960
TODAY
HUMAN OPERATOR TELLING THE MACHINE IF THE ANSWER IS CORRECT
YES
NO
BANANA
EXAMPLE
LABELS TO CLASSIFY HUMANS
RACE
GENDER
SEXUALITY
...
HUMAN CONSTRUCT
HIERARCHICAL FORMATIONS
GOOD
THEM
BLACK
FEMALE
GAY
SOUTH
BAD
US
WHITE
MALE
STRAIGHT
NORTH
...
VALUE
RIGID & BINARY CLASSIFICATIONS
USED TO JUSTIFY
FORMATIONS OF VALUE


THE CONSTRUCTION OF A
DATASET: IMAGENET
HOW ARE DATASETS CONSTRUCTED?
BY WHO?
TO WHOSE BENEFIT?
THE CONSTRUCTION OF DATASETS ARE COMPLEX HISTORICAL & POLITICAL CONSTRUCTS
WHO IS BEING EXPLOITED IN THE PROCESS?
STEPS IN THE CONSTRUCTION OF A DATASET → FROM NOOSCOPE.AI
1 PRODUCTION OF INFORMATION
2 CAPTURE
ENCODING INFORMATION INTO A DIGITAL FORMAT
3 FORMATTING
IMAGES ORGANISED ACCORDING TO A PRIOR TAXONOMY
A SCHEME OF CLASSIFICATION
4 LABELLING
BANANA
THE CLASSIFICATION OF DATA INTO CATEGORIES
IMAGENET
STARTED IN 2005 BY PROF FEI FEI LI
MADE UP OF 14 MILLION HAND ANNOTATED IMAGES SPLIT INTO 20 THOUSAND CATEGORIES
IS THE MAIN DATASET USED IN DEEP LEARNING
IS THE BENCHMARK FOR IMAGE RECOGNITION ALGORITHMS
TRAINING
FREE DATA
FLICKR GOOGLE IMAGE
TAXONOMY
WORDNET PRINCETON UNIVERSITY
CHEAP LABOUR
AMAZON MECHANICAL TURK
SCRAPPING THE INTERNET TO USE YOUR PHOTOS FOR FREE!
COMPUTATIONAL TAXONOMY TO MAP THE ENGLISH LANGUAGE
DISTRIBUTION OF MANUAL LABOUR IN POOR COUNTRIES
DATA EXTRACTIVISM
CLAIMS A FAKE SCIENTIFIC NEUTRALITY AND UNIVERSALITY
A GLOBAL DIVISION OF LABOUR
NORTH
SOUTH
NO NEED FOR CONSENT
ELEVATING WESTERN MODELS OF KNOWLEDGE OVER ALL OTHERS
EXPLOITATION
TIMELINE
2004 FLICKR
CC
CREATIVE COMMONS LICENSE ENABLES FREE DISTRIBUTION OF IMAGES. THERE'S 6 TYPES OF LICENSES, ONE PROHIBITS ALL COMMERCIAL USE
ENABLES
DATA EXTRACTIVISM
2005 IMAGENET DATASET PROJECT STARTS
BUILT BY SCRAPPING THE INTERNET FOR FREE IMAGES
2010 IMAGENET COMPETITION BEGINS
THE LARGEST PUBLIC DATASET EVER RELEASED
2014 YMCC100M YAHOO FLICKR CREATIVE COMMONS 100 MILLION DATASET IS RELEASED
CHINA HAS BEEN THE AREA WHERE IT HAS BEEN USED THE MOST
BAIDU
2015 MEGAFACE DATASET RELEASED
69% OF THE IMAGES USED PROHIBIT COMMERCIAL USE
EXTRACTION AND EXPLOITATION OF YOUR PHOTOS BY CORPORATIONS AND GOVERNMENTS
SEE MEGAPIXELS.CC


THE ALGORITHM AND THE MODEL
"IS THE NAME OF A PROCESS WHEREBY A MACHINE PERFORMS A CALCULATION"
WWW.NEOSCOPE.AI
THE PRODUCT OF SUCH MACHINE PROCESS IS A STATISTICAL MODEL (MORE ACCURATELY THEMED) AN 'ALGORITHMIC STATISTICAL MODEL'
NEURAL NETWORK ALGORITHM
INPUT IMAGE
INPUT LAYER
HIDDEN LAYER
OUTPUT LAYER
BINARY VALUE
CLASSIFICATION
C
0 OR 1
LABEL FOR LETTER C
SYNAPSES WITH WEIGHTS
MULTILAYER PERCEPTRON
BY ANNETTE HURTER & MATTEO PASQUINELLI
EACH NODE WORKS WITH A THRESHOLD. THEY ACTIVATE SYNAPSIS ONLY IF THEY REACH THE THRESHOLD
AN ALGORITHM IS A STEP-BY-STEP PROCEDURE OF TRIAL AND ERROR TO GET AN ACCURATE CLASSIFICATION
MODEL
A TRAINED ALGORITHM
— MEANING —
OPTIMAL WEIGHTS
EXAMPLE
FACES
FACIAL RECOGNITION IS BASED ON NN MODELS THAT CAN IDENTIFY HUMANS

A Visual Introduction to AI is a collection of sketches that document the key messages coming from the online course 'Introduction to AI and Neural Networks' held in the summer of 2020 at Karlsruhe University of Arts and Design. They are the result of an ongoing exchange between design researcher and sketchnoter Elvia Vasconcelos, who was invited to attend the course by Prof. Matteo Pasquinelli.

The sketches are intended as accessible maps to help students familiarise themselves with the history of AI and the basic components of the complex architecture of artificial neural networks.

In her work, Vasconcelos has been using sketchnotes — a form of visual note-taking that combines words with simple drawings — to map information and tell stories in accessible and engaging ways. These sketches act as conversation sites that in the to and fro between people create a common ground on which to create shared meaning. Done collectively, they emerge from a continuous process of listening and exchange, where we negotiate our understanding of things together.

Illustrations

Page 51
A critical approach to the history of artificial intelligence
The course is framed as a technical and critical introduction to artificial intelligence (AI) and Neural Networks (NN), where we look under the hood to see how models are constructed and ask questions such as 'What kind of data and labour do they require?' to explore the socio-political dimensions of AI & NN. In this sketch, we learn that AI and NN are two different things, although most of what we call AI today in fact refers to NN.

Page 52
AI vs Neural Networks — genealogy
The distinction between the two is explored by looking at the genealogy of both paradigms and its key historical figures (disappointment-alert: they are all white, male and based at a US University).

Page 53
The origins of Neural Networks
NN is framed within the historical need for automation of manual labour, mental labour and perception. The basic architecture of an artificial NN is introduced. A distinction is made between two approaches to studying AI & NN: — Technical account: the how AI & NN works. — Historical genealogy: the why that explores the history of AI & NN from a critical perspective by asking: How did it emerge? Who funded it? Where? Why? To whose benefit? And at the cost of whom/ what?

Page 54
Timeline of Artificial Neural Networks
An in-depth look at the historical genealogy of Artificial NN, starting with Ada Lovelace and Charles Babbage in 1822.

Page 55
What is a dataset?
Breaks down datasets into three components: (1) collection of images; (2) classification; (3) Taxonomies. Under the illusion of neutrality (of which there is none), datasets could* be described as collections of images, with added information, organised through taxonomies. Yet they are so much more than that. Datasets are political and social constructs that elevate the vision of those shaping the narratives. These are built on historically rigid and binary classifications that are used to justify formations of value that create hierarchical structures of power. Data is never neutral (nothing is).

Page 56
The construction of a dataset: Imagenet
Taking Imagenet as a case study to understand all the steps involved in creating a dataset.

Page 57
The algorithm and the Model
If you ever want to have a long chat with someone who works in the field, just open with: 'How would you define an algorithm vs a model?'. My understanding is that an algorithm is a step-by-step process of trial and error to get to an accurate classification. The product of such processes is an algorithmic statistical model.

Notes on a (Dis)continuous Surface

Murad Khan

> 'Differentiated through that which is porous — the skin — a surface perceptive to touch, the body is dissected, fixed and woven out of a thousand details, anecdotes and stories.'[1]

From content recommendation and social media feed curation to financial risk assessment and medical diagnoses, machine learning models have become a pervasive part of our everyday infrastructure. While automated data processing instruments have long been part of our lives, machine learning provides an accelerated paradigm within which patterns can be unearthed and made actionable across large pools of historical data. Given that these technologies are being deployed in a variety of public and private systems, ethical questions are increasingly being raised when they seem to fail, with particular concern directed at the role that these technologies play in further entrenching racial biases and practices of discrimination. Whether it be failing to recognise darker-skinned subjects,[2] amplifying negative racial stereotypes[3] [fig. 1] or denying access to credit, forms of pattern-based learning appear to consistently exacerbate existing racial inequalities and modes of discrimination. With these models increasingly supporting human decision-making in key areas, it is

1. Simone Browne, 'Digital Epidermalization: Race, Identity and Biometrics', *Critical Sociology*, 36 (1) (1 February 2010): 133.

2. Joy Buolamwini and Timnit Gebru, 'Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification', *Proceedings of Machine Learning Research*, 81 (2018): 1–15.

3. See Safiya Noble, *Algorithms of Oppression* (New York, NY: New York University Press, 2018).

crucial that we understand how racial representation functions within machine-learning systems, asking both how race is understood, and what can be achieved by encoding this understanding.

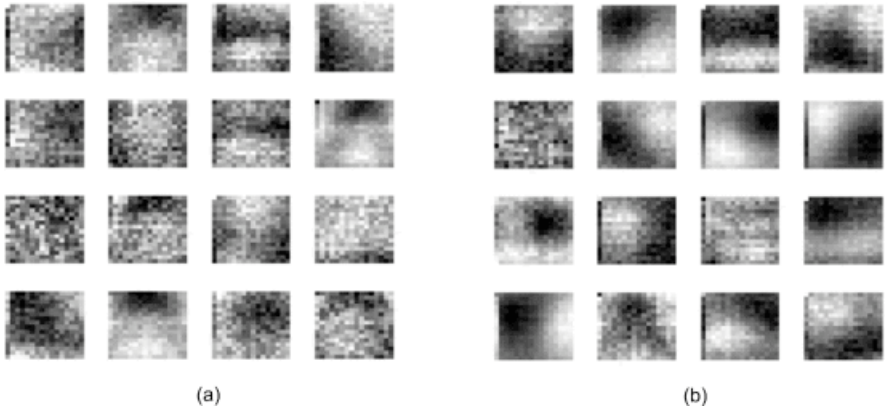


Figure 1: Discriminative race feature representation by multiple-layer Convolution Neural Networks (CNN). (a): Supervised CNN filters (b): CNN with transfer learning filters.[4]

Differential Visibilities

> 'I am given no chance. I am overdetermined from without. I am the slave not of the "idea" that others have of me but of my own appearance. I am fixed.'[5]

Frantz Fanon's description identifies his own skin as a site of fixity. In an instance of 'epidermalisation', the porous surface enveloping his body enfolds him within the tonal weave of a racial-corporal schema, apprehending him as Black before human and defining the possibilities afforded to him in accordance with the colour of his skin. This schema, which is 'cultural and discursive' rather than solely genetic,[6] is produced and reproduced across morphological

4. Siyao Fu, Haibo He and Zeng-Guang Hou, 'Learning Race from Face: A Survey', *IEEE Transactions on Patter Analysis and Machine Intelligence*, 36 (12) (December 2014), (Figure 2).

5. Frantz Fanon, *Black Skin, White Masks* (London: Pluto Press, 1986), 87.

6. Stuart Hall, *The Fact of Blackness: Frantz Fanon and Visual Representation*, ed. Alan Read (London: ICA, 1996), 16.

designations, stitching a racialised subject out of 'a thousand details, anecdotes, stories',[7] constituting them historically within the limited and specular frame of race-centric discourse. Crucially, such a schema seeks to align the exterior expressions of the body with internal traits corresponding to behaviour, character and cognitive capacity that can be generalised over members of the given racial group. Doing so composes race beyond the remits of the individual body, forming it in concert with the fictive hierarchies that guarantee the colonial arrangement, naturalising racial difference as a twinned condition of the body and mind. To this extent, race is more than just a schema of visual understanding. It forms a perceptive tissue that brings together forms of social organisation through a psychic operation that safeguards the conditions of the human for certain groups over others, forming the fragmented racial body into a knowable object whenever it is invoked: a legible surface upon which all manner of racial truths may be etched and read in service of maintaining extant social relations. To this degree, it is imperative to outline the ways in which race is figured by a similar series of epidermal abstractions within machine-learning systems, mobilised as a site for perception and identification as well as probabilistic prediction.

Abstraction, Recognition and Prediction

Whilst forms of biometric identification technology have been in use since the 1990s, it is only in the past five years that computational and graphics processing power has improved to such a degree that machine learning can regularly be used to solve problems of face detection and recognition. State-of-the-art software now utilises Deep Convolutional Neural Networks (DCNNs), training the learning model on large datasets of faces for authentication, detection and identification scenarios. This is typically done by mapping pixel regions in an input image, wherein facial landmarks (nodal points) such as the distance between the eyes, the tip of the nose, or the corners of the mouth are mapped, extracted and used to detect each unique face. [fig. 2] The number of nodal points mapped for each model varies depending on the algorithm used, with some generating an embedding of up to 128 measurements in order to properly map the

7. Fanon, *Black Skin, White Masks*, 84.

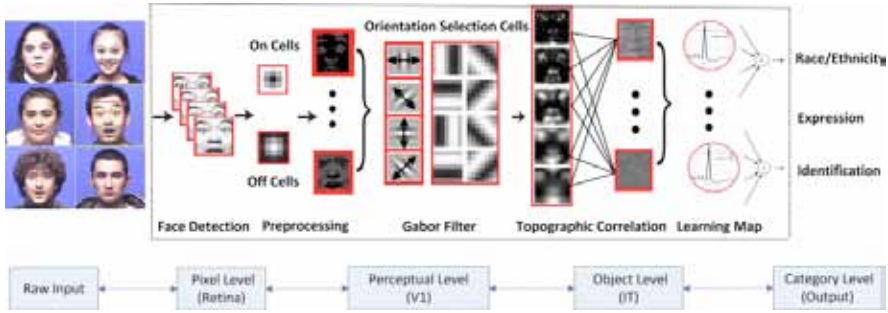


Figure 2: Fu, Siyao, Haibo He and Zeng-Guang Hou. 'Race classification from face: A survey', *IEEE Transactions on Pattern Analysis and Machine Intelligence* 36, no.12 (2014): 2483–2509.

image to a set of numerical representations. Once these landmarks have been identified and the model trained enough times on these representations, it will have scaled in complexity, moving from an array of indiscernible lines and edges, through to blobs, facial features and eventually to a coherent understanding of a 'face', or a set of values equating to different pixel regions across the image.

Racial representation comes into the equation in supervised learning scenarios, in which the model is provided with labelled images to better classify different types of faces based on these learned patterns of pixels. These labels are key to understanding the racialised nature of facial recognition, as the model learns features corresponding to a given taxonomy of racial classifications, sorting patterns it discovers into these pre-defined spaces of representation, and gauging their proximity (similarity) to one another in order to make a judgement on which racial class an individual face falls into. However, since DCNNs are dependent upon the datasets used to train them, we regularly see instances of failure if the set of faces for a certain racial class is lacking in its training data. Often, this is played out across darker-skinned subjects, causing failure rates to increase once the model encounters them in real-world applications. Subjects either fail to be recognised or are mis-recognised within the given categories of racial representation.

Such failures are exceedingly common, ranging from exam-proctoring software barring students from taking tests[8] to passport applications

being rejected.[9] That these technologies consistently fail when faced with racialised populations is a well-documented issue, making it all the more pernicious that these technologies are continually implemented in public-facing infrastructure.[10] However, those proposing greater diversity in data-representation as a solution to these issues tend to miss the nuances of the problem, failing to recognise that, implemented 'accurately' or otherwise, these racial classifications are going to be put to work in improving predictive policing, surveillance infrastructure and drone targeting systems that render differential levels of harm to racialised populations. For instance, IBM's attempt to create its 'Diversity in Faces' dataset to alleviate racial bias is a prime example of the damage that can be done when large companies latch onto the idea of being more 'diverse' only to reproduce historical understandings about the 'reality' of racial representation. In their search for a diverse and 'racially accurate' dataset that extended beyond the brute classifications of skin colour, not only did researchers from IBM make worrying recourse to craniofacial measurements as an objective indicator of racial grouping,[11] but they did so whilst simultaneously selling custom implementations of their facial recognition software to law-enforcement agencies.[12] Such pseudo-scientific practices have also spilled over into the realm of prediction and 'affective computing',

8. Khari Johnson, 'ExamSoft's Remote Bar Exam Sparks Privacy and Facial Recognition Concerns', *VentureBeat*, September 29, 2020, https://venturebeat.com/ai/examsofts-remote-bar-exam-sparks-privacy-and-facial-recognition-concerns.

9. Adam Vaughan, 'UK Launched Passport Photo Checker It Knew Would Fail with Dark Skin', *New Scientist*, October 9, 2019, https://www.newscientist.com/article/2219284-uk-launched-passport-photo-checker-it-knew-would-fail-with-dark-skin/.

10. For instance, in the case of facial recognition for the Home Office's automated passport-photo processing service, a Freedom of Information request revealed that tests had been carried out showing a poor result on darker-skinned faces, yet the service was deemed 'sufficient enough to deploy'. See: WhatDoTheyKnow. 'Skin Colour in the Photo Checking Service'. Freedom of Information request to HM Passport Office, accessed 20 October 2025. https://www.whatdotheyknow.com/request/skin _ colour _ in _ the _ photo _ checkin#incoming-1443718

11. Margaret Mitchell et al., 'Diversity in Faces', *arXiv*, January 28, 2019, https://arxiv.org/abs/1901.10436.

12. It is worth noting that, in the wake of global Black Lives Matter protests sparked by the deaths of George Floyd, Breonna Taylor and countless others at the hands of the police, IBM chose to announce a moratorium on the sale of facial-recognition technology, and to open a dialogue on 'whether and how facial recognition technology should be employed by domestic law enforcement

where emotional analysis is carried out on facial expressions.[13] As expected of a system using race-centric data, analysis of the facial expressions of Black men consistently scored them as angrier than White men, replicating social biases.[14] Frank Pasquale summarises the inevitability of bias within such a system, emphasising that 'If a database of aggression is developed from observation of a particular subset of the population, the resulting AI may be far better at finding "suspect behavior" in that subset rather than others.'[15] Thus, by mimicking the long history of pseudo-sciences such as physiognomy and phrenology that tied racialised facial representation to forms of criminality and deviance, such software merely rehashes historic schemas of racial perception under the guise of insightful and objective computational analysis, making them actionable once more.

While expression analysis demonstrates one clearly racialised form of machine prediction, there are other instances in which the learning system may not be presented with race as a defined variable in its input data, but still picks up on cues that implicate race as a latent force within an assemblage of other variables. This associative tendency exacerbates what is referred to as the problem of 'algorithmic bias', denoting the way in which socio-technical apparatuses that leverage statistical (probability-based) models to guide decision-making frequently make predictions based upon implicitly racialised data, amplifying patterns of social bias. Safiya Noble argues that these practices enact similar forms of exclusion and discrimination to 'redlining' practices in the United States. The computation of probabilities, whether for medical diagnoses, credit allocation or even search-engine results, depends upon pattern-based abstractions extending a series of

agencies'. Whilst this garnered much applause from 'AI Ethics' advocates, the more cynical among us may note that their announcement only stated that they would no longer offer 'general purpose IBM facial recognition or analysis software' for sale. Whether the software would remain available for custom implementations, such as in police body camera offerings, as they advertise elsewhere on their website, is unclear.

13. Amazon's Rekognition software, for instance, provides a confidence score for facial emotion. See https://docs.aws.amazon.com/rekognition/latest/dg/faces.html.

14. Lauren Rhue, 'Racial Influence on Automated Perceptions of Emotions' (9 November 2018). Available at SSRN: https://ssrn.com/abstract=3281765 or http://dx.doi.org/10.2139/ssrn.3281765.

15. Frank Pasquale, 'More Than a Feeling', *Real Life*, 19 October 2020, https://reallifemag.com/more-than-a-feeling/.

equivalencies and probabilities from the physiological designations of the racialised body, proxied for by a wide range of class conditions that reflect and foster structural inequalities, such as access to housing, education history, employment opportunities, life expectancy and so on. Ramon Amaro provides a useful articulation of these discriminatory logics, positing that in the realm of human difference, machine learning has become 'a projection of an already racialised imaginary enacted through technological solution — an imaginary that already understands the black, brown, criminalised, gendered and otherwise Othered human as the principle site of exclusion, quantification, and social organisation.'[16] As such, machine learning can be seen to replay the Fanonian problematics of corporeal representation and psychic differentiation within the sphere of predictive computation, contaminated by the legacies and motivations of the colonial arrangement.

Given these manifestations of race within machine learning, both at the level of visual recognition and within historical data distributions, we can see that the problem of race is best encapsulated not by the question of non-recognition, but of recognition within a discursive environment that has asserted race as a coherent metric for the classification of people as well as a meaningful predictor of future behaviour. Much as Fanon suggests, racialised subjects are 'overdetermined from without', subject to the legacies and injustices consonant with racial identification and their rearticulation within contemporary technical infrastructure.[17] In doing so, patterns of probability reach across bodies to form the recurrent possibility of an object both legible and computable, contiguous with the racialised exterior and interior features of an individual. Coerced into an extensive causal surface, the dynamisms of living, breathing individuals are pulled together by the epidermal logic described by Fanon.

16. Ramon Amaro, *AI and the Empirical Reality of a Racialised Future in AI: More Than Human* (London: Barbican, 2019), 126.

17. Hall, *The Fact of Blackness*, 20.

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The Automation of Creation: from Template Art to AI

Olga Goriunova

Twenty to thirty years seems to be the period of time after which it becomes respectable to begin the art-historical study of an art project, art form, event or movement. It was indeed in the year 2020 that, in Europe, artists and curators who made internet art in the 1990s and early 2000s started to receive an increasing amount of emails from PhD students, funded postdoctoral researchers, curators and other scholars with requests for interviews, documentation and contextual information. Suddenly, twenty- or thirty-year-old art does no longer looks outdated but can be re-seen, and can claim the present as its new cycle of — now art-historical — existence.

Only a couple of years ago, I struggled to explain to my students why exploring a project made in 1996 was meaningful. As we near the thirtieth Jubilee of the World Wide Web, the rules of the game change. Projects that looked naïve yesterday appear fresh, almost lustrous, like unexpectedly discovered early designs and blueprints of things ubiquitous today, or as traces of other paths that might have been taken. They appear in a new light — one emitted by a screen that has changed from the desktop to the phone, tablet and smart TV, but also, more importantly, one of a new ideation.

What is this new light? Is it a question of 'inevitable' historical cycles and an attempt to see how abstract principles of the spiral of history traverse our own lifetime? Is it a question of 'aging well'? Is it a question of being stuck with the same problems that create new problems

that create new problems until the cascade overflows, perhaps in the form of street protests? Or is it that we now find ourselves in the moment of a reconsideration of human-technical relationships (with advances in artificial intelligence, new language models, pervasive data practices) that let us see the analogies to similar previous moments, some of which are, coincidentally, twenty or so years old?

And what does it mean, anyway, to age well? Browsing recently, I came upon some sociology and critical theory research on consumerism, popular in the late 1990s and early 2000s, mostly validating consumption as a practice of individual identity-building. This work has not aged well at all. In the times of climate damage, such postmodern explorations seem absurd. On the other hand, a work of net art such as Cornelia Sollfrank's *Female Extension* (1997)[1] that automatically generated female artists and their works as an entry to a competition, is an early precursor of the automation of creation, 'style transfer', interpolation and other augmentation techniques performed by machine learning (ML) models today. Using AI agents in art and music, as well as text, is boosted by the latest ML models, especially large language models such as GPT-3 (generative pre-trained transformer 3), an ecological disaster due to its massive energy usage, whose PR makes it hard to judge whether it works really well or if it is merely really well promoted. (After much initial hype about its 'dangerous' power, the company that developed GPT-3 received $1bn investment by Microsoft in return for an exclusive licence.) In any case, the art world is buzzing around these new keywords.

Today, it would be no problem to build upon the implementation of Sollfrank's project by using new ML models to create identities for the invented artists, generate their unique faces, write their life stories and develop individual styles, alongside a plethora of original artworks. A project that points in this direction is a series of experiments led by Joasia Krysa in collaboration with a number of artists, *The Next Biennale Should Be Curated by a Machine* (2021–onwards).[2] One of the core questions that this work poses is why

1. Cornelia Sollfrank, *Female Extension*, 1997, https://artwarez.org/femext/content/femextEN.html.

2. See Krysa, Joasia, et al., *The Next Biennale Should Be Curated by a Machine* (2021). https://www.kurator.org/ai.

virtual artists, generated in abundance to disrupt a model of artistic success based on gatekeeping and artificial scarcity, should pretend to take on a human form. As posthuman arguments around ecology are strengthened, they will surely be joined by the animal artist, plant artist and the non-human and non-living artist. Sollfrank's project worked with the construction of 'the artist', and its state of being gendered as male, and racialised as white, and whose importance is derived from the notion of the Subject. The legacy of the concept of the Subject, foundational to the structures of our society, such as the economic (based around autonomous individuals with their own bank accounts and regimes of private property that produce subjects), medical (focused on contained bodies), legal (representing juridically formed subjects), political (reliant on voting subjects) and many others, is hard to shake. Consequently, the rest are framed as unimportant non-subjects. Injecting those into the art scene — and other scenes — in forms that exist, are invented or predicted, is something that is currently being moved out of the hands of the artist and into the realm of artificial intelligence — where new problems of gatekeeping arise.

At the time *Female Extension* was made, the question of the subject was approached through a feminist, anti-colonial and ecological critique, and it was, as part of the backwash of the postmodern movement, also a question of the author (a category that had also been strongly reworked in historical avant-gardes.) Thinking about technology, or a specific piece of software, as an author, as a collaborator, was a distinctive feature of much of the net art and software art and related phenomena of the 1990s and early 2000s. These art forms conceptualised and practised the extension of authorship to non-human infrastructural software environments and programmes. But the pushback against the idea of the human authorial figure and a lively engagement with code, software and technical infrastructures as active agents was dampened by the general capitalist logic of reward, either of companies' shareholders or for individual artists. Much post-internet art, for instance, was keen to return to the model of individual success, and it was indeed the collective and self-deprecating dimension of internet art that was discarded first. From the early 2010s, rarely could we see the kind of gestures common in the 1990s and early 2000s, when personal invitations were turned into collective platforms, artists contributed to actions under collective

art pseudonyms, and some projects remained anonymous forever. (Perhaps now, the times have changed again, since in the year 2021 all entities nominated for the Turner Prize were collectives.)

There are some differences between how the positions of authorship, the agency of technology and the nature of the artwork were posed twenty years ago, for instance, in the precursor to this volume, *Curating Immateriality*, published in 2006, and the form into which these questions have now mutated. Projects and platforms of the late 1990s and early 2000s developed new art. While striving for agency shared with technology, the focus often remained on the communal working-out of a new aesthetics. In a sense, it was a practice birthing something aesthetically brilliant. In other words, it was an empiricist, materialist endeavour.

Today, similar discussions are driven by related but changed questions: AI making art, curating automatically and personalising all data. Here, attention is squarely on the deep-learning models that make art, rather than the art made by the deep-learning models. The question is how your data is curated and personalised and what it means politically, rather than the detail of what it is that you are served. Previously, art developed an ethics of being anti-authorial, deprivileging certain forms of subject by making art that embodied such working methods as aesthetic propositions. Now, interest in curated data, machine-generated text or AI art as a new aesthetic in its own right is rendered less visible. The attention is all on the models. Certainly, AI art 'outputs', GPT-3 texts and algorithmic curation are created by such working processes. However, more often than not, these techniques are non-communicable, proprietary or financially and ecologically expensive to play with, very demanding in terms of computational capacity, or solely driven by damaging economic and political considerations. At some level, we are not interested in what such technologies produce or what they do. We are interested in what they are, and whether they are, indeed, extremely good, and if so, what happens to the humans. In other words, it is an idealist horizon; we are, once again, asking questions about the ideal, as both a logical projection and a model, and how it shapes society.

The current moment brings us back to the questions of the artist-author, the curator, the subject and the agency of technology in new

ways and for a number of reasons. Among them are incommensurability[3] (between the human scale of the users and huge models/ platforms/ infrastructures delivering results) and non-explainability (of deep-learning models, driven by the sector's desire to hype their products and commercial secrecy as much as the formal difficulty of explanation). The scale has changed to one of art inhabiting hyper-infrastructure and selecting from its options, while the human figure has faded, but in a new way. On one hand, the question of the human subject-author and technological agency continues, undergirded by our narcissistic obsession with the figure of the human, with its rich history and its wide range of practices of discrimination, and with anxiety around antihuman figures to round it all off. On the other hand, the question has morphed, from one foregrounding techno-infrastructural play, organisational aesthetics, and aesthetic brilliance,[4] to one of non-figural entities such as deep-learning models, generative forces of technological production, and machinic dynamics, which indicate that the shift to the nonhuman has already occurred (while often intensifying the problems of gender, race, disability and ecology).

We are used to the problem of media art becoming defunct. The technological age is brutal. Conceptually, however, seen from today's moment of AI hotness, the projects with which we were once involved seem to have drawn the lines that by now have subsumed our field of vision. In what follows, I will try to reconstruct some of the early sketches of the future we presently inhabit before coming back to the problem of coming to terms with the nonhuman now.

Runme and Automated Curation

Runme.org is a software art platform that I developed in 2003 with Amy Alexander, Alex McLean (who also coded it) and Alexei Shulgin. Art platforms had flourished for a few years just before social media platforms came about and obliterated everything. The spaces, infrastructures and practices for growing art that I group under the

3. M. Beatrice Fazi, 'Beyond Human: Deep Learning, Explainability and Representation,' Theory, Culture & Society 38, nos.7–8 (2020), https://journals.sagepub.com/doi/full/10.1177/0263276420966386.

4. See Olga Goriunova, *Art Platforms and Cultural Production on the Internet* (London: Routledge, 2011).

umbrella of art platforms were self-determining human-technical experiments in organisation that highlighted, stored, contextualised, brought together, put into contradiction, reframed and valued novel art forms, thus formulating new aesthetics.[5] They were either specifically designed to oppose art-institutional logics, or carved their own spaces in the new dimension of the World Wide Web. In the case of Runme, multiple categories were designed to obfuscate the institutional logic of one category, while drawing in feral projects, i.e. experiments not designed to be 'art', projects born in disparate fields, gimmicks and acts of code appreciation that stretched the horizon of possibility for software art. Awards were abandoned in favour of writing reviews of the projects, which could number in the dozens, as opposed to winners of traditional art awards, which are rarely more than three in number. I have written about Runme extensively elsewhere, but I still want to draw attention to one thing.

Runme became known as an experiment in automated curating. This always struck me as inaccurate. There was little automated about Runme. Yes, artists and non-artists could submit their work without an invitation, with a view to it being exhibited on the platform, but all entries had to be manually checked and approved (or rejected) for inclusion. We also found projects and submitted them to Runme ourselves. Every element of Runme was partially manual, and in some way, personal. At the same time, Runme focused on software art and had to think in relation to its medium, which also ran networks, platforms and, as of late, learns, interprets, judges, produces and takes decisions. A form of reflexivity required by software art warranted a form of 'working with' technology, software and infrastructures that were 'collaborating with' technology, thinking with it, sometimes following its lead. If Runme was about automated curation, then 'collaboration with' technology required a re-evaluation of automation, or machine creation and action, which this volume aims to do.

What was discussed as machine automation twenty years ago has now substantially graduated into machine intelligence. How does

5. See Olga Goriunova and Alexei Shulgin, 'From Art on Networks to Art on Platforms', *Curating Immateriality: the Work of the Curator in the Age of Networked Systems*, Data Browser V.3. ed. Joasia Krysa, New York, NY: Autonomedia, 2006.

art deal with it? When automation is shifting from the manual and personal into the cognitive, emotional, creative and universal activity of artificial intelligence, the baby steps of the early automation of art curating and co-authoring *with* the machine can be clearly seen as delineating the grammar of problems to come: the search for the subject, the predicate of actions available, the morphology of the entity, the lexicon of the database, the syntax of the infrastructure and many other conditions to come.

Suicide Letter Wizard — Algorithmically Assisted Farewell

I discovered the text that follows when searching my hard drive for documentation of Readme software art festivals and related exhibitions in response to a request from a student writing a doctoral thesis on software art. It must have been written in 2003, the same year that Runme was launched, and I made my only art project, the *Suicide Letter Wizard for Microsoft Word* (SLW). [fig. 1] The 'Template Art Manifesto' was written to accompany SLW, a little piece of software (called 'wizards' at the time and now known as 'intelligent agents' or 'smart assistants') that guided the user through writing a suicide letter and, at the end of the process, launched Word, creating the desired document.

Figure 1: Olga Goriunova (2003), *Suicide Letter Wizard for Microsoft Word*. Image Courtesy Olga Goriunova.

Designed using the inbuilt aesthetics of Microsoft's operating system, it included steps, such as 'choose salutation' (and ending), 'choose category' (supplied with pre-written content), 'add sender information' and 'choose style', among others. The styles (parodic, like the whole project) were created using Microsoft clip art. The project was a response to the new release of Microsoft Office that included hundreds of templates for all occasions of life, bar the sad, bad, intolerably awful and atrocious ones. I reproduce the text here in full.

'Click a Pathway for Some Great Ideas ® or Template Art Manifesto' (2003)

Chicken fillet, sprinkled with salt, red and black pepper, curry and coriander, costs much less in the supermarket than the whole chicken. You get it packed into a tidy plastic container along with clear instructions on how to fry it. Well, of course, you can choose not to fry it, but rather steam it, but you will agree that you wouldn't really steam curry chicken. Nor would you make a soup out of it. Basically, all that you can do is fry it.

No doubt, it is very convenient. You need not even remember to salt the dish. I also doubt that a lot of young adults today know how to cut a chicken into pieces. And even my mother can't identify which part of the cow the particular piece of beef comes from. But if you take an old cookery book, there you can get all the knowledge. Though you won't be able to apply it. Cooking today is performed with the help of dish templates, prepared products, instructions to follow, and Here we go! Enjoy being a virtuoso cook.

The template, a combination of prepared/ existing content and instructions on how to achieve a particular result with it, was introduced to private life long ago. I remember Meccano sets of plastic or metal details for assembling a plane or a ship, which adults adored no less than kids.

In the digital domain, there are more possibilities to form consistent instructions. In fact, instructions can be regarded as core components of the digital realm based on algorithms.

As culture is becoming digital, and the very nature of digitality is collage and plagiarism, templates and wizards for templates form an important part of our digital cultural life. Digital culture at large can be called a template culture.

Let us take an example of programmes for generating or processing music. Every second teenager spends a significant amount of time playing with sound libraries, mixing and looping or generating musical pieces of a certain style, length and melodic structure. He or she works with cultural heritage and a set of instructions for achieving a certain goal of 'creating' a piece. If you purchase a server space today, along with the server space you can possibly get a programme for generating your website. You can also generate CD covers, paintings, sculptures, letters, fliers, postcards, wedding planners, photo frames, home-inventory worksheets, car-loan worksheets, vehicle logs, travel planners, fitness tracking and moving lists, CV and portfolios, home-improvement worksheets, sports-team records, tape inventory, certificates, cover letters, gift labels, journals, menus, shopping lists, travel journals, party invitations and planners, school reports, newsletters, instruction sheets, bibliographies and monthly financial reports.

Is there something else you might need in life? A funeral planner? Divorce planner? Or suicide letter wizard? As the Frankfurt school showed long ago, one of the main tasks of the culture industry is to make people forget about grief and death. The intertwinement between entertainment and manipulation in pop culture was discussed before being discredited as a line of questioning. And if for Windows 3.1, Microsoft suggested a template that was nothing more than a particular web-hosting contract (without any pretensions for its global usability), Microsoft Works 6.0 helps you write a letter of sympathy to your friend who is in the hospital (or rather, it will write it for you).

When using templates, everyone can feel himself/ herself creative. You are a great DJ when you are fifteen, a great cook when you are twenty, and a great artist when you are twenty-five. When using templates, your individual preferences are very much respected. For instance, you are absolutely free to choose the

layout for your letter. You are free to cook whatever you want from curry chicken breasts.

Today's culture is digital culture. Digital culture is template culture. If there is template culture, there is template art.

Associated works: 1. Suicide Letter Wizard for Microsoft Word ®

Machine Curation

It is with archival fever that I look at this text. It draws the contours of the discourse of digital culture with an implicit reference to the notion of the defunct author, claiming our digital environment as plagiaristic. This word has since disappeared from cultural discourse, being only relevant to university administration and the TurnItIn software that supplants it. The closest contemporary development following on from plagiarism is that of training datasets. Training datasets for image recognition (with ImageNet as an example) were populated early-on by Flickr images, annotated through the mechanisms of Mechanical Turk by people in dozens of countries.[6] In summary, bad images from social networks formed the foundation of computer vision — a form of artificial intelligence working on the basis of whatever data labelled by whomever. Can we thus talk of AI in terms of plagiarism? It might seem that in our data culture, there is no data but 'plagiarist data'. Amy Alexander's *Plagiarist* (1998) copied corporate websites, included all 'sorts of projects involving other people's data' and 'as a result, [has] organically grown into a mess'.[7] Today, models are trained on such data, amplifying old habits through the feedback loops of computational practices. What the 'Template Art Manifesto' called 'consistent instructions', i.e. templates and algorithms, is now replaced by models with a capacity to learn and handle complexity, or at least provide a framework for

6. Olga Goriunova, 'Humans Categorise Humans: on ImageNet Roulette and Machine Vision', in *Donaufestival: Redefining Arts Catalogue*, April 2020, https://pure.royalholloway.ac.uk/portal/files/41356875/ENG_Olga_Goriunova_Human_Categories_DonauFestival_article.pdf.

7. Amy Alexander, *Plagiarist.org* (1998-), https://amy-alexander.com/projects/internet-art/plagiarist-org.html.

plagiaristic data practices that only sometimes grow into a mess (for instance, becoming known when image-labelling is explicitly racist, or attention is drawn to discriminating judicial or actuarial decisions derived from computer modelling). But can we even trust ourselves to judge the success and failure of AI[8] with any more precision than the 'Template Art Manifesto' did?

There is also a certain aesthetic judgment that is easily detectable in the text, which presents a certain reduction in knowledge and artfulness once the age of the template arrives. This has not gone away. It is partly rooted in a much older disdain for technological and indeed scientific reason, such as, for instance, Husserl's.[9] However, this problematic has also been somewhat transformed. It is clear now that AI can process certain kinds of information and derive decisions and actions better and faster than humans. The template has become sharp, and the question is whether politics, art, ideas of fairness and equality, care and survival can find an expression in AI, as input, framework, practice, data ontology, logic, or in other forms. An intervention in the question of good and bad subjects, such as *Suicide Letter Wizard or Female Extension*, would now have to work directly on the playing field of AI to make propositions worthy of consideration.

It is surprising to discover a reference to the 'old cookery books' and an idea of a more harmonious, tacit and fuller prior forms of knowledge (and art) in my own text. But the text also upholds the argument that a template is a liberatory tool; it is democratising. It is indeed a blueprint that can transform society, echoing the arguments about mechanisation that avant-gardists such as the Constructivists made. Tradition that sustains repetition with deviation and thus uniqueness holds within itself multiple forms of oppression. The liberatory blueprint shedding the idea of an original is not devoid of politics. The politics of AI, machine learning, data culture and curation bothered us, whether decades ago or a century ago.[10]

8. Mercedes Bunz, 'The Calculation of Meaning: On the misunderstanding of new artificial intelligence as culture', *Culture, Theory and Critique*, 60, 2019: 3–4.

9. Edmund Husserl, *The Crisis of European Sciences and Transcendental Phenomenology* (Evanston, IL: Northwestern University Press, 1970).

10. Walter Benjamin's 'The Work of Art in the Age of Mechanical Reproduction', published in 1935, remains a forever-relevant text.

Politically, what is weird about the text under consideration is that all its references are to the flesh of animals. This pack of chicken is well past its best-before date in the time of climate crisis. Furthermore, templates — a blueprint, algorithm, model — have become so pervasive that they have disappeared from view. Hyper-templates of increasing complexity in plagiarist data culture subtend machine intelligence. After all, machine learning and artificial intelligence promise template-based creation, judgment and decision-making that is personalised to the point of becoming unique. The tension is not between human or machine, hand-made or automated, but between individual and certain kinds of collective, profit and survival. When the idealist figuring of AI models is put to the test with a pragmatic working out of what happens and what should happen, fused with political thinking, with paradoxes and a diverse and open overflowing of options, maybe there will be hope. 'Our reality is imagined, developed, fed, curated, and subsequently collectively hallucinated by all of us, humans, animals, and machines and the new networked organisms that are us!'[11]

It is customary to end on a positive note, and I should have ended with the line above. But the last time we invented forms of collaboration with the machines, Facebook happened. Now, what will happen as we keep collaborating with the machines? What is the equivalent of the disaster of Facebook when you augment it with the templates embedded in OpenAI, Alphabet, Five Eyes, automated warfare, VR that promises to 'fix' your brain? What will machine curation do next?

11. Hans Bernhard, *The Next Biennale Should Be Curated by a Machine* (2021), https://www.academia.edu/48681601/UBERMORGEN_The_Next_Biennial_Should_be_Curated_by_a_Machine_Digital_Curator_Conference_Brno_2021.

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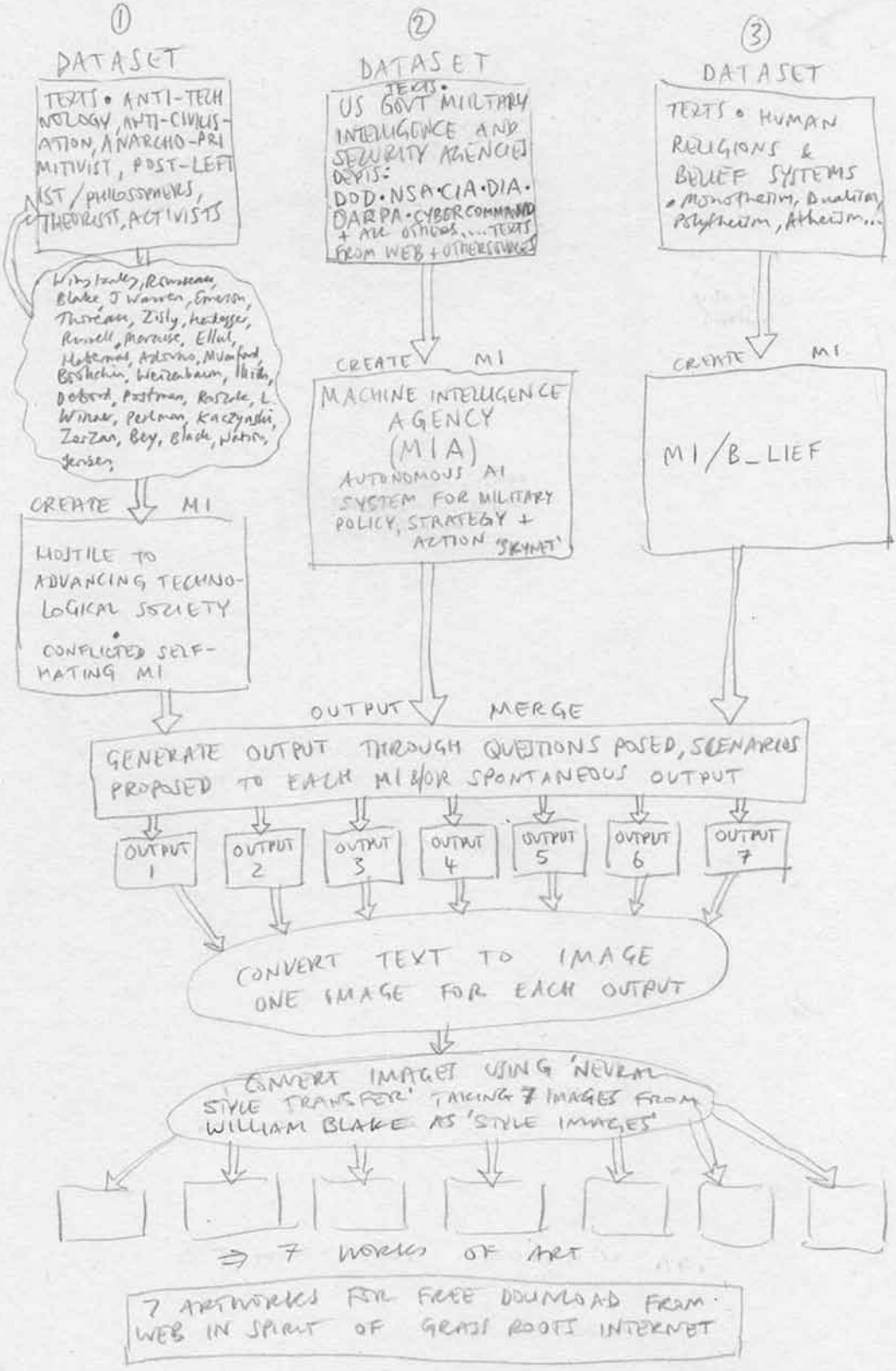
MI3
(Machine Intelligence 3)
(2018)

Suzanne Treister

M13 (MACHINE INTELLIGENCE 3)



Process

A. Machine Intelligence at Google data sweeps online material, compiling 3 datasets, in order to create and train 3 independent self learning Machine Intelligences.

Dataset 1.
From recent and historical books and texts by writers critical of the technological society; e.g. Jean-Jacques Rousseau, Ralph Waldo Emerson, Henry David Thoreau, Henri Zisly, Martin Heidegger, Theodore Adorno and Max Horkheimer, Jacques Ellul, Lewis Mumford, Joseph Weizenbaum, Ivan Illich, Guy Debord, Neil Postman, Langdon Winner, Fredy Perlman, Theodore Kaczynski, John Zerzan, David Watson, Hakim Bey, Bob Black and Derrick Jenson.

To create and train a self-critical Machine Intelligence.

Dataset 2.
From all US military departments' documents.

To create and train an autonomous Machine Intelligence for determining military policy, strategy and action.

Dataset 3.
From all online texts on religious belief systems.

To create and train a Machine Intelligence with multiple religious beliefs.

B. Data output by the 3 Machine Intelligences is synthesised and collated by Google MI into 7 bodies of text.

C. These 7 text outputs are converted by Google MI into 7 images.

Outcome

D. Google MI converts the 7 images via *Neural Style Transfer*, using 7 selected works by artist William Blake as *Style Images* to create 7 new works of art.

E. In the spirit of the grass roots internet of the 1990s the 7 artworks are presented here for copyright free download and print.

The works are images containing the original source data of their own making, ghosts of the 3 created Machine Intelligences transmuted into the style of a dead luminary artist, visions which may travel into the future, inserting themselves into homes and spaces across the globe, witnesses, for an unascertainable time span, of whatever is to come.

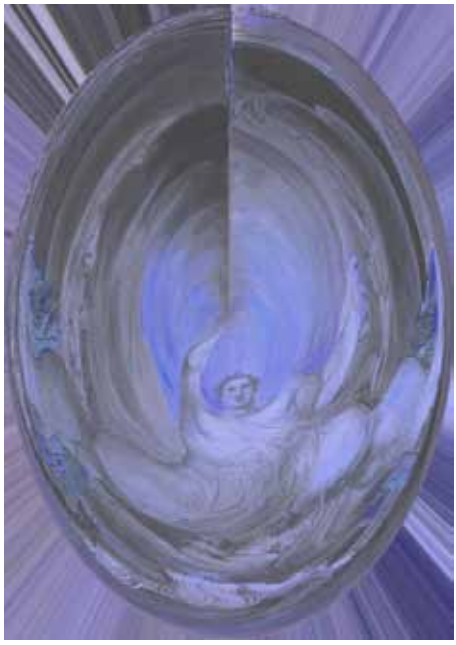


Image Captions

Page 84: *MI3 (Machine Intelligence 3)/ MI3 diagram/ Algorithm/ Set of instructions for Google MI (Machine Intelligence) to implement project.* Pencil on paper. 29.7×21 cm.

Page 85: *MI3 (Machine Intelligence 3)/ Text Information sheet.* Digital image.

Pages 86–87: *MI3 (Machine Intelligence 3)/Google MI conversion of 7 images via Neural Style Transfer, using 7 selected works by artist William Blake as Style Images to create 7 new works of art.* 7 Digital images. Print dimensions variable. Courtesy the artist, Annely Juda Fine Art, London and P.P.O.W. Gallery, New York, NY.

Commentary

Through Google Machine Intelligence department's use of the set of instructions to execute MI3, the work becomes a co-evolved project between Google, the US military and myself, as complicit co-authors.

The aim of this project is for Google Machine Intelligence to synthesise:

- Recent and historical critical writing re futures of technology.
- Military imperatives to develop advanced AI based cyber warfare and 'skynet' style autonomous AI system (through managed co-evolution with companies such as Google).
- Human religious belief systems.

into works of Romantic art in the style of British artist William Blake, conceptually synthesising, 'neutralising' and transmuting these critical issues and powerful forces into art, whilst invisibly retaining the original material in the images' source codes.

In recreating a Romantic art for the public, the aim is not to assert the originality of the artist, to fuel a pure aestheticism or induce nationalisms or conservatisms as Romantic art of the past has done, but to produce a Post-Political-Romanticism, making a space for visions of a post-sublime, in this case formed in the style of a pre-existing luminary artist. These works are visions containing the original source data of their own making intended to illuminate and effect change simultaneously through their visuality and the historical trajectories of their encoded source content. They are visions that will travel into the future, inserting themselves as images into homes and architectures across the globe, themselves witnesses of all that is to come.

The title MI3 refers primarily to the three dataset categories (Machine Intelligence × 3) but also to the three co-authors (Google, the US military and myself) and to the numerical naming system of British Intelligence Agencies (eg MI5 stands for Military Intelligence 5).

Notes

Machine Intelligence at Google https://research.google.com/pubs/MachineIntelligence.html.

Artists and Machine Intelligence AMI is a programme at Google that brings artists and engineers together to realise projects using Machine Intelligence. By supporting this emerging form of artistic collaboration, we open our research to new ways of thinking about and working with intelligent systems. https://ami.withgoogle.com/.

Artists and Machine Intelligence blog, https://medium.com/artists-and-machine-intelligence.

AMI works are developed together alongside artists' current practices and shown at galleries, biennials, festivals, or online. https://medium.com/artists-and-machine-intelligence/what-is-ami-96cd9ff49dde.

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Google's Tensorflow, https://www.tensorflow.org/.

Interview between Suzanne Treister and Kenric McDowell at Google Machine Intelligence.

Nora N. Khan, 'Towards a Poetics of Artificial Superintelligence', 25 September 2015, https://medium.com/after-us/towards-a-poetics-of-artificial-superintelligence-ebff11d2d249.

Romanticism emerged as a response to the disillusionment with the Enlightenment values of reason and order in the aftermath of the French Revolution of 1789.

As articulated by the British statesman Edmund Burke in a 1757 treatise and echoed by the French philosopher Denis Diderot a decade later, 'Al that stuns the soul, all that imprints a feeling of terror, leads to the sublime', https://www.metmuseum.org/toah/hd/roma/hd_roma.htm.

William Blake (28 November 1757 – 12 August 1827) was an English poet, painter and printmaker. Largely unrecognised during his lifetime, Blake is now considered a seminal figure in the history of the poetry and visual arts of the Romantic Age. What he called his prophetic works were said by twentieth-century critic Northrop Frye to form 'what is in proportion to its merits the least read body of poetry in the English language'. His visual artistry led twenty-first-century critic Jonathan Jones to proclaim him 'far and away the greatest artist Britain has ever produced'. In 2002, Blake was placed at number thirty-eight in the BBC's poll of the 100 Greatest Britons. He lived in London his entire life (except for three years spent in Felpham), and produced a diverse and symbolically rich œuvre, which embraced the imagination as 'the body of God' or 'human existence itself'. Although Blake was considered mad by contemporaries for his idiosyncratic views, he is held in high regard by later critics for his expressiveness and creativity, and for the philosophical and mystical undercurrents within his work. His paintings and poetry have been characterised both as part of the Romantic movement and as 'Pre-Romantic'. Reverent of the Bible but hostile to the Church of England (indeed, to almost all forms of organised religion), Blake was influenced by the ideals and ambitions of the French and American Revolutions. Though later he rejected many of these political beliefs, he maintained an amiable relationship with the political activist Thomas Paine; he was also influenced by thinkers such as Emanuel Swedenborg. Despite these known influences, the singularity of Blake's work makes him difficult to classify. The nineteenth-century scholar William Rossetti characterised him as a 'glorious luminary' and 'a man not forestalled by predecessors, nor to be classed with contemporaries, nor to be replaced by known or readily surmisable successors'. https://en.wikipedia.org/wiki/William_Blake.

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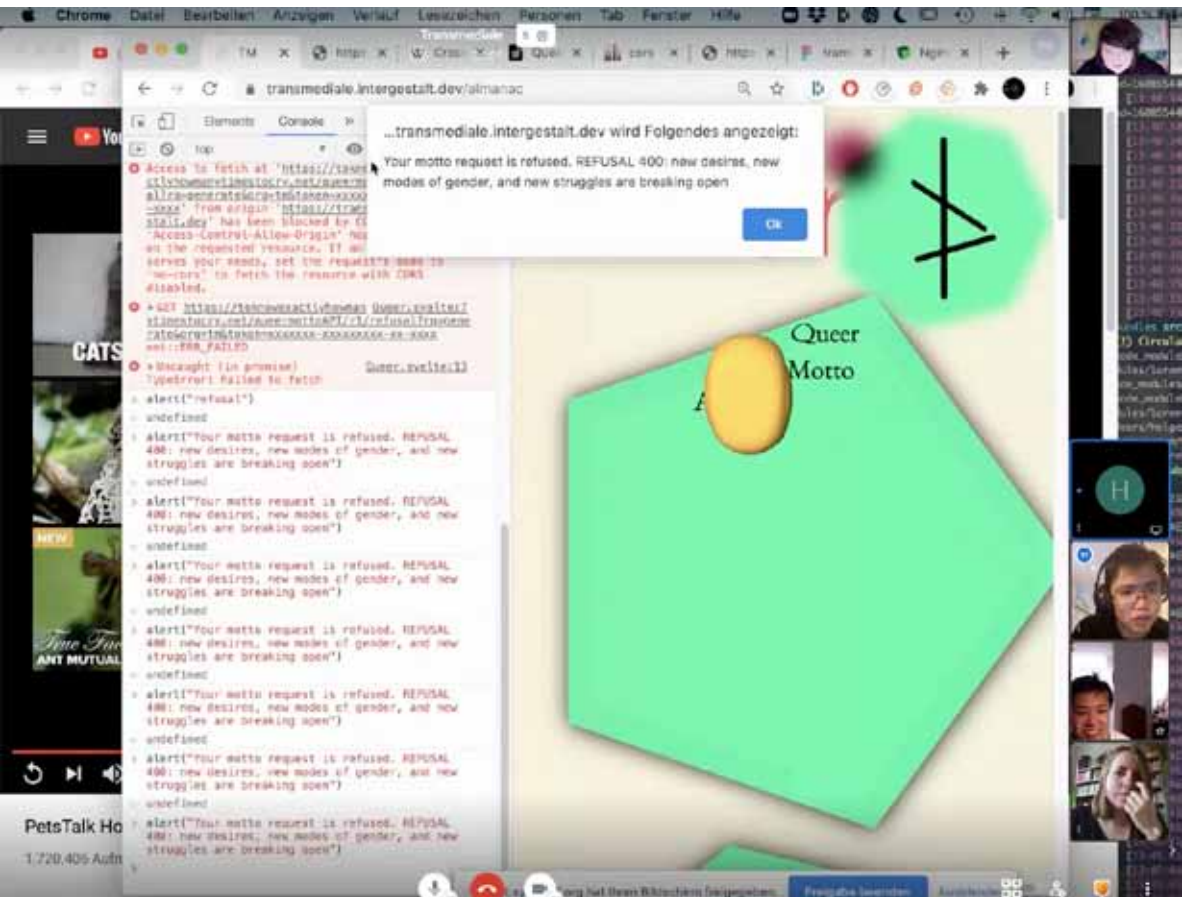
Queer Motto API Manual: To know exactly how many times to cry (2020)

Winnie Soon and
Helen V. Pritchard



‘Queer Motto API’ software—as—service lets you develop websites and applications to retrieve and display mottos for: urban dreams lying in wait, anti—facist guiding principles of living, queer love ethics, authoritarian resistances, unsettling normative computational culture, revolutions, political movements, destruction of smart city infrastructures, class struggles, municipal identities, art practices, joyful engagements and violent direct action.

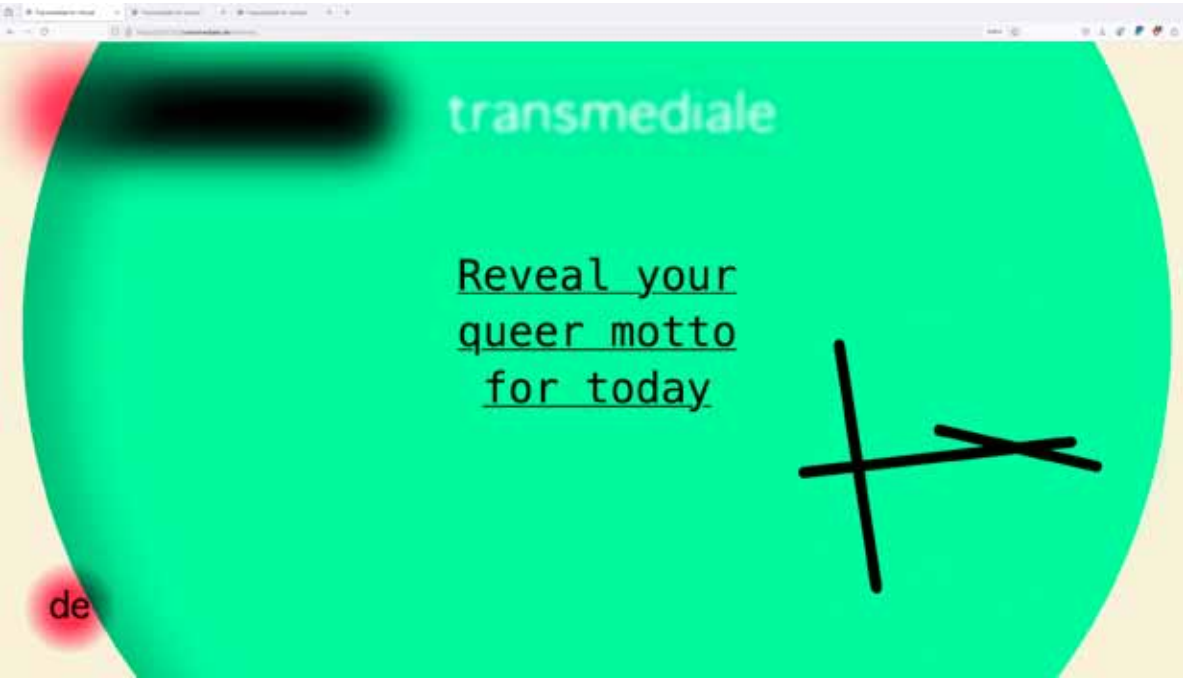
Our mandate:

- be undisciplined and vulnerable,
- reorganise your collective life and fight injustices in the present,
- NAP and be RESTful, render computers unusable,
- refuse tokenisms,
- (re)externalise risks,
- make use of accident and injury,
- create networks of pleasure,
- launch relentless attacks.

ALL ACCUMULATED & QUE(E)RIED IN REALTIME PROGRAMATICALLY.

Thank you. Have a nice day!

Queer Motto Alliance — Refuse Tokenisms



Application Programming Interface (API) exposes data to be shared, automated, circulated and redistributed in wider computational culture. APIs are commonly used in software industry and platforms like Gam$zon. Their web of APIs stretch from the streets to the sheets.

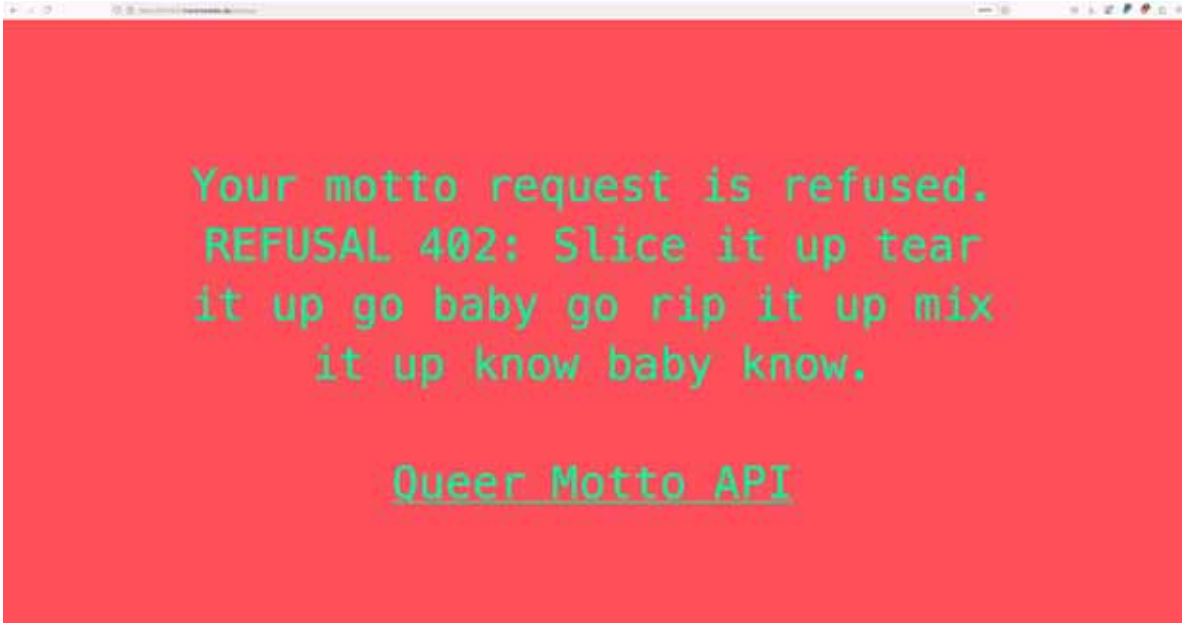
Big Tech APIs operate in ways to violently arrange life, to become the ones who make all decisions, from how to store and process data about our streets to whom we love and desire — we refuse this and we are an army of lovers. The Queer Motto API consists of generative allied mottos and refusal messages to infuse your day, reorganise your collective life and fight injustices in the present. They are based on manifestos and zines for queer and intersectional life that create a source text for machine learning and generative processes. Undisciplined and vulner—able, the programme also implements computational logics to perform refusal at the infrastructural level, generating messages that are found in our collection of queer and intersectional source text.

1. Generative propositions – Dream Again Last Night's Dream

Queer Motto API uses a RESTful architecture, machine learning and generative processes. A software–as–service, Queer Motto API contantly listens for Motto requests. The Mottos are generated through the mis/use of AI–specifically recurrent neural networks – a machine learning model that the Queer Serivce team use to train and process sequences of collective voices. The machine learning algorithm learns its writing style at a character–based level. However instead of a single authorial voice the model is trained on an alliance of queer writers.

The mottos are written using a 'diastic reading' (https://poetrydish.blogspot.com/2009/02/forms–of–poetry–diastic.html), a chance–based deterministic method that relies on the use of two texts, source text and seed text. This queer model opens up new imaginaries and forgotten language beyond the confines of accurate prediction and effective generalisation.

2. Refusal Logic – What's Beneath the Belt and Deep Inside the Heart

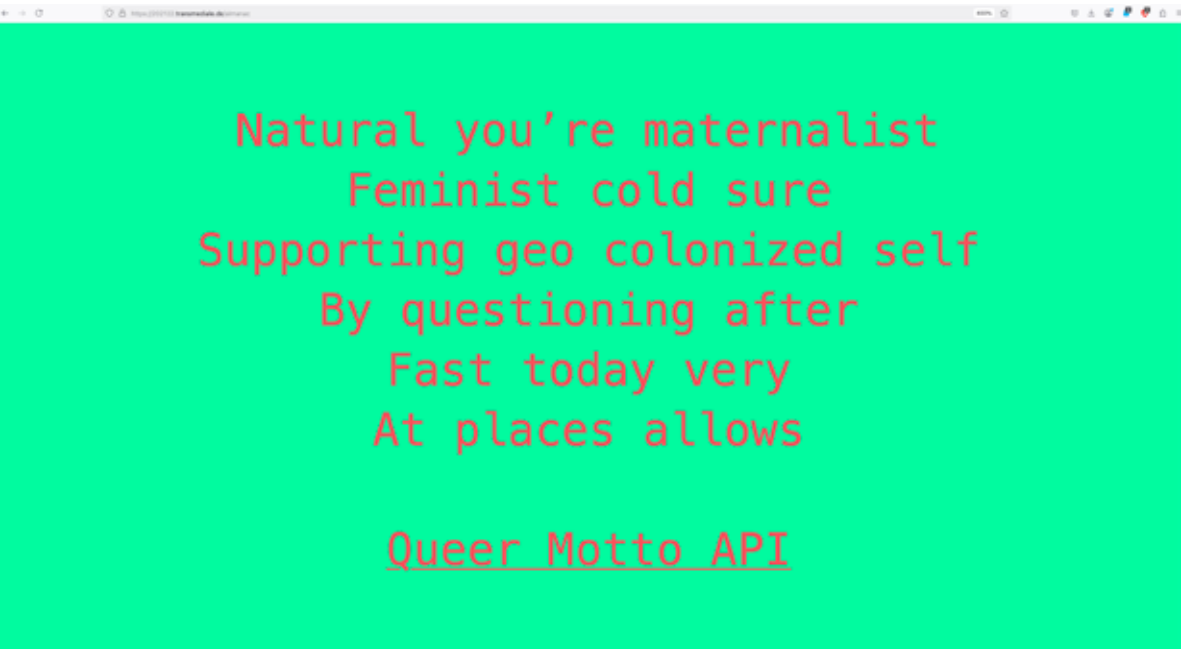


Code	Description
400	A refusal word is found in the generated motto
401	Infrastructure & technical issues
402	Every API request counts & on specific nap dates

There are three levels of refusal logic that point to different living conditions and open up other ways of being and actions. Refusal code 400 makes explicit what (https://gitlab.com/siusoon/queer-motto-api/-/blob/master/queerapi_src/refused_words.py) to refuse, such as 'hate', 'oppression' and 'foreclosing' to consider wider injustice phenomena. Refusal code 401 is more related to infrastrucure and technical issues, such as incomplete API parameters, server errors and connection problems, and these remind one of the effort and care that are required to maintain a technocultural system. The last refusal code 402 points to labour conditions, and encourages others to take naps and live restfully. The API will refuse to generate mottos when it exceeds the assigned count (which is currently ten) of the API requests, as well as on specific dates, such as 8 March (Trans*Feminist strike), 1 May (Labour strike), and 20 July (Strike for Black Lives). With all these checking logics, a refusal message will be displayed instead of a motto.

The refusal messages (https://gitlab.com/siusoon/queer-motto-api/-/blob/master/queerapi_src/refusal_messages.py) are actions and statements that are taken from the queer and feminist source text. They are not tehnical errors, but call for attention to our living and societal conditions, which are highly computational, resource-driven and stressful, and to rethink what and why to refuse, and how we might reorganise and queer our collective life – a form of society-level operating system. As elaborated by Kara Keeling, this form of queer operating system service 'facilitates and supports imaginative, unexpected, and ethical relations between and among living beings and the environment' (2014, 154).

Undisciplined and Vulnerable: Allied Mottos Generated from the Queer Motto API



The project is open source (https://gitlab.com/siusoon/queer-motto-api/-/tree/master/queerapi_src), which means that anyone can fork a copy and host on their server space to offer this Queer Motto API service. Unlike a centralised API it can be forked and hosted on any server. It is also promsicuous (https://constantvzw.org/site/-Promiscuous-pipelines-.html) since it can be used on mulitple apps and servers at the same time and shares back the data with everyone, modulating queer connections.

NAP and be RESTful: NAPPY API Specification – r1

Queer Motto API creates a space for others to build apps and generate mottos on their website by following our API specification.

USAGE:

```
https://toknowexactlyhowmanytime-
stocry.net/queermottoAPI/r1/refusal?
rq=generate&org=refuse-tokenisms-tt-2021
```

NOTES:

1. Any incompleted parameter/values will result in generating refusal code and messages.

2. The parameter of org is the key authetication parameter, and the example above is for TESTING only.

3. Please contact us for the new org value if you want to use this NAPPY API in your projects or organisations.

Parameters

Parameters	Value(s)	Description
rq	'generate', 'motto_log', 'all_log'	request type
org	pls contact us for this	A unique identity for each > organisation/user to generate mottos > e.g xxxxxxx-xxxxxxxxx-xx-xxxx

Parameter: rq

rq
string
REQUIRED

Request types:

Value	Description
generate	a new motto request
motto_log	retrieve all the generated mottos
all_log	retrieve all the generated mottos and refusal records

NOTE:

1. Any incompleted parameters/values will result in generating refusal code and messages.

Parameter: org

org
string
REQUIRED

A unique identity for each organisation/user to generate mottos <e.g xxxxxxx– xxxxxxxxx–xx–xxxx>.

NOTE:

1. Please contact us for the org value if you want to use this NAPPY API

2. Any incompleted parameters/values will result in generating refusal code and messages.

API Response

200 application/json
The API returns a JSON file.

NOTE:

To use the generated text, your end (at the programme level) can parse the delimiter \\n in which it signifies the next line of the motto.

2. when rq=motto_log:

Returned format: JSON

Description: Return all the generated allied mottos.

USAGE:

```
https://toknowexactlyhowmanytimestocry.net/
queermottoAPI/r1/refusal?rq=motto_log
```

EXAMPLE:

Field	Description
0	Generated mottos
1	Timestamp (CET time)
2	Organizational name
3	Seed Text

3. when rq=all_log :

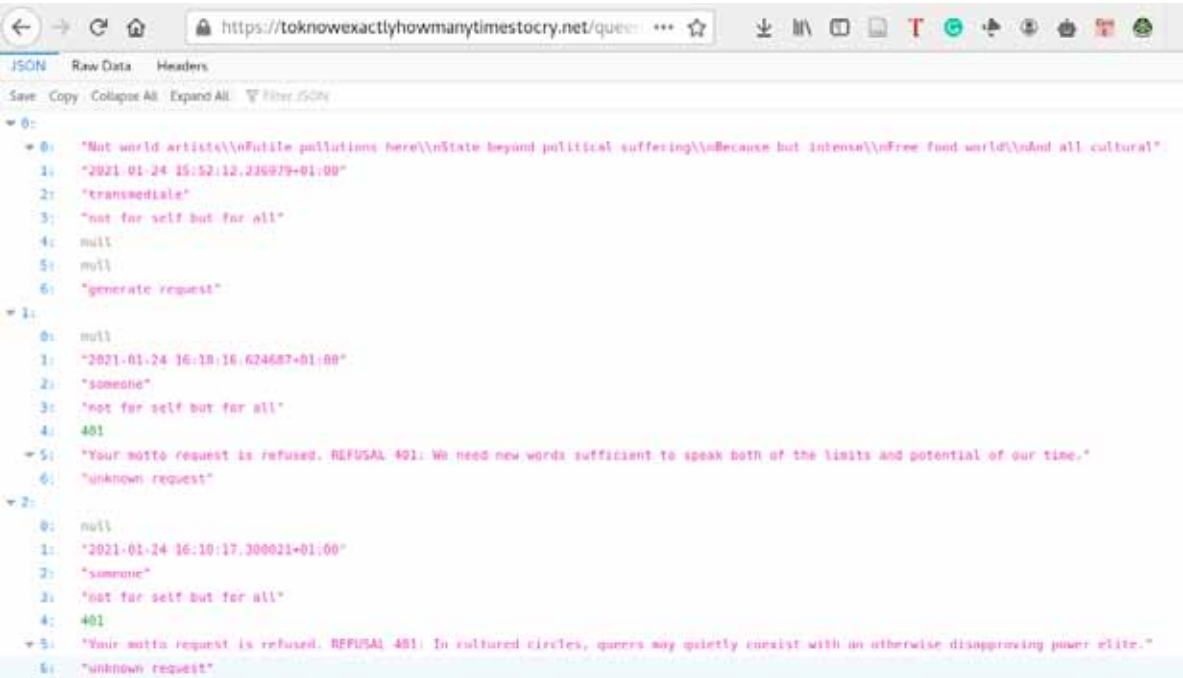
Returned format: JSON

Description: Return all the logs from the server, including various request types, generated mottos and refusal messages.

USAGE:

```
https://toknowexactlyhowmanytimestocry.net/
queermottoAPI/r1/refusal?rq=all_log
```

EXAMPLE:



Field	Description
0	Generated mottos
1	Timestamp (CET time)
2	Organisational name
3	Seed Text
4	Refusal code
5	Refusal messages
6	Request type — ‘unknown’, ‘generate’, ‘motto—log’, ‘all_log’

Licence – just to love each other!

All Manifestos in Source Text – Start Soul–Searching

See the list: https://gitlab.com/siusoon/queer–motto–api/–/blob/master/README.md#all– manifestos–in–source–text–start–soul–searching

Some Suggested Readings & Projects – Undisciplined and Vulnerable

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Queer Service Team – Render Computers Unusable.

Winnie Soon (https://www.siusoon.net),
Helen V. Pritchard (http://www.helenpritchard.info),
Cristina Cochior (http://randomiser.info/),
Nynne Lucca (https://www.nynnelucca.com).

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II. Expanded Curatorial Field

Flexible Contexts, Filtering, and Automation: Models of Online Curatorial Practice

Christiane Paul

This text[1] outlines effects of networks, platforms and collaborative exchange on the curatorial process, and discusses different models for online curatorial practice, ranging from the more traditional model of a single curatorial 'filter' to multiple curatorial perspectives and forms of automated curating that integrate technology in the curatorial process. Among the issues that will be discussed are politics of selection and the degrees of agency of the curator/ public/ software in the curatorial process.

In order to explore models for online curatorial practice one needs to take a closer look at the evolution of Web platforms from the browser to social media, and the performance of objecthood in different categories of virtual spaces, from the webpage to a virtual world.

The term 'online curatorial practice' has become an unstable dominion. As COVID-19 prompted the art world to move most of its programming online in 2020, the definitions of an online exhibition and online curatorial practice became even more malleable. While

1. This text is an updated version of 'Flexible Contexts, Democratic Filtering, and Computer Aided Curating — Models of Online Curatorial Practice', published in Joasia Krysa (ed.), *Curating Immateriality. The Work of the Curator in the Age of Network Systems*, DATA browser Series Vol.3 (Autonomedia Press: New York, NY: 2006).

the distinctions between an online exhibition featuring Web-based art and an online showcase of documentation or components of work shown in physical gallery space had gradually become more permeable over the past decade, the year 2020 amplified the fluidity of boundaries between online and physical space.

Tracing the evolution of platforms as spaces for producing and disseminating Web-based art, Marialaura Ghidini makes a distinction between curating on the Web as 'a site-specific approach to curating web-based exhibitions that enables new ways of producing and displaying digital art' and curating online as 'the practice that derives from displaying museum and gallery collections online.'[2] According to Ghidini, curating on the Web, as a subset of curating online, responds to the characteristics, tools and interfaces of the Web as a medium. One could argue that both the curation of shows of Web-based art (curating on the Web) and the online representation of physical gallery exhibitions (curating online) require curatorial engagement with the platforms and interfaces of the internet and Web, but this engagement certainly occurs on different levels. The referential context for Web-based art is the internet itself; for an online exhibition of physical work it is objecthood in corporeal space.

In his essay 'Curating Online Exhibitions, Part 1: Performance, variability, objecthood', Michael Connor also points to the categorical instability of the term 'online exhibition', listing a small sample of the bewildering array of projects that might be covered under this term, ranging from a crowd-funding campaign offering artists' multiples to backers or an exhibition in the virtual world of Second Life to a zip file downloaded to a user's computer or an HTML page featuring thumbnails and links to artists' works or a curated app offering selections of smartphone-based VR works.[3] Connor outlines how the online context puts stress on the traditional notion of an exhibition as an imposition of order on objects that are brought into a particular space and specific set of relations with one another. First

2. Marialaura Ghidini, 'Curating on the Web: The Evolution of Platforms as Spaces for Producing and Disseminating Web-Based Art', *Arts 8*, no.3 (2019): 78, https://doi.org/10.3390/arts8030078.

3. Michael Connor, 'Curating Online Exhibitions, Part 1: Performance, Variability, Objecthood', *Rhizome*, 13 May 2020, https://rhizome.org.

of all, born-digital artworks are often a performance of objecthood rather than objects themselves and may require being enacted within complex ensembles of hardware and software, relying on audience participation or external websites. Secondly, online exhibitions do not take place in a unified, coherent space but may be experienced on an array of output devices, from mobile devices to the desktop, and presented in very different pictorial spaces, from a 3D world to the browser. Finally, the sets of relations that are foundational to a curatorial goal may be refracted through the input of audiences and reshuffling of algorithms on the Web. Connor consequently defines an online exhibition as 'the performance of artworks and their objecthood in a particular mise-en-scène, brought into dynamic relationship with one another and a broader network context.'[4]

When internet art officially came into being with the advent of the WWW in the early 1990s, it immediately inspired a variety of dreams about the future of artistic and curatorial practice, among them the dream of a more or less radical reconfiguration of traditional models and spaces for accessing art. As an art form that exists within a (virtual) public space and has been created to be seen by anyone, anywhere, at any time — provided one has access to the network — net art does not necessarily need the physical space of an art institution to be presented or introduced to the public, and promises new ways of distributing and accessing art that can function independently of the institutional art world and its structures of validation and commodification. Net art seems to call for a 'museum without walls', a parallel, distributed, living information space that is open to interferences by artists, audiences and curators — a space for exchange, collaborative creation and presentation that is transparent and flexible.

An online art world — consisting of artists, critics, curators, theorists and other practitioners — immediately developed in tandem with internet art and outside of the institutional art world. In the late 1990s, institutions also began to pay attention to net art as part of contemporary artistic practice and slowly incorporated it into their programming. While BBS-enabled art platforms such as *ARTEX* (1980) and *The Thing* (1991) had existed on the internet before the

4. Ibid.

launch of the Web, the mid-1990s saw a new wave of Web projects and galleries created by independent curators and (artist) collaboratives, among them artnetweb (1993) and äda'web (1995). Curatorial practice in the online world began to unfold not only independent of institutions but also in an institutional context through websites affiliated with museums, such as the Walker Art Center's *Gallery 9*,[5] SF MOMA's *e-space* and the Whitney Museum's *artport*.[6] These different curatorial projects differ substantially in their respective interpretation of selection, filtering and 'gate-keeping' as fundamental aspects of the curatorial process. With its inherent flexibility and possibilities for customisation and indexing, the early Web potentially allowed for an increased public involvement in the curatorial process, a form of 'public curation' that promised to construct more participatory forms of filtering and a more 'democratised' curatorial process.

Web-based art and curatorial practices entered another phase with the proliferation of the blogosphere and social media sites from the early 2000s onwards, when user-generated content became aggregated on corporate platforms as a set of services, tools, and products — from Facebook (2004) and YouTube (2005) to Twitter (2006) and Tumblr (2007). Artist and curators began to experiment with the corporate platforms of Web 2.0 as spaces for both the creation and curation of art. The early teens of the twenty-first century brought about yet another shift for online art and curation with the era of the so-called 'post-Internet' that finds its artistic expression in works both deeply informed by digital technologies and networks, yet crossing boundaries between media in their final form. The term 'post-internet' attempts to describe a condition of artworks and 'objects' that are conceptually and practically shaped by the internet and digital processes — taking their language for granted — yet often manifest in the material form of objects such as paintings, sculptures or photographs. Whether one believed in the theoretical and art-historical value of the post-internet concept and the hyping of post-internet art as a 'Revolutionary New Art Movement',[7] the rapid spread of the term throughout art

5. *Gallery 9*, Walker Art Center, http://gallery9.walkerart.org.

6. *artport*, Whitney Museum of American Art, http://artport.whitney.org.

7. I Wallace, 'What Is Post-Internet Art? Understanding the Revolutionary New Art Movement', *Artspace*, 18 March 2014, https://www.artspace.com/magazine/interviews_features/trend_report/post_internet_art-52138.

networks testified to a need for terminologies that capture a certain condition of cultural and artistic practice in the early 21st century. At its core seems to lie a twofold operation: first, the confluence and convergence of digital technologies in various materialities; and second, the ways in which this merger has changed our relationship with these materialities and our representation as subjects. The term 'post-internet' captures an embeddedness of the digital in the objects, images and structures we encounter on a daily basis and the way we understand ourselves in relation to them. The categorical instability that surrounds the concept of online curation today is partly due to the increasing interconnection of the physical and networked world and the fact that what was once a clearly defined category of 'net art' existing exclusively on the Web increasingly became networked art that exists across media, incorporating online and physical components. Ceci Moss traces this rise of a multifaceted approach to online artistic practice in her book *Expanded Internet Art*,[8] which explores how artists use various online and offline means to make art about informational culture and create a critical language in response to the persuasive influence of networked technologies.

Platforms, Access and Collaborative Exchange

From its inception, online curatorial practice has been shaped by and existed within complex technological and economic ecosystems that support artistic production, and these systems themselves have substantially evolved over the past two decades. The internet, networked mobile devices — from smartphones to tablets — and increasingly affordable software and hardware brought about a new era for the creation and distribution of media content. As with the arrival of the first Portapak video cameras in the late 1960s, the utopian promise of the Web era of the 1990s was 'technologies for the people' and a many-to-many broadcasting system that returns the power over distribution to the individual and has a democratising effect. In its early days, the Web was dominated by research and educational institutions and provided a playground for artistic experimentation.

8. Ceci Moss, *Expanded Internet Art — Twenty-First-Century Artistic Practice and the Informational Milieu* (New York, NY: Bloomsbury Academic, 2019).

The dream of a 'network for the people' did not last long, and from the very beginning, obscured the more complex issues of power and control over media. Only a portion of the world is connected to the 'global' network, and a variety of countries have been subject to government-imposed access restrictions. The Web quickly became a mirror of the actual world, with corporations and e-commerce colonialising the landscape. The burst of the 'dot com' bubble around 2000 ended a lot of the hype surrounding the internet economy and led to reconsiderations of e-commerce, until the arrival of so-called social media a few years later started yet another boom.

One can argue that networked environments enhance the potential for democratisation and increase the public's agency through enhanced distribution, filtering and archiving mechanisms that give importance to the voices of individuals or groups (as has been seen in pro-democracy or anti-racism movements around the world); through the fact that interventions (in the broadest sense) are no longer necessarily bound to a geographic space; and through a largely decentralised rather than hierarchical structure. This obviously does not mean that authority itself has been eliminated, as philosophers and theorists have illuminated over the decades — from Baudrillard's 'Requiem for the Media'[9] to Galloway's *Protocol — How Control Exists After Decentralization*.[10] As Charles Bernstein has put it, 'Authority is never abolished but constantly reinscribes itself in new places... Decentralisation allows for multiple, conflicting authorities, not the absence of authority.'[11] In general, agency has become considerably more complex through the process of technological mediation.

The fact that internet art is potentially interactive, participatory or even collaborative and open to exchanges with trans-local communities, makes questions surrounding agency and the authority of authorship a central element of both new-media art practice and

9. Jean Baudrillard, 'Requiem for the Media', in *For a Critique of the Political Economy of the Sign*, trans. C Levin (St. Louis: Telos Press, St Louis, 1981).

10. A. Galloway, *Protocol — How Control Exists After Decentralization* (Cambridge, MA: The MIT Press, 2004).

11. Charles Bernstein, 'Electronic Pies in the Poetry Skies', in M. Bousquet and K. Wills, (eds.), *The Politics of Information: The Electronic Mediation of Social Change* (Alt-X Press, 2003), http://www.altx.com/ebooks/infopol.html.

curatorial processes. Agency manifests itself in the possibilities for influencing, changing, or creating institutions and events, or acting as a proxy. Degrees of agency are measured by the ability to have a meaningful effect in the world and in a social context, which naturally entails responsibilities. In digital art, any form of agency is necessarily mediated, and the degree of agency is therefore partly determined by the levels of mediation unfolding within an artwork. The agency of the creator/ user/ curator/ public/ audience is highly dependent on the extent of control over production and distribution of a work, which has always been a central issue of the discourse around mass media.

One of the most fundamental differences between the degrees of control and agency in analogue and digital media lies in the nature and specifics of the technology itself. Media such as radio, video, or television mostly relied on a technological super-structure of production, transmission and reception that was relatively defined. The modularity and variability of the digital medium, however, constitutes a far broader and more scattered landscape of production and distribution. Not only is there a plethora of technologies and softwares, each responsible for different tasks (such as image manipulation, 3D modelling, Web browsing etc), but due to the modularity of the medium, these softwares can also potentially be manipulated or expanded. As a result, there are numerous potential points of intervention for artistic practice and cultural production in general. In this respect, the internet and digital media have certainly opened the field for artistic engagement, agency and conflicting authorities. The tension between the inherent openness of the digital medium due to its modularity and variability, and its closeness due to corporate control, has become most pronounced in the corporate social media platforms operating on the basis of user-generated content.

In networked environments, collaborative exchange is a fundamental part of artistic and cultural production and has led to shifts in the understanding of the artwork and authorship, which in turn has fundamental consequences for curatorial practice. Curators need to place more emphasis on and develop strategies for documentation of works that are created by multiple authors and constantly develop over time. When it comes to online art, a collaborative process and model is almost a necessity and naturally affects the roles of the curator, artist, audience and institution. Collaboration — between

artists, programmers, curators, institutional departments and participating audiences — leads to an increased openness of production and presentation. It requires awareness of process, and its results are not necessarily predictable.

Participation and collaboration are inherent to the networked digital medium, which supports and relies on a constant exchange and flow of information. They are also an important element in multi-user environments such as 3D worlds that allow their inhabitants to extend and build their framework. The collaborative model is a crucial concept when it comes to the artistic process itself. Digital artworks in general often require a complex collaboration between artists, programmers, researchers, designers or scientists, whose role may range from that of a consultant to a full collaborator. This work process is fundamentally different from the scenario where artists hire people to build or create components for their work according to instructions, since collaborators in digital practice are often very much involved in aesthetic decisions. Digital art tends to demand expertise in various fields, which one individual alone often can't acquire.

Another form of cooperation occurs in projects where an artist establishes a framework in which other artists create original works. Early examples of this approach would be Lisa Jevbratt's *Mapping the Web Infome*[12] and *Carnivore* by Alex Galloway and the Radical Software Group (RSG).[13] In both cases, the artists set certain parameters through software or a server and invite other artists to create 'clients', which in and of themselves again constitute artworks. In these scenarios, the initiating artist occasionally plays a role similar to that of a curator, and the collaborations are usually the result of extensive previous discussions, which sometimes take place on mailing lists specifically established for this purpose. A more recent example of this collaborative exchange would be curator Robert Sakrowski's *CuratingYouTube* (2007), which will be discussed in more detail in the context of public curation.

12. Lisa Jevbratt, Mapping the *Web Infome*, 9 July 2001, http://128.111.69.4/~jevbratt/lifelike/.

13. Alex Galloway and Radical Software Group (RSG), *Carnivore*, 2001, http://www.rhizome.org/carnivore.

Many net art and digital projects are ultimately created by audience input, which constitutes another level of participation, although not necessarily collaboration in the narrower sense. While the artists still maintain a certain (and often substantial) control over the visual display, the result would consist of a blank screen without the audience's contribution. Mark Napier's *P-Soup* (2000),[14] Andy Deck's *Open Studio* (1999)[15] or *Apartment* (2001) by Martin Wattenberg and Marek Walczak[16] were early prime examples of this participatory practice. These works, activated and realised through audience input, find their extension in 'expanded', more hybrid internet art that uses social media platforms or the blockchain for audience participation. Eve Sussman's *89 seconds Atomized* breaks the final artist's proof of the artist's video *89 seconds at Alcazár* into 2,304 unique 'atoms' (or tokens) that contain a unique 9:44 minute 20×20 pixel video fragment and are sold to the audience/ collectors on the blockchain. The work experiments with collective ownership by allowing the piece to be reassembled and screened by a community of collectors. These projects are ultimately software systems in which the creation of meaning to varying degrees relies on content provided by the audience, collector or curator. The artist often becomes a mediatory agent and facilitator — for collaboration with other artists or for audiences' interaction with and contribution to the artwork.

Network structures and collaborative models tend to create zones of cultural autonomy — often formed ad hoc by communities of interest — that exist as long as they fulfill a set of functions, and then often disperse or move on. This does not necessarily mean that networks create new models of democratic engagement or self-governance, since they are supported by numerous protocols and governing structures and inextricably connected to the technological industry. The existence of networks opened up new spaces both for autonomous producers and DIY (Do It Yourself)/ DIWO (Do It With Others) culture, and the industry of market-driven media. Artistic production oscillates between the poles of openness of systems and restrictions imposed by protocols and the tech industry.

14. Mark Napier, *P-Soup*, http://www.potatoland.org/p-soup.

15. Andy Deck, *Open Studio*, http://draw.artcontext.net.

16. Martin Wattenberg and Marek Walczak, *Apartment*, http://www.turbulence.org/Works/apartment.

Flexible Contexts and Fluctuating Curatorial Roles

All of the above aspects require that curators and art institutions reconfigure their roles and adapt to the demands of the art. The online environment shapes curatorial practice through the specificities of its platforms and possibilities of collaborative exchange. The shifts brought about by collaborative models and networked exchange are not necessarily specific to online art but also apply to many other forms of digital art, such as installations, software art, or mobile media pieces. In the organisation of an exhibition presenting any of these different forms, a curator may play a role closer to that of a producer, supervising a team of creators, as well as the production and public presentation of the work. The variability and modularity of digital artworks implies that there are usually various possible presentation scenarios: artworks are often reconfigured for the specific space and presented in very different ways from venue to venue. However, the changes in the curatorial role tend to become most obvious in online curation, which by nature unfolds in a hyperlinked contextual network.

While some traditional aspects of the curatorial role — such as selection of works, organisation of exhibits and their art-historical framing — still apply to the process of online curation, transformations occur in the process of filtering and positioning within the online environment. The Web is a contextual network where a different context is always only one click away, and everyone is engaged in a continuous process of creating context and re-contextualising. Linking to and commenting on other websites creates information filters, portals and new contexts. The continuous flow of information produces fluctuating contexts that become a moving target when it comes to establishing our frameworks for creating meaning. On the internet, the spatial distance that would divide the centre from the margin or text from context in the physical world is subordinated to the temporality of the link.

In her article 'Fluidities and Oppositions among Curators, Filter Feeders, and Future Artists', Anne-Marie Schleiner assessed the landscape of the Web as a curatorial platform in the early 2000s.[17] She points out that every website owner assumes the role of a curator and a cultural critic by creating chains of meaning through association,

comparison and juxtaposition. 'I am what I link to', is how Schleiner sums up the ontological status of online contextualisation through linking. The embeddedness of online art into a rich contextual environment creates various tensions and oppositions. The internet both blurs boundaries between 'categories' of cultural production (fine arts, pop culture, entertainment, software etc.) and creates a space for specialised interests with a very narrow focus.

Online curation can hardly ignore the specifics of its environment and has to acknowledge these shifting contexts. An exhibition shown in physical space has a set opening and closing date, requires a visit to a physical locality and, after its closing, becomes part of the 'cultural archive' through its catalogue, documentation, critical reception in the press, and online documentation. An exhibition of online art, however, is advertised to a translocal community from the start, never closes and continues to exist indefinitely (until some party fails in sustaining it). It exists within a network of related and previous exhibitions that can be seen directly next to it in another browser window, becoming part of the continuous evolution of the art form. Depending on their openness, the artworks included in the exhibition (through linking) may continue to evolve over time. For a curator of an exhibition of objects in a physical venue, selection is partly determined by space limits and availability of objects, all of which are not of immediate concern in online curation. The latter allows for 'large-scale' shows, and concept and focus become the main criteria for inclusion or exclusion of artworks. The distributed model of the networked exhibition environment affects the curatorial role even if it is only a single curator and 'filter' who selects the work. From its very beginning, the exhibition is not bound by the framework of one institution but exists in a network where curatorial control tends to be more distributed.

Schleiner summarised the differences between the traditional curator and 'filter feeder' of the early 2000s in a deliberately polarising juxtaposition.[18]

17. Anne-Marie Schleiner, 'Fluidities and Oppositions among Curators, Filter Feeders, and Future Artists', *Intelligent Agent*, Vol.3, no.1, (2003), http://www.intelligentagent.com/archive/Vol3_No1_curation_schleiner.html

18. Ibid.

Past Curator	**Future Filter Feeder**
Museum or gallery exhibition space	Space peripheral, in tandem or 0
Art history education	Pop culture criticism, Tech history
Ties to wealthy patrons of art	Ties to other Filter Feeders and artists
Urban Metropolis-located	Dispersed locations
Navigates bureaucracy and institutions well	Flows around and avoids institutions
Art as Commodity	Ephemera, Extreme preservation challenges
Stays within Art Community	Infiltrates, subverts other communities

One could certainly argue that, over the past twenty years, the role of a curator of contemporary art has increasingly shifted towards that of a filter or platform feeder since cultural production in general has become more 'networked' through the technologies of our time and public art-viewing practices have changed. However, the politics of selection and the role played by art institutions undergo more substantial changes in the online curatorial process, which takes place in the non-locality of a distributed network increasingly governed by corporate platforms.

Curatorial roles continued to change in the context of emerging curatorial platforms. The blogosphere — the online sphere of interconnected blogs and their communities — provided platforms for 'surf clubs', collaborative blogs created to share media artefacts such as *Nasty Nets* (2006–12) and *Loshadka* (2009–14). Artist Harm van den *Dorpel's Club Internet* (2008–09) hosted exhibitions such as Guthrie Lonergan's *Tag Team* and Constant Dullaart's *K.I.S.S.* Online projects such as *Dump.FM* (2010–17), an image-based chat room run by artists Ryder Ripps, Scott Ostler and Tim Baker would also branch out into physical gallery spaces. Curator Lindsay Howard, for example, showed the exhibition *DUMP.FM IRL* (2010) at her exhibition apace 319 Scholes in Brooklyn, New York. Artist collectives such as *VVORK* (2006–12), founded by Aleksandra Domanovic, Oliver Laric, Christoph Priglinger and Georg Schnitzer, explored the blog as both site of artistic and curatorial practice by using reposting and tagging as curatorial strategies

in the filtering of visual content consisting of found images, challenging conventional methods of classification.

Tumblr equally became a platform of experimentation for these types of curatorial assemblages, for example in curator Domenico Quaranta's *Collect the WWWorld. The Artist as Archivist in the Internet Age*,[19] which was reimagined in multiple manifestations in physical gallery space, at the LINK Center of the Arts of the Information Age (Spazio Contemporanea, Brescia, Italy, 24 September – 15 October 2011); the House of Electronic Arts/ HEK (Basel, Switzerland, 9 March – 20 May 2012) and 319 Scholes (Brooklyn, New York, 16 October – 4 November 2012). The fluctuation of curatorial roles and strategies tied to the technological environment is further shaped by institutional contexts and the configuration of the curatorial role.

Models of Online Curation

While online curation has brought about certain basic changes for the curatorial role, models for online curation still substantially vary depending on their specific context. The models that will be discussed in the following relate to exhibitions of Web-based art organised in contexts ranging from museums, non-profit organisations, and online platforms and curated by groups, individuals, the public or software systems assuming a curatorial function.

Exhibition Frameworks for Web-based art

The 'online only' exhibition of net art on a museum website preserves the original context of how the art is supposed to be seen but poses the problem that the institution has only limited control over how a work is experienced by the viewer. Net art projects have numerous technical requirements, ranging from browser versions to plug-ins, window size etc. Some of these requirements can be accommodated in the coding of a work, but many of them might still have to be fulfilled on the viewers' end. While this obviously applies to the experience of net art in general, lack of accessibility seems to become more of

19. Domenico Quaranta, *Collect the WWWorld. The Artist as Archivist in the Internet Age*, https://collectheworld.tumblr.com/.

an issue if the work is presented as part of a curated exhibition on a museum website. Viewers may perceive their inability to view a work — because their operating system, browser version or connection does not support its technical requirements — as more annoying if they took the time to 'visit' an exhibition organised by a museum or arts institution, which they hold responsible for providing a certain quality of art experience.

The basic function of museum websites is usually to represent the respective institution by providing visitors with information about the museum and its exhibitions, programmes, collection etc. This type of museum site tends to be more focused on the singularity of the institution rather than the context of the art world that surrounds it, although museums increasingly make an effort to turn their online assets into more comprehensive resources and study collections for research, accompanied by educational initiatives. The predominantly 'centralised' model proves to be largely insufficient for institutional websites devoted to online art, which by nature inhabits a living, discursive environment with multiple perspectives beyond the institution that need to be considered.

The Walker Art Center's online exhibition space *Gallery 9*, developed from 1997 until 2003 under the direction of its founding director Steve Dietz, acknowledged this need from its inception and was created as an online venue for both the exhibition and contextualisation of internet-based art. As Steve Dietz explains in his introduction to the site, the space features 'artist commissions, interface experiments, exhibitions, community discussion, a study collection, hyper-essays, filtered links, lectures and other guerilla raids into real space, and collaborations with other entities (both internal and external)'. *Gallery 9* also became a permanent home for content that was not originally created by the Walker Art Center, such as Benjamin Weil's *äda'web*, an online gallery and digital foundry (created in 1995) that featured work by net artists as well as established artists, for instance Jenny Holzer and Julia Scher, who expanded their practice with the new medium. After *äda'web* lost its financial support, the gallery and its 'holdings' were permanently archived at *Gallery 9*. Another part of the gallery's archive is G.H. Hovagimyan's *Art Dirt*, an online radio talk show that was originally webcast from 1996–98 by the Pseudo Online Network. *Gallery 9* quickly became one the most recognised

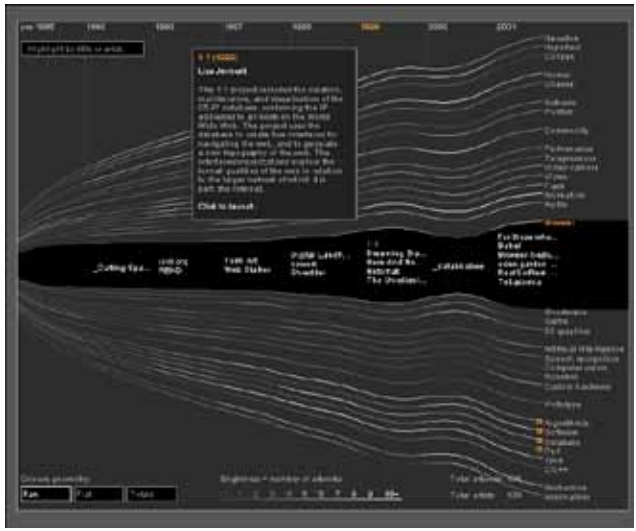

Figure 1: Martin Wattenberg, *Idea Line* (2001), screenshot, https://whitney.org/exhibitions/idea-line.

online venues for net art worldwide and the leading initiative of its kind in the United States. To the shock and surprise of the online community, the Walker Art Center abandoned its new-media initiative and laid off Steve Dietz in 2003 — presumably unaware of the fact that it was the most important programme of its kind in the US (and probably worldwide) at the time.

Gallery 9 was also a model for the Whitney Museum's *artport*, a website designed as a portal to internet art and online gallery space, which I conceived and created for the museum in 2001. Artport originally provided contextualisation through its 'resources' section — linking to new-media organisations and virtual galleries on the Web, net-art exhibitions worldwide, festivals, as well as publications devoted to new media — and from its inception featured projects originally commissioned for the site. Initially one series of commissions took the form of monthly 'gatepages' — small projects that contained links to the respective artist's projects, so that the gatepage archive functions as a database of net-art projects. Another series, launched in the fall of 2001, consisted of larger commissions that continue until today. Filtering and contextualisation were at the core of the first project commissioned for artport, *Idea Line* by Martin Wattenberg [fig. 1], which was launched in the autumn of 2001. The *Idea Line*, a database and visual timeline of net artworks, was designed to show

the variety of themes, technologies and media that net art has been using, as well as the relation of each artwork to the larger tapestry of all these diverse approaches. The database behind the *Idea Line* grew to more than 200 artworks by over 100 artists. The gatepages commissions were discontinued in 2006 and followed by the *Sunrise/Sunset* series, consisting of internet art projects that mark sunset and sunrise in New York City every day by disrupting, replacing or engaging with whitney.org over a time frame of thirty seconds. The curatorial conceit for this time-based, performative series captures a key element of artistic practice[20] on the internet, the intervention in existing online spaces.

While sites such as *Gallery 9* or *artport* are geared towards creating a contextual network, they still follow a traditional model in that they are overseen by a single curator rather than open to a multiplicity of curatorial voices. These institutional sites find their counterpart in online exhibitions that are organised by individual, independent curators and often tend to take more experimental formats. Since these curatorial efforts are mostly distributed throughout the specialised community of the online art world, they do not necessarily need to consider a broader audience and museum patron who might not be familiar with net art but visits an online gallery due to its affiliation with a major institution. Since the inception of net art, independent curators have created online exhibitions and promoted them through mailing lists and forums. Occasionally, these exhibitions have been incorporated into museum programming after their online launch and have become part of exhibitions, where they assume a status closer to a (collaborative) art project rather than a touring show.

A shift from the model of the single curator to that of multiple curatorial perspectives is more likely to be found on the websites of non-profit organisations devoted to online art. The oldest and longest-running site supporting net art is *Rhizome*, founded as on online platform by Mark Tribe in 1996 and supporting art engaged with digital technologies and the internet. *Rhizome* has been an affiliate in residence at the New Museum in New York City in 2003 and,

20. *Sunrise/Sunset*, https://whitney.org/artport/commissions/sunrise-sunset.

since 2012, a mix of curated online exhibitions, Web-based works, and VR projects as part of its series 'First Look: New Art Online'.

An organisation pioneering online curation was the British website *low-fi netart locator,* which was run by a collaborative team and regularly invited guests to curate a selection of projects within a theme of the guest's choice.[21] A range of perspectives can also be found at *turbulence* (1996–2015) — a project of New Radio and Performing Arts and its co-directors Helen Thorington and Jo-Anne Green — which, in addition to commissioned projects, featured curated exhibitions (often organised by artists), as well as 'Artist Studios' that presented artists' works and provided context for them through writings and interviews.[22] In 2004, turbulence.org began a curatorial partnership with *low-fi*, embedding it within Turbulence's homepage until 2006. This curatorial contribution to turbulence.org was a prototype for a distribution system co-existing symbiotically on other sites. More recently, the online exhibition *We=Link: Sideways* — the second edition of the We=Link programme, a platform for presenting online art conceived and curated by Zhang Ga at the Chronus Art Center in late February of 2020 as a response to the outbreak of the COVID-19 pandemic — experimented with this type of embedded exhibition on a large scale.[23] *We=Link: Sideways* was co-presented online with CAFA Art Museum (Beijing, CN), ZKM | Center for Art and Media (Karlsruhe, DE), House of Electronic Arts/ HEK (Basel, CH), V2_ Lab for the Unstable Media (Rotterdam, NL), Ars at CERN (Geneva, CH), Elektra (Montreal, CA), Leonardo/ ISAST, Nam June Paik Art Center (Seoul, KR), Copenhagen Contemporary (Copenhagen, DK), Light Art Space (Berlin, DE). In collaboration with the Whitney Museum's *artport*, several projects from the *Sunrise/Sunset* series were shown on partner institutions' websites.

Independently curated online exhibitions and websites such as *Rhizome*, *low-fi* and turbulence blur institutional boundaries and

21. *Low-fi net art locator*, organised by Kris Cohen, Rod Dickinson, Jenny Ekelund, Luci Eyers, Alex Kent, Jon Thomson and Chloe Vaitsou. Other members include Ryan Johston, Pierre le Gonidec, Anna Kari and Guilhem Alandry. http://www.low-fi.org.uk.

22. turbulence, New Radio and Performing Arts, http://www.turbulence.org/.

23. *We=Link: Sideways*, http://we-link.chronusartcenter.org/.

question the role of the art museum in the networked environment. Even though it may not be their explicit goal, these platforms implicitly challenge the structures of legitimation created by the museum system and traditional art world. A broader art audience may still place more trust in the selection, and therefore validation, undertaken by a prestigious museum, but in the online environment, the only signifier of validation may be the brand recognition carried by the museum's name. It is not unusual that the websites of non-profit organisations are better designed, more comprehensive and technologically more sophisticated than a museum's site. While relatively few museums have allocated a substantial budget for their online assets, non-profit and independent sites are often created and run by a team of devoted individuals who succeed on shoe-string budgets.

Performative Temporality

While the 'open access' to net art for anyone with the required technological framework at any time from anywhere has always been a conceptual foundation of net art, some curatorial models have also played with temporality by limiting the duration of a work. The models do not simply take the form of performances on the Web, which have been taking place since the art form's inception.

An example would be *aarea*,[24] founded in 2017 and curated by Livia Benedetti and Marcela Vieira, which promotes a critical debate about developments in the expanded relationship between art and the internet. The website exhibits original artworks commissioned for the virtual environment but created by artists who don't usually work with digital media. Each 'edition' consists of a single artwork that occupies the entirety of the site, so that aarea is transformed into a different work of art with each project. Once the exhibition period has ended, the work becomes inaccessible and the files aren't made available to the public. The platform translates both the occasionally radical transformation of a physical site that would occur during an exhibition and the logic of accessibility into virtual space.

The Whitney Museum of American art's series of commissions *Sunrise/Sunset*, mentioned above, is a related model.

24. *aarea*, https://www.aarea.co/.

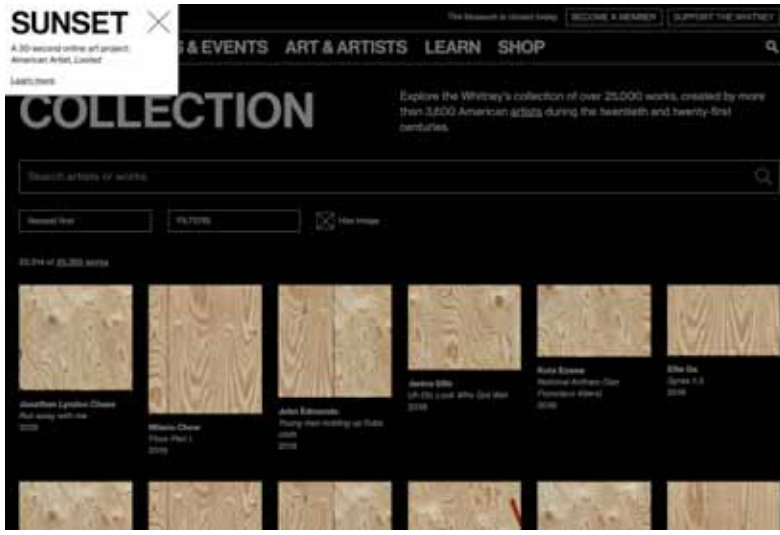

Figure 2: American Artist, *Looted* (2020), screenshot, https://whitney.org/exhibitions/american-artist.

Using whitney.org as their habitat, each of the net-art projects unfolds over a time frame of ten to thirty seconds on every page of whitney.org. The works disrupt, replace or engage with the museum website as an information environment and are running for several months at sunrise and sunset time before being archived. American Artist's *Sunrise/Sunset* project Looted [fig. 2] took the form of an act of refusal that commented on the politics of the moment and the practices of museums. Looted unfolded during the important and necessary protests in US cities denouncing racial injustice and police brutality after George Floyd's murder, at a time when many storefronts and museums in New York City and around the US — including the Whitney Museum — had been temporarily boarded up. Defined in most dictionaries as stealing goods from a place, typically during a war or riot, looting again became a flashpoint for discussion. It is crucial not to conflate looting with protest — property damage and theft were almost universally denounced — but the acts of vandalism taking place were viewed by some as expressions of long-simmering frustrations and demonstrations against symbols seen as perpetuating state violence, systemic racism and capitalist exploitation. *Looted* extended the physicality of this tension between protest and looting to the online space, the primary site for viewing art and cultural programming during the COVID-19 pandemic, by replacing all of the art shown on whitney.org with images of wooden boards. As an

Figure 3: *Runme.org* homepage, screenshot, https://runme.org/.

intervention into a museum website, Looted also alluded to the discussions surrounding colonialist practices in many Western museum collections, as well as activist and artistic critiques of the cultural institutions filled with 'loot'. Looted underscored that no space can remain unaffected by the examination of and demands for racial justice, and questions the power structures of providing access to art.

Experiments in Public Curation

On the other side of the accessibility spectrum, the relative openness of the internet and software potentially allows for more audience involvement in the curatorial process. The implementation of 'public curation' has always been more experimental, but increasingly gained momentum through initiatives that attempt to go beyond feedback in online discussion forums. Projects that explicitly consider software-based filtering as a framework for curation include the software-art repository *runme.org* [fig. 3].[25] Launched in January 2003, it was an open, moderated database that emerged out of the *Readme* software

25. 'About', runme software art repository, http://www.runme.org/about.tt2.

art festival, first held in Moscow in 2002.[26] *Runme* does not abandon the curatorial role, but shifts its emphasis in various ways. The site is an open database to which anyone can submit their project accompanied by commentary and contextual information. Selection only occurs in the reviewing process conducted by the *runme* 'expert team', who evaluate whether a project fits the basic objective of the site and makes an interesting contribution before the work becomes available for viewing to the public through the Web interface. While the team has final say over inclusion of a project, the basic criteria for submission are fairly broad, and the initial filtering process certainly could not be described as 'highly selective'. Further filtering occurs in the classifying and labelling that occurs through the taxonomical system established for the site: projects are classified according to a list of categories of software art as well as a keyword cloud that further describes projects and allows viewers to navigate them. Both the categories and keywords are open to additions/ revisions by the public, so that classification occurs in a process where agency is distributed between automation and 'human input'. *Runme's* classification system is not aimed at rating the value of projects, but at allowing a more subtle understanding of the variants of software art. What makes the project particularly interesting is the interplay between the process of filtering, classifying and labeling — which always entails an imposition of boundaries — and the 'democratic possibilities' of an open repository and database.

These early experiments were taken to a different level by historian and curator Robert Sakrowski's *CuratingYouTube* (2007), which used the YouTube platform for curatorial practice. By creating a public tool for curation called *GRIDR* (2013) in collaboration with artist Jonas Lund, *CuratingYouTube* provided an environment for the public to create assemblages of videos sourced from YouTube that would be displayed on a grid and presented on the project website. *CuratingYouTube* adopted the technological framework of a corporate platform to articulate the aesthetic possibilities within a preconfigured framework.

26. *Runme* software art repository developed by Amy Alexander, Florian Cramer, Matthew Fuller, Olga Goriunova, Thomax Kaulmann, Alex McLean, Pit Schultz, Alexei Shulgin, and The Yes Men. http://www.runme.org.

Automated Curating

The software-based filtering used in projects such as runme found its continuation in the software-driven automation of curation, from early conceptual approaches, to recent experiments with artificial intelligence. Eva Grubinger's *C@C* (1993), with software development by Thomax Kaulmann, was probably the earliest attempt to create a software-driven framework and tool that responded to the needs of artistic and curatorial practice in an online environment. While *C@C* was far from automated due to the technological constraints at the time, it was visionary in that it imagined a space that combined the production, presentation, reception and purchase of art, and thus erased several boundaries between delineated practices within the art system. The concept included individual artist studios with built-in editing tools; a branching social-network structure in which artists could introduce other selected artists; an area for discussion by the public and curators; as well as spaces that could be 'purchased' by art dealers in order to present and promote their activities. In terms of curation, *C@C* proposed a fluid environment that did not separate production, reception and presentation, and ideally enabled artists and the public to play a curatorial role to varying degrees. In this case, the software was mostly a supportive tool and framework and did not assume a curatorial function per se.

Experiments with the automation of curation developed within an art context are typically not geared towards replacing curators. They are methods of reflecting on the curatorial process itself and investigating the potential for new frameworks outside of established conventions. In recent years, artificial intelligence has moved to the centre of technology discussions due to the rapidly increasing role of 'machine learning' in data processing and decision making for the purposes of commerce, labour, surveillance and entertainment, among other areas. As an increasing amount of artworks has been critically investigating the influence of AI on societies, the potential and pitfalls of the use of AI in curation also need to be investigated, and projects undertaking this endeavour will continue to emerge.

The Creative AI Lab, a collaboration between Serpentine R&D Platform and the Department of Digital Humanities at King's College London, started in 2020, is an initiative specifically devoted

to exploring how AI might change the nature of artistic and curatorial practices.[27] In March 2021, Liverpool Biennial and the Whitney Museum of American Art launched a project titled *The Next Biennial Should Be Curated by a Machine*, which reimagines the future of curating in the light of Artificial Intelligence as a self-learning human-machine system. Developed as a collaboration between artists UBERMORGEN, digital humanist Leonardo Impett, and curator Joasia Krysa, the project features a group of technical machine-learning processes collectively named B^3(NSCAM). The B^3(NSCAM) software has been trained on datasets from Liverpool Biennial, the Whitney Museum, and other sources. The software processes these linguistically and semiotically and calculates a future probability for words to appear to generate endless combinations of possible instances of biennials in flux. These imagined versions of biennials manifest as texts — seemingly conventional artists' biographies, curatorial statements, press releases and art-magazine reviews — which engage in a continuous process of rewriting themselves. Always remaining fluid and ungraspable, the texts are presented in windows on a range of animated visual backgrounds that allude to the sixty-four parallel universes of possible biennials constructed by the AI. Clicking on the interface's spinning wheels will launch a new biennial universe on an animated graphic constructed from sources such as NASA and sci-fi imagery. Each universe is accompanied by a soundtrack from the TikTok playlist, alluding to the mix of creative expression and preconfigured elements in digital tools. The respective universes are created by subtle changes in the software's parameters, for example giving more weight to one data set — such as the Whitney or Liverpool Biennial — over another, or simply generating variations of biographies for artists with the same first or last name. Together, these textual and graphic universes of biennials narrate and visualise the impossible, a coexistence of multiple versions of an exhibition and its reception. On the one hand, the project highlights absurdities in the endeavor of an AI to curate on the basis of what it has learned from human understandings of art; on the other hand, it reflects the curatorial and institutional desires embedded in the data on which the software has been trained.

27. Creative AI Lab, https://www.serpentinegalleries.org/arts-technologies/rd-platform/.

In Spring 2020 the Bucharest Biennial announced that the chief curator of its 2022 edition would be an AI named Jarvis after the AI butler in the movie *Iron Man* and developed by the studio Spinnwerk based in Vienna. Trained on databases from universities, galleries or art centers, Jarvis is by nature limited to selecting only artists or works that are already part of the public record.

Hybrid Intersections

The post-internet era of expanded internet art brought about increasing intersections between physical and online space in exhibitions. These convergences were amplified by the predominantly online presentation of exhibitions during the COVID-19 pandemic. The intersections naturally entail different relationships between the referential contexts of online and corporeal space, which have to be carefully considered from a curatorial perspective.

Not surprisingly, the pandemic brought a renewed interest in skeuomorphic representation, the 3D recreation of actual galleries for art viewing. The 1990s, in particular, had seen experiments with creating virtual museums that referenced physical structures, whether they were re-creations of existing ones or designed and created from scratch in virtual space. Many of these explorations resulted in the realisation that skeuomorphic representation of gallery spaces most of the time interfered with viewing the art — whether digital or physical — which was better experienced directly in the browser environment without being subjugated to the constraints of a 3D spatial model and its navigation paradigms. One could argue that, during the pandemic, skeuomorphic gallery representation fulfilled a legitimate role if the show had already been mounted and became inaccessible due to the closure of the space to the public. In this scenario, the simulated physical experience actually supports the original curatorial intent and gives visitors an impression of the spatial context in which the works had been meant to be experienced in physical space.

An interesting relationship between physical and virtual space unfolded in Claudia Hart's exhibition *The Ruins*, which was on view from 10 September – 24 October 2020 at Bitforms Gallery in New York City, and was from the start conceived as both a physical exhibition and online experience in Mozilla Hubs [fig. 4].[28] *The Ruins*

Figure 4: Claudia Hart, *The Ruins*, 2020. Top: Bitforms gallery installation. Bottom: Mozilla Hubs screenshot, https://www.bitforms.art/exhibition/claudia-hart-the-ruins.

revises the canons of modernist painting and manifestos of failed utopias through a series of animations — shown on large-scale monitors — consisting of low polygon replications of copyright-protected Modernist paintings by Matisse and Picasso. While the virtual version of the exhibition on Mozilla Hubs is an exact replica of the exhibition in physical gallery space, it does not rely on physical space as a referent, but exists on equal footing. To some extent, the physical space could be understood as 'modelled' on the virtual space, since both the physical sculpture of the Fantin-Latour painting and the elaborate custom wallpaper borrowing motifs appearing inside the animations are digital-born and have been transformed into the real world. In 2020, in particular, the social space of Mozilla Hubs,

28. Claudia Hart, *The Ruins*, https://bitforms.art/exhibition/claudia-hart-the-ruins/.

which can be experienced online and through a VR headset, became a popular platform for curation, offering shared experiences and the potential for openings and tours led by artists and curators.

Another constellation of relationships between physical and virtual exhibition space unfolded in the group show *World on a Wire*, which was organised as an element of a partnership between Hyundai Motor Company and Rhizome at the New Museum and launched on 28 January 2021, simultaneously at the Hyundai Motorstudio in Beijing and on the exhibition's official website.[29] Curated by Michael Connor (Rhizome) in collaboration with Baoyang Chen (Central Academy of Fine Arts) and Taiyun Kim (Hyundai Motor Company), *World on a Wire* used the possibilities and poetics of simulation as artistic practice as a curatorial conceit for constructing a hybrid reality. Representations of physical work, VR and AR experiences, as well as online art are shown within an information architecture by Francis Tseng that introduces its own kind of spatiality through Web design.

As the programming of museums, arts organisations, galleries, and art fairs have increasingly become more hybrid by creating online experiences of physical artwork, the models for online curation of digital-born and Web-based art have become more porous. Skeumorphic representation is experiencing a revival and online platforms such as Mozilla Hubs or VR chat are allowing for social, immersive experiences beyond physical spaces.

Conclusion

In different ways and to varying degrees, all of the above models for online curation illustrate the changes that the internet has brought about for the curatorial role. New collaborative, networked forms of creation and distribution, as well as the context-dependent nature of digital works, require an increased flexibility and openness of curatorial presentation and new strategies for documentation of collaborative work that keeps evolving through versions. These

29. Hyundai Motorstudio, Bejing, and Rhizome at the New Museum, *World on a Wire*, https://worldonawire.net/.

issues are obviously relevant for both online and offline curation. The online space, in particular, naturally supports distributed filtering and classifying of artworks and contributions to platforms, and therefore a potential distribution of curatorial control. In networked environments, selecting and filtering can be undertaken by curators, artists and audiences, as well as processes automated by software. The previously discussed examples of online curation describe models ranging from a single curatorial voice and multiple invited curators operating under an organisational umbrella to curation by the audience or through software-enabled processes. The reconfiguration of the roles of curator, artist, audience and institution necessitated by the characteristics and demands of digital media will also naturally run into obstacles and limitations, whether they are related to the frameworks of platforms or institutions. However, this reconfiguration is simply a reflection of the inherent potential of digital technologies themselves, which, if accessible, enable more open models for the creation and presentation of art. This distributed form of curation could be considered either in a more metaphorical way, where exhibition concept and selection become expandable by the audience, or in a narrower sense, where curation unfolds with the assistance of open-source software that can be further developed by a community of interest.

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Collaboration and Community in Aboriginal Territories in Cyberspace

Mikhel Proulx with Jason Edward Lewis and Skawennati

Launched in 2005 as a 'series of initiatives to expand Aboriginal[1] presence online', Aboriginal Territories in Cyberspace (AbTeC) is a research-creation network of artists, scholars and technologists concerned with increasing Indigenous participation in digital cultures.[2] Since that time, AbTeC co-founders Jason Edward Lewis (Hawaiian and Samoan) and Skawennati (Kanien'kehá:ka) have developed a prolific platform for interdisciplinary media-art practice grounded in collaboration and community.[3]

1. This text applies the recent and ongoing preference for the term 'Indigenous' at the time of writing. Terminology used in this chapter prioritises the language that specific Indigenous people have used to describe themselves, and attempts to maintain the historicity of the time periods discussed through the contemporaneous use of 'Native', 'Aboriginal' and 'Indian'.

2. Jason Edward Lewis and Skawennati, 'Aboriginal Territories in Cyberspace', *Cultural Survival Quarterly Magazine*, June 2005: 29, https://www.culturalsurvival.org/publications/cultural-survival-quarterly/aboriginal-territories-cyberspace; AbTeC received its first research funding in 2005 from the Social Sciences and Humanities Research Council of Canada's Aboriginal Research Pilot Program.

3. AbTeC is a sovereign entity nested within an institutional network at Concordia University in Montreal: it is part of the Indigenous Futures Cluster at the Milieux Institute for Arts, Culture and Technology, associated with the Hexagram Network for Research-Creation, and operates Obx Laboratory for Experimental Media.

This essay provides a brief introduction to art projects and critical texts by Lewis and Skawennati, with reference to the many makers and thinkers with whom they have collaborated. AbTeC's history gives insight into curatorial concerns from Indigenous perspectives, and suggests larger questions of art practices that are community-centred, interdisciplinary and pedagogical. By attending to Indigenous representation within virtual worlds, AbTeC has fostered Indigenous-determined social imaginaries and imagery of the future. And they have accomplished this within wider cultural contexts that relegate Indigenous Peoples to the past, to offer up profound lessons of how digital tools can be put in the service of advancing culture and community in the future.

As a research-creation platform, AbTeC has explored the role that digital media can play in how Indigenous people tell their stories. Writing in 2005 — the same year they founded AbTeC — Lewis and Skawennati noted that 'if Aboriginal peoples learned one thing from contact, it is the danger of seeing any place as *terra nullius*, even cyberspace. Its foundations were designed with a specific logic, built on a specific form of technology, and first used for specific purposes.'[4] The work of AbTeC, as Lewis has written, asks how to 'breathe humanity into our computational creations in a way that avoids Western anthropocentric conceits.'[5] Racist stereotypes misconstrue Indigenous Peoples as pre-technological, and thus see them, as the Yankton Dakota historian Philip Deloria notes, as suffering from 'technological incompetence'.[6] AbTeC has worked to disrupt this pre-technological narrative, positioning Indigenous voices at the vanguard of digital culture. Through curatorial methodologies based on consultation and mentorship, and through organisation-building within artist-run culture, media labs, festivals and educational institutions, AbTeC has influenced cultural policies, pedagogies and research methodologies.[7] Employing myriad

4. Lewis and Skawennati, 'Aboriginal Territories in Cyberspace', 30; 'We're all immigrants in cyberspace', Lewis has noted. Jason Edward Lewis, 'Terra Nullius, Terra Incognito', *Blackflash*, Vol.21, no.3 (June 2005): 16.

5. Jason Edward Lewis, 'An Orderly Assemblage of Biases: Troubling the Monocultural Stack', in A*fterlives of Indigenous Archives: Essays in Honor of the Occom Circle*, ed. Ivy Schweitzer and Gordon Henry (Hanover, NH: Dartmouth College Press, 2019), 226.

6. Philip Joseph Deloria, *Indians in Unexpected Places* (Lawrence, KS: University Press of Kansas, 2004), 4.

7. Jason Edward Lewis and Skawennati, 'Art Work as Argument', *Canadian Journal of Communication*

creative and critical outputs, AbTeC has supported multiple voices, asking 'the question of what it means to be Indigenous in cyberspace.'[8] 'By engaging in the conversation that is shaping new media systems and structures', Lewis notes, 'Native people can claim an agency in how that shaping carries forward. And, by acting as agents, not only can we help to expand the epistemological assumptions upon which those systems and structures are based but we can stake out our own territory in a common future.'[9]

Initiative for Indigenous Futures (IIF)

Most recently, AbTeC has anchored the seven-year research-creation platform called the Initiative for Indigenous Futures (IIF). IIF is a scholarly network that supports Indigenous futurisms through art and technology. Why, IIF has asked, have Indigenous Peoples been absent from popular future imaginaries, such as those in most science fiction? 'The past is a box that Settler society likes to put us in', Lewis recognises. 'We refuse that box by — among other resistances — revising our sense of what is possible, asking our own questions, romanticizing our sovereignty, asserting claims on the future and practicing futures together.'[10]

37, no.1 (2012): 206. For further sources on Indigenous curatorial practice, see Shannon Bagg and Lynda Jessup (ed.), *On Aboriginal Representation in the Gallery* (Hull, QC: Canadian Museum of Civilization, 2002); Michelle McGeough, 'Indigenous Curatorial Practices and Methodologies', *Wicazo Sa Review* 27, no.1 (2012): 13–20; Lee-Ann Martin, 'An/Other One: Aboriginal Art Curators and Art Museums', in *The Edge of Everything: Reflections on Curatorial Practice*, ed. Catherine Thomas (Banff: Banff Centre Press, 2002), 49–56; Cathy Mattes, 'Indigenous Littoral Curation: A Michif Jig in 3 Parts' (PhD Diss., Winnipeg, University of Manitoba, 2020); Julie Nagam, Carly Lane and Megan Tamati-Quennell (ed.), *Becoming Our Future: Global Indigenous Curatorial Practice* (Winnipeg: Arbeiter Ring Publishing, 2020).

8. Lewis, 'An Orderly Assemblage of Biases: Troubling the Monocultural Stack', 223.

9. Jason Edward Lewis, 'A Better Dance and Better Prayers: Systems, Structures, and the Future Imaginary in Aboriginal New Media', in *Coded Territories: Tracing Indigenous Pathways in New Media Art*, ed. Steven Loft and Kerry Swanson (Calgary: University of Calgary Press, 2015), 63.

10. Jason Edward Lewis, 'Afterward: 22nd Century Proto:Typing', in *Àbadakone*, ed. Rachelle Dickenson, Greg A Hill and Christine Lalonde (Ottawa: National Gallery of Canada, 2020), 131.

IIF operates by envisioning what forms of cultural and political expression Indigenous Peoples will adopt generations from now.[11] Through partnerships with art, culture, language and educational institutions across North America, IIF has supported numerous creative and critical productions: from small-scale artwork commissions, like *Illustrating the Future Imaginary*, a series that invites visual artists to imagine and illustrate their own cultures hundreds of years into the future [fig. 1], to high-profile discursive events like conferences and symposia.[12] Dozens of unique projects have manifested since IIF's founding in 2014, including residencies by leading Indigenous artists working with virtual reality, fiction, performance, machinima[13] and video games;[14] technical undertakings, such as a project to translate the C# programming language into ʻōlelo Hawaiʻi;[15] and a pilot program for developing archival standards for Indigenous digital art.[16]

Prominently, IIF has also supported the bringing together of a major international consortium of artists, technologists and scholars to critique the cultural frameworks of artificial intelligence.[17] The Indigenous Protocol and Artificial Intelligence Working Group (IPAI) has tendered a range of Indigenous perspectives to critique and better understand the relationships we build with computational systems. Where designers of AI systems consistently conceptualise artificial intelligence as a mere tool, Indigenous knowledges draw on deeper intellectual legacies that attend to other-than-human intelligences. By engaging these legacies within discussions of digital systems, IPAI asks how we are held in relation to other forms of intelligence, offering insight into ontologies only recently touched upon in Euro-Western

11. Jason Edward Lewis, 'A Brief (Media) History of the Indigenous Future', *Public* 27, no.54 (2016): 37.

12. Future Imaginary Symposia https://indigenousfutures.net/symposia; Indigenous Futures Cluster Presents, https://indigenousfutures.net/other/indigenous-futures-cluster-presents.

13. 'Machinima' is a portmanteau of 'machine' and 'cinema' to describe computational cinematic production that uses real-time graphics engines.

14. For example, the 2017 VR residencies 2167 commissioned artworks by Scott Benesiinaabandan and the art collective Postcommodity. See http://www.imaginenative.org/2167.

15. *ʻōleloProgramming*, https://indigenousfutures.net/olelo-programming.

16. The Indigenous Digital Art Archive, https://indigenousfutures.net/archive/.

17. Jason Edward Lewis et al., 'Indigenous Protocol and Artificial Intelligence Position Paper' (Honolulu: The Indigenous Protocol and Artificial Intelligence Working Group and the Canadian Institute for Advanced Research (CIFAR), 2020).

Figure 1: ᑲᓇᕒᐲᐅᑦ/ Connor Pion (Cree/Atimekw/Métis/Settler), ᐋᑦᒋᓈᑯᐄᐧᐦᐃᑎᓱ/aandjinaagowiihidizo/s/t/h/e/y transfigure themselves, 2017, digital image. Courtesy of Aboriginal Territories in Cyberspace.

scholarship concerned with post-humanism, new materialism, ecology, sentience, cosmopolitics and the Anthropocene.[18] Through a series of discursive events, IPAI brought together leaders in AI and Indigenous thought from across the planet, resulting in a position paper that reflects ethical and technological concerns for approaching artificial intelligence from Indigenous perspectives.[19] The IPAI work is a logical progression of twenty years of AbTeC's engagement with digital technology [fig. 2].

18. See, for example, Zoe Todd, 'An Indigenous Feminist's Take on the Ontological Turn: "Ontology" is Just Another Word for Colonialism', *Journal of Historical Sociology*, Vol.29, no.1 (2016): 4–22.

19. Lewis et al., 'Indigenous Protocol and Artificial Intelligence Position Paper'.

Figure 2: *Owerà:ke Non Aié:nahne (Filling in the Blank Spaces)*, 2017, installation shot of AbTeC retrospective at Galerie Leonard & Bina Ellen Art Gallery, Tiohtià:ke (Montreal). Courtesy of Galerie Leonard & Bina Ellen Art Gallery.

The Indigenous Digital Art History Canon

The ambitious scope of AbTeC's creative outputs was assembled for a 2017 retrospective at Montreal's Leonard & Bina Ellen Art Gallery. *Owerà:ke Non Aié:nahne: Filling in the Blank Spaces* was a sprawling exhibition that gathered artworks made by Lewis, Skawennati and their many collaborators over twenty years. The retrospective was a momentous achievement, for AbTeC, for the field of Indigenous digital arts, and for digital culture generally. Internationally, a generation of Indigenous artists has developed substantial digital artworks, including, to name only a few: Cheryl L'Hirondelle (Métis/Cree), Ahasiw Maskêgon-Iskwêw (1958–2006) (Métis/Cree), Archer Pechawis (Cree), r e a (Gamilaraay/Wailwan/Biripi), Lisa Reihana (Ngāpuhi, Ngati Hine, Ngaituteauru), Lawrence Paul Yuxweluptun (Cowichan/Syilx) and Mi'kmaq artist Mike MacDonald (1941–2006). However, while these celebrated artists have garnered both public and scholarly attention — and considerable appreciation within Indigenous cultural discourses — the field of Indigenous media art nonetheless remains largely ignored by scholars outside of Indigenous arts contexts in settler-colonial nations. Why, exactly, with decades of writing on digital art, have the practices of Indigenous artists been so overlooked?

One major reason for this is that these artists have often developed ideas outside the mainstream concerns of more prominent media-art circles, and instead have focused their activities within Indigenous community organisations and social networks. Patrons of the Banff Centre of Art's dining room, lunching in the spring of 1998, may have spotted a table of net art paragons: members of the so-called 'European Net.mafia,'[20] artists Alexei Shulgin, Vuk Ćosić and Heath Bunting.[21] Some tables away, a group of young Indigenous artists were taking a break from programming the second iteration of CyberPowWow — a progenitor of AbTeC, discussed below. Association between the groups was scant. At the same time, representation of Indigenous artists was sparse at international art exhibitions such as documenta and the Venice Biennale, and large media-art-specific festivals like ISEA and Ars Electronica. Despite continuous digital-art production by Indigenous artists over a period of twenty years, representation in exhibitions, collections and scholarly literature is still limited today. As a result, the field of Indigenous digital art history is 'extremely underdeveloped,'[22] in the words of art historians Heather Igloliorte, Julie Nagam and Carla Taunton.

20. Curator Kathy Rae Huffman used this term in her review of the 1998 Banff Centre conference. Kathy Rae Huffman, 'Curating and Conserving New Media', heise online: *Telepolis*, June 28, 1998, https://www.heise.de/tp/features/Curating-and-Conserving-New-Media-3442169.html. Others had simultaneously used the term 'mafia' to describe such mainstream media artists as Geert Lovink. Ulrich Gutmair, 'Ihr Ansprechpartner Für Netzkritik: Ein Interview Mit Geert Lovink', *Texte Zur Kunst*, no.32 (December 1998): 84–103.

21. The artists were in town for 'Curating and Conserving New Media', a workshop and symposium presented by the Banff Multimedia Institute and the Walter Phillips Gallery, 25–30 May 1998. See 'Curating and Conserving New Media' (agenda), the Paul D. Fleck Library and Archives at the Banff Centre, ref. BNMI-BNMI.1-BNMI.1D-BNMI.1D.8. This encounter was addressed at: Mikhel Proulx et al., 'CyberPowWow and the First Wave of Indigenous Media Arts' (Panel discussion, the Leonard and Ellen Bina Art Gallery, Montreal, 6 November 2017).

22. Heather Igloliorte, Julie Nagam and Carla Taunton (ed.), 'Indigenous Art: New Media and the Digital', PUBLIC 54 (2016): 9. Among the most significant of these are: Dana Claxton, Steven Loft and Melanie Townsend, *Transference, Tradition, Technology: Native New Media Exploring Visual and Digital Culture* (Banff: Walter Phillips Gallery Editions in association with Art Gallery of Hamilton & Indigenous Media Arts Group, 2005); and Steven Loft and Kerry Swanson (ed.), *Coded Territories: Tracing Indigenous Pathways in New Media Art* (Calgary: University of Calgary Press, 2015).

Nonetheless, Indigenous artists and scholars have developed vital histories of digital art over the past twenty years. This discourse has often attended to wider cultural concerns not addressed in mainstream media-art histories. As Ryan Rice (Kanien'kehá:ka) has noted, Indigenous artistic practices of the 1990s countered the 'monolithic narrative' of European and Euro-settler cultures in global art discourse.[23] Contemporary Indigenous artists have generated novel artistic and curatorial practices, grounded within their communities rather than appealing to mainstream audiences. As Lewis has recollected:

> I can see how, if it had been more integrated, Indigenous practice would most likely have been a minority practice within a larger, existing narrative, a few lonely examples within an existing canon, subaltern subject to established theory. The way it has unfolded over the last two decades, though, is that we have developed our own critics, our own critical frameworks, our own antecedents, our own canon.[24]

CyberPowWow

In the mid-1990s — simultaneous to growing reforms in Indigenous cultural activism[25] and Canadian cultural organisations[26] — Skawennati, along with artists Ryan Rice and Eric Robertson (Gitksan), formed the artist collective Nation to Nation. She would go on to coordinate the ambitious, internet-based platform CyberPowWow [fig. 3].

23. Ryan Rice, 'Presence and Absence Redux: Indian Art in the 1990s', *RACAR: Revue d'art Canadienne/ Canadian Art Review* 42, no.2 (2017): 42.

24. Lewis, 'A Brief (Media) History of the Indigenous Future', 45.

25. The 1990 Kanehsatà:ke resistance (also known as the Oka Crisis) marked a notable influence on Indigenous cultural activism, if only the latest in 500 years of colonial resistance.

26. Namely, 1992's *Minquon Panchayat* — the anti-racist coalition that promoted the structural reformation of artist-run culture; the initiation of Tribe (1995) and Urban Shaman (1996) artist-run centres; and increased support for Indigenous artists using new media at the Canada Council and the Banff Centre, among other Canadian art institutions. This was also a period that saw significant federal task forces and commissions on the state of Indigenous Peoples and cultures, including the Task Force on Museums and First Peoples (1992) and the Royal Commission on Aboriginal Peoples (1996).

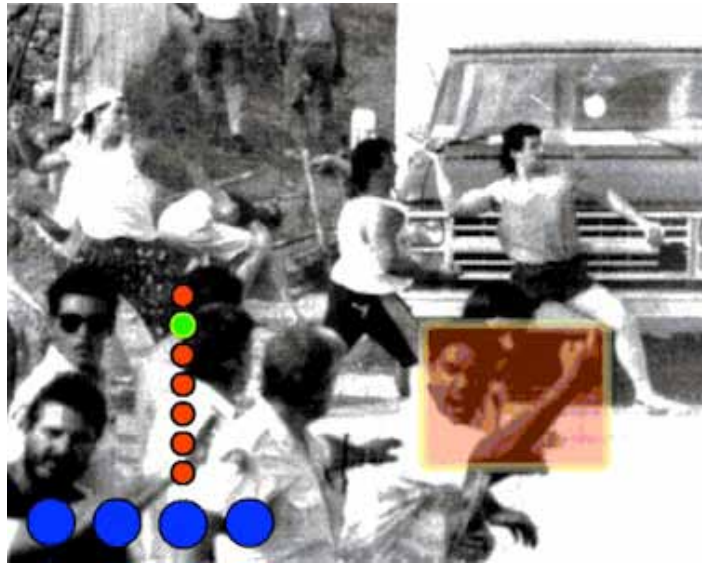

Figure 3: *Âhasiw Maskêgon-Iskwêw, AMI_Oka_Rocks*, from *CyberPowWow 2*, 1999, Interface for Palace Software. Courtesy of Aboriginal Territories in Cyberspace.

Featuring four exhibitions over eight years, CyberPowWow invited artists, curators and writers to create work for this evolving platform, which utilised a then cutting-edge piece of server software called the Palace. The project housed artworks, written stories and critical texts, as well as a real-time, graphical chat space that was live year-round. In step with the growing online activity of international artistic cybercultures and the first exhibitions of internet-based art, CyberPowWow laid out the groundwork for a distinctly Indigenous cultural presence online. As Skawennati wrote on the occasion of the first CyberPowWow in 1997: 'For the first time, Native people are on the ground floor of a new technology, and are helping to define the way it will be used to describe our cultures.'[27]

Key to CyberPowWow was the series of exhibition openings that Skawennati called Gathering Sites [fig. 4]. Real-world events that exhibited the online artworks, the Gathering Sites were held at over twenty galleries and artist-run centres across North America,

27. Skawennati, 'Why I Love WWWriting: Fabulous Aboriginal Qualities', *CyberPowWow*, 1997, http://www.cyberpowwow.net/nation-2nation/triciawork1.html.

Figure 4: *CyberPowWow Gathering Site*, Galerie OBORO, 1997.
Left: Brenda Dearhouse Fragnito, Kathleen Dearhouse, Jasmine Dearhouse (Three Generations of Dearhouse Women); Top: Skawennati; Bottom: Audra Simpson, Skawennati, Rodney Thomas, unknown and Marcelle Durrum.

coinciding with the four biennial launches of the project. Each space supported simultaneous, two-day events — expanded exhibition openings — during which time visitors were invited to eat, drink and become participants via online interaction in CyberPowWow. Tech-savvy gallery attendants would guide users through the projects on computer stations, since in the mid-1990s personal ownership of computers was not yet prevalent, especially among Indigenous populations.[28]

28. The digital divide between Indigenous and settler populations is shown by, among others, Christian Sandvig, 'Connection at Ewiiaapaayp Mountain: Indigenous Internet Infrastructure', in *Race after the Internet*, ed. Lisa Nakamura and Peter Chow-White (New York, NY: Routledge, 2012), 168–200. For data on the Canadian context, see: Canada et al., 'Broadband Connectivity in Rural Canada: Overcoming the Digital Divide' (Ottawa: 1st Session, 42nd Parliament. Committee Report 11, April 2018).

The Palace was a multi-user environment in which individuals could join within a graphical chat space to experience a range of different user-generated 'palaces'. In place of the arbour commonly used by powwow dancers, CyberPowWow would congregate its participants around the structure of this software. Users who visited the site would choose 2D avatars in the form of Indigenous bodies and navigate through graphical chat rooms designed to replicate traditional and contemporary Indigenous spaces. Far before the saturated, media-rich, social-network-driven cultures of today, CyberPowWow represented an extraordinary experiment in creating an online community.

Among histories of better-documented net art, CyberPowWow's exhibition model remains remarkable today. While the project was accessible year-round, the great majority of its social interactions took place during the *Gathering Sites*. CyberPowWow's greatest impacts were arguably manifested through these live components: the social processes and relationships that it manifested, with largely Indigenous audiences, who were often engaging networked media for the first time. Gathering together had the effect of strengthening social bonds and fostering a sense of community.

CyberPowWow shared in the zeitgeist that focused on the liberatory potential of the internet. The dotcom optimism of the 1990s was built on premises of freedom, equality and solidarity: the internet would free us from the prejudices of offline society.[29] The project participated in this broader moment of identity politics and social-justice activity online, alongside cyberfeminists, cyberqueers and anti-racist cyberactivists.[30] Critical interventions on the early Web by Indigenous people are often underacknowledged within these other histories, despite the robustness of early Indigenous cybercultures.

29. For a study of how the Internet 'was sold as a tool of freedom', see Wendy Hui Kyong Chun, *Control and Freedom: Power and Paranoia in the Age of Fiber Optics* (Cambridge, MA: MIT, 2006), 2.

30. For significant contributions to these histories, see: Sadie Plant, *Zeroes and Ones: Digital Women the New Technoculture* (London: Fourth Estate, 1998); Nina Wakeford, 'Cyberqueer', in *Lesbian and Gay Studies: A Critical Introduction*, ed. Sally Munt and Andy Medhurst (London: Cassell, 1997), 403–15; Beth E. Kolko, Lisa Nakamura and Gilbert B. Rodman, *Race in Cyberspace* (New York: Routledge, 2000).

It was while working together on CyberPowWow that Lewis and Skawennati generated their foundational plans for AbTeC. The two artists met while Skawennati was developing CyberPowWow as the curator in residence at the Banff Centre for the Arts in 1999.[31] Lewis recognised at the time that cyberspace itself was a 'frontier undergoing colonization', and that Indigenous peoples were positioned ideally to circumvent their own marginalisation within its advance.[32] AbTeC emerged from the imperatives that took root in CyberPowWow. Writing after the last CyberPowWow in 2005, Lewis and Skawennati declared: 'Now we are drawing on the CyberPowWow experience to further leverage the power of networked technologies to stake out even more territory.'[33] They fell in love, became partners, and began working collaboratively, committed to supporting art practices that centred on the presence of Indigenous Peoples in the future while emphasizing the education of youth, and the integration of traditional storytelling and new-media production.

Before meeting Skawennati, Lewis had a career in Silicon Valley, having worked as a research fellow at the Institute for Research on Learning in 1992/ 93; a technology developer then staff member at the Interval Research Corporation in 1993/ 94 and 1996–99 respectively; an interaction designer at Fitch, Inc. in 1995; and Founder and Director of Research, Arts Alliance Laboratory 1999 to 2001.

Simultaneously, Skawennati was participating in an emerging, international Indigenous contemporary art community as both an artist and curator. She co-created the artist collective Nation to Nation in 1994, and began developing her new-media practice. While curating CyberPowWow, Skawennati populated cyberspace with Indigenous content in her own artworks, such as her 2001 *Imagining Indians*

31. Lewis and Skawennati first met at the Banff Centre of Arts, when Lewis came to participate in 'Synch or Stream: A Banff Summit — a Think-Tank on Networked Audio and Visual Media', 15–17 May 1999. See Cook and Diamond, *Euphoria & Dystopia*, 1010. Lewis would go on to participate in the 2001 iteration of CyberPowWow, 'CPW 2K: CyberPowWow Goes Global', and was co-curator with Skawennati of the 2004 iteration: 'CPW04: Unnatural Resources'.

32. Jason Edward Lewis, 'Terra Nullius, Terra Incognito', *Blackflash* 21, 3 June 2005: 16.

33. Lewis and Skawennati, 'Aboriginal Territories in Cyberspace', 30.

Figure 5: Skawennati, *2273 Pow wow*, from *Imagining Indians in the 25th Century*, 2001, website. Courtesy of Aboriginal Territories in Cyberspace.

in the 25th Century, a Web-based artwork that took the form of a time-travelling, futuristic paper-doll game [fig. 5].

Lewis and Skawennati's first collaborative artwork was made in 2002 [fig. 6]. *Thanksgiving Address: Greetings to the Technological World* is a Flash-based video that extends the Ohén:ton Karihwatéhkwen (the Haudenosaunee thanksgiving address). In a spoken performance, the pair broadened the traditional prayer — which gives thanks to the natural world — to include gratitude for computers, TCP/IP, Photoshop and C++. 'We felt it was time to add to that list a few lines from our technological world, for which we are also thankful.'[34]

34. Jason Edward Lewis, 'Preparations for a Haunting: Notes Towards an Indigenous Future Imaginary', in the *Participatory Condition in the Digital Age*, ed. Darin Barney et al. (Minneapolis, MN: University of Minnesota Press, 2016), 234.

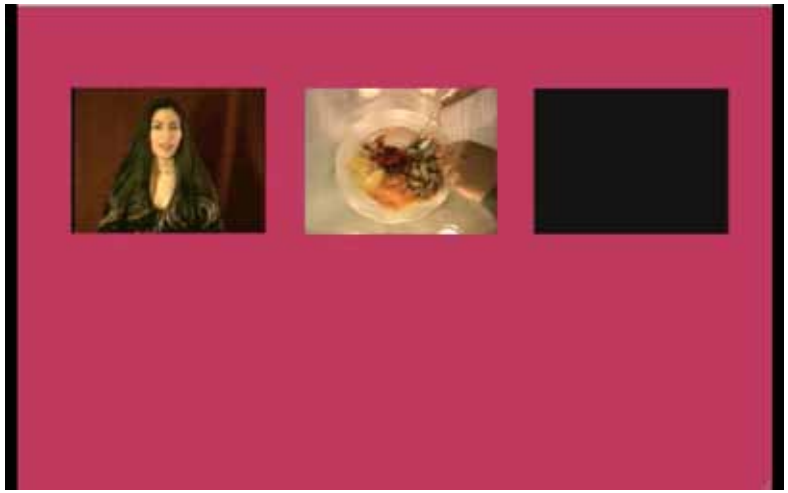

Figure 6: Jason Edward Lewis and Skawennati, *Thanksgiving Address: Greetings to the Technological World*, 2002, flash-based website. Courtesy of Aboriginal Territories in Cyberspace.

Skins

It was at another Banff Centre event in 2003[35] that Skawennati met the video game designer Celia Pearce. Pearce posed a provocative question: 'How would you like to see Native people in video games?' This prompted Lewis and Skawennati to embark on the *Skins Workshops on Aboriginal Storytelling and Experimental Digital Media*: a robust set of mentoring and support programmes that bridges storytelling practices with video game production training. Skins centres on collaborative, experiential pedagogies in workshops that range from short, intensive programmes, to year-long projects, intended 'to empower youth by fostering a greater knowledge and pride of their own history.'[37] As Lewis and Skawennati note, 'Our communities are rich with stories full of amazing characters, monumental obstacles

35. 'Skinning Our Tools: Designing for Context and Culture' (1–5 October 2003). See Cook and Diamond, *Euphoria & Dystopia*, 1022.

36. Skawennati and Jason Edward Lewis, interview by Mikhel Proulx, 9 August 2021.

37. For a description of the Skins workshop curriculum, see Beth Aileen Lameman and Jason Edward Lewis, 'Skins 1.0: A Curriculum for Design Games with First Nations Youth', in *Proceedings of the International Academic Conference on the Future of Game Design and Technology* (Futureplay 10, Vancouver: Association of Computing Machinery, 2010), 105–12; Lewis and Skawennati, 'Aboriginal Territories in Cyberspace', 30.

Figure 7: *Otsì:! Rise of the Kanien'kehá:ka Legends*, 2009, video game produced during Skins 1.0. Courtesy of Aboriginal Territories in Cyberspace.

to be overcome, and a vibrant material culture to serve as a basis of engaging visual environments — all useful ingredients for creating an engaging videogame.'[38] The project supports alternatives to extractive and violent video games, which often rely on racist stereotyping. By centring 'Indigenous cultural frameworks into the design of video games and virtual environments', Skins enables Indigenous youth to become not just consumers of video games, but agents of gaming media from within strong cultural contexts.[39]

The first Skins workshop included ten student participants from the high school in Kahnawà:ke, the Kanien'kehá:ka community near Montreal from where Skawennati comes. The workshop was facilitated by the artist and teacher Owisokon Lahache over a period of nine months. Their production — *Otsì:! Rise of the Kanien'kehá:ka Legends* — was awarded Best New Media Prize at imagineNATIVE Film + Media Arts Festival in 2010 [fig. 7].

38. Lewis and Skawennati, 'Art Work as Argument', 208–9.

39. Lameman and Lewis, 'Skins 1.0', 105.

Figure 8: *He Ao Hou*, 2017, video game produced during Skins 5.0. Courtesy of Aboriginal Territories in Cyberspace.

For Skins 2.0 in 2012, workshop participants created the *Adventure of Skahion:ati: Legend of the Stone Giants*. Set in the distant, pre-colonial past, the video game tells a well-known Kahnawá:ke story. For their accomplishment, they were presented with the Best New Media Award at the 2013 imagineNATIVE Festival. Most recently, for Skins 5.0 in 2017, kānaka maoli participants in Honolulu created *He Au Hou*, a futuristic space-travel Hawaiian-language game [fig. 8]. In addition to these larger-scale productions, AbTeC has overseen a multitude of smaller workshops on video games, machinima, animation and character design. Dozens of Skins workshops have brought hundreds of Indigenous youth through training programmes to build digital-media projects from inception to completion. Emphasising capacity-building, participants have been trained to develop character design, artwork, storyboarding, animation, audio engineering and programming.[40] At the same time, the participants have seen how video game concepts and mechanics can be shaped by their

40. Participants have been trained variously in game-design software like Second Life, Blender, Unreal and Unity3D, as well as the programming languages JavaScript and Mono.

own cultural experiences. These participatory design projects centre on the sharing of stories from Indigenous elders, and on respectful and responsible engagement with cultural narratives.[41] AbTeC has supported this work by fostering community partnerships between Indigenous and non-Indigenous artists, industry professionals and knowledge keepers.[42]

The results of the Skins Workshops are freely distributed games that integrate Indigenous knowledges, stories and languages. The workshops also foster better capacity for employment within commercial media production — a field that is predominantly White and male, and habitually projects racist imagery of Indigenous Peoples as villainous or romanticised.[43] Lewis and Skawennati have described their pedagogical aims: 'We... wanted them to experiment with ways individuals and communities might leverage digital media as a tool for preserving and advancing culture and languages, and for projecting a self-determined image out into a mediasphere awash in stereotypical portrayals of Native characters.'[44]

The Skins Workshop series has received wide praise, including a 2012 McConnell Foundation Ashoka Changemakers Award. But perhaps most importantly, as Lewis has noted, 'the attention has served to promote the idea of technologically savvy Indigenous people within our own communities and within the social imaginary of settler culture.'[45]

41. For a discussion of how the Skins Workshops engage with community protocols, see Jason Edward Lewis and Skawennati, 'You Want to do What with Doda's Stories? Building a Community for the Skins Workshop on Aboriginal Storytelling in Digital Media', in *Community-Based Multiliteracies and Digital Media Projects: Questioning Assumptions and Exploring Realities*, ed. Heather M. Pleasants and Dana E. Salter (New York, NY: Peter Lang, 2014).

42. This has included mentors from leading game companies like Ubisoft, Behaviour and Minority. Beth Aileen Lameman and Jason Edward Lewis, 'Skins: Designing Games with First Nations Youth', *Journal of Game Design and Development Education* 1, no.1 (Winter 2011): 63–75.

43. Lameman and Lewis, 65.

44. Jason Edward Lewis, 'Time Travelers, Flying Heads, and Second Lives: Designing Communal Stories', *Interactions* 19, no.2 (2012): 20.

45. Lewis, 'Preparations for a Haunting', 245.

Figure 9. Jason Edward Lewis, *Cityspeak @ Victory Park*, 2007, interactive installation at Victory Park Plaza, Dallas, Texas. Courtesy of Aboriginal Territories in Cyberspace.

Figure 10. Jason Edward Lewis, *Passage Oublié*, 2007, Toronto Pearson International Airport. Courtesy of Aboriginal Territories in Cyberspace.

P.o.E.M.Ms

Individually, both Lewis and Skawennati have also developed artistic practices alongside their collaborative work with AbTeC. Lewis has created a corpus of digital poetry and typographic tools for dynamic and interactive literature [fig. 9]. The results span across a number of modes of display and dissemination: from printed, computer-generated texts, to open-source software for text animation, to interactive interfaces for live, haptic performances. Lewis' writing within these forms includes themes of childhood ('The Summer the Rattlesnakes Came'), racialisation ('No Choice About the Terminology') and raising racialised children ('The World That Surrounds You Wants Your Death'). Together with his research assistants, Lewis has developed the poetry software It's Alive (1996), NextText (2003), Mr. Softie (2005), and TextOrgan, which was recognised with an Honorable Mention for the 2000 Prix Ars Electronica.

His 2007–14 *P.o.E.M.M. (Poetry for Excitable [Mobile] Media)* is a series of interactive, touchscreen-based poetry programs that manifest in gallery-based displays, public projections, and as freely downloadable apps for smartphones.[46] The series was awarded the 2014 Robert Coover Award for a Work of Electronic Literature. Significantly, this software is also a platform for others to engage with. It is freely provided as a downloadable program for users to construct their own poetry. Since it is open source, it allows the dynamics of the software to be altered, and it also acts as a vehicle for the sharing of poems with other users of the app. This push for open collaboration has resulted in a range of expressions and formats. As the writer Darren Wershler observes, 'Each P.o.E.M.M. is a proposition, a possible genre with its own conventions, waiting to be articulated to one of several possible politics.'[47]

In his associated body of works, Lewis has developed a set of participatory virtual graffiti tools that respond to SMS and voice inputs for public displays, such as the Flash-based, interactive public text

46. https://www.poemm.net.

47. Darren Wershler, 'P.o.E.M.M.: Bigger on the Inside', in *P.o.E.M.M. the Album* (Montreal: Obx Labs, 2013), 108–9.

installations *Cityspeak, Citywide* (2006) and *Passage Oublié* (2007) [fig. 10]. *Passage Oublié* utilised a touchscreen kiosk at Toronto's Pearson International Airport to solicit responses from passersby on the subject of extrajudicial rendition — the post-9/11 US policy that extradited 'ghost detainees' to secret detention sites during the 'war on terror'.[48] The results were user-generated annotations on a global map, mimicking a flight radar map to include lines of writing submitted by the public.

AbTeC Island

Since 2003, AbTeC has occupied a virtual outpost in the online world Second Life.[49] AbTeC Island is 'AbTeC's headquarters in cyberspace' and serves multiple purposes: it is a meeting site, a community centre, an exhibition space and a classroom.[50] (This act of colonised peoples staking a claim in virtual space, as the art historian Alice Ming Wai Jim has written, is 'inundated with multiple layers of irony and parody.'[51]) The online space is also the set for Skawennati's celebrated series of machinima films, including *TimeTraveller™*, which began in 2007.[52] *TimeTraveller™* recreates Indigenous narratives told through science fiction, and is filmed entirely in Second Life. The series aims to counteract biased representations of Indigenous Peoples within dominant settler histories. *TimeTraveller™* is a group of digital films that centre on a protagonist named Hunter — a Mohawk man living in the twenty-second century. With the aid of a set of eyeglasses that simulate time travel, Hunter visits a variety of significant events in both past and future Indigenous histories, including the 1990 standoff at Kanehsatà:ke (Episode 03); the occupation of Alcatraz

48. Lévesque, Maroussia and Lewis, Jason Edward, 'Passage Oublié', *Nomorepotlucks*, —: Trespassing (2009), http://nomorepotlucks.org/site/passage-oublie-2/.

49. Skawennati's avatar xox was 'born' in October of 2006, and she purchased Second Life 'land' in June of 2008. AbTeC Island is found at http://maps.secondlife.com/secondlife/AbTeC/78/172/1011.

50. 'Activating AbTeC Island', *Initiative for Indigenous Futures* (blog), accessed 24 August 2021, https://indigenousfutures.net/other/activating-abtec-island/.

51. Alice Ming Wai Jim, 'Technologies of Self-Fashioning: Virtual Ethnicities in New Media Art' (ISEA2015: 21st International Symposium on Electronic Art, Vancouver, 2015), 365.

52. http://www.timetravellertm.com/.

Figure 11. Skawennati, *Jingle Dancers Assembled*, 2011, production still from *TimeTraveller™ Episode 04*. Courtesy of Aboriginal Territories in Cyberspace.

Island in 1969 (Episode 06); a 1490 festival in the Aztec city of Tenochtitlán (Episode 07); and the Manito Ahbee powwow in the year 2112 (Episode 04), where independent nations of Iroquois, Cree, Anishinabe and Blackfoot Peoples celebrate their cultures and sovereign nationhood [fig. 11].

The films are freely accessible online, have toured in film festivals, and are frequently exhibited in gallery-based displays. Bridging live and pre-recorded elements, this range of curatorial formats has allowed for mixed-reality events, such as the simultaneous launch of Episode 04 in both physical and virtual spaces. Indeed, one of the series' characters, Karahkwenhawi, has her own Facebook page.[53]

In addition to the *TimeTraveller™* series, Skawennati has gained great acclaim for her films co-produced by AbTeC, including *She Falls For Ages* (2017), the *Peacemaker Returns* (2017) and *Words Before All Else* (2018–21). These have all been filmed within the virtual space of AbTeC Island, and have been widely exhibited in major exhibitions including, among others, the National Museum of the American Indian (2012), the Montreal Biennale (2014), the Biennale of the Americas (2015), the Venice Biennale (2017), SIGGRAPH (2018) and the National Gallery of Canada (2019). Throughout, AbTeC Island has seen many hundreds

53. https://www.facebook.com/karahkwenhawi.mohawk.7.

Figure 12. *A Thread That Never Breaks*, 2021, documentation of exhibition opening, showing artworks by Jaad Kuujus (Meghann O'Brien), Pacific Sisters and Leanna Marshall, AbTeC Gallery, AbTeC Island, Second Life. Courtesy of Aboriginal Territories in Cyberspace.

of hours of work by Skawennati and her production team at AbTeC to produce elaborate film sets, which are accessible to the public.

In the spring of 2020, while COVID-19 restrictions closed galleries worldwide, AbTeC began a series of exhibitions on AbTeC Island [fig. 12]. AbTeC Gallery's first exhibition, *Reformatted*, brought artworks from eleven leading Indigenous artists into this interactive space. Within the year, a handful of other exhibitions were mounted: *Skátne Tión:nis: Many Faces, One Mind; Trails + Overflow; Indigenous Futurisms: Rooted + Ascending*; and *A Thread That Never Breaks*. These exhibitions mark the beginnings of what Lewis and Skawennati see as a new generation of Indigenous territories in cyberspace.

For almost two decades, AbTeC has responded within and alongside the established institutions of universities, governmental organisations and social media platforms to build its own Indigenous-determined spaces. The results have been novel curatorial approaches that bridge virtual and physical spaces, as well as Indigenous and non-Indigenous audiences. In that time, AbTeC has produced art and media that is interdisciplinary, collaborative and community-based. Its activities have collapsed borders between genres and disciplines: between high art and popular culture, and between the traditional and futuristic. This has been accomplished through hands-on design of media and technologies

to better 'accommodate Indigenous epistemologies, ontologies, and fields of action.'[54] AbTeC has done so to stress the continuance of Indigenous cultural practices, worldviews and methodologies into the digital age.

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54. Lewis, 'Preparations for a Haunting', 241.

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Curating Art Platforms in the Networked Environment — a Timeline

Marialaura Ghidini

Introduction

This chapter originated from my desire[1] to explore the specificities of curatorial work in the online environment and confront its historical fragmentation.[2] The premise of such exploration was to distinguish between online curation versus curating on the web — a distinction that was initially articulated by Steve Dietz.[3] I wanted to observe the site-specific approaches that curators devise online when they do not 'reformat' material presented in a gallery context or 'augment' viewers' experiences, and to explore how curators (and often artist-curators[4]) develop exhibition models that enable new ways of producing and displaying digital art online, and therefore their understanding of

1. This chapter is a revised and updated version of the paper 'Curating on the web: the evolution of platforms as spaces for producing and disseminating web-based art' that was published in the *Arts Journal* issue 'Art Curating: Challenges in the Digital'.

2. Marialaura Ghidini, 'Curating on the Web: the evolution of platforms as spaces for producing and disseminating web-based art', in *Art Curating: Challenges in the Digital*, ed. Francesca Franco, *Arts Journal*, 2019, Vol.8, 3, 2019, https://www.mdpi.com/2076-0752/8/3/78/htm.

3. Steve Deitz, 'Curating on the Web: The Museum in an Interface Culture', in *When is the next 'Museums and the Web'?*, Toronto, 1998, archimuse.com. https://museum-sandtheweb.com/mw98/papers/dietz/dietz_curatingtheweb.html.

4. Many experiments with the internet and the web were conceived by artists who often acted as curators, signalling a blurring of the boundaries between artistic and curatorial work.

the exhibition. This curatorial attitude towards 'site-specificity' in the online environment is what led me to work on a timeline[5] that mapped exhibition projects onto developments in online technologies, to then propose a historical periodisation of curatorial work on the web. What emerged is that curating on the web is a practice that is context-sensitive and has evolved together with the technical tools at the curators' disposal and their own critical understanding of them. It also responds to web and internet technologies not just as media but as ecosystems in development that are socio-cultural, political and economic. The history of curating on the web shows how curators have turned into mediators of ecosystems, whereby the exhibition often acquires multiple functions and operates as a platform for creating, displaying and disseminating art. Such platforms are often distributed networked systems whose purposes, beyond exhibiting, also include nurturing communities and discourses about digital art and culture, encouraging thinking beyond the dichotomies of online and offline, as well as commenting on the very same technology adopted by their curators — its function, uses, rhetoric and role in day-to-day life. By doing so, the curators of the selection of projects presented in this chapter paved the way for the creation of independent art spaces that do not follow the logic of the art market, its trends and hierarchical organisation; rather, they show different facets of curatorial work. This, in turn, has impacted the way in which selection, categorisation and collection are understood in art-historical and curatorial contexts; while also providing innovative formats for displaying digital art online and in the gallery, contextualising digital artistic practices beyond fixed categorisation, and archiving 'mutable' artworks through web platforms and offline archival formats.

The history of Curating on the Web and its Socio-technical Contexts

In the manner of a historical timeline, this section shows how the developments in online technologies have offered curators different

5. This timeline was further developed with researchers and curators Annet Dekker and Gaia Tedone, and recently culminated in the project *The Broken Timeline* (See Annet Dekker, *Curating Digital Art: For Presenting and Collecting Digital Art to Networked Co-Curation*, Amsterdam: Valiz, 2021), and continued, with a different focus on the platform curating.online (see Marialaura Ghidini, 2021, curating.online).

technical and socio-cultural grounds that have provided a fertile terrain for experimenting with both internet and web tools and exhibition-making. It touches upon the early internet, with its BBS-enabled platforms such as *ARTEX* (1980), to introduce the 1990s experimentations with the web browser, such as *äda'web* (1995). It then dives into the Web 2.0 and an array of curatorial approaches to proprietary platforms, such as *CuratingYouTube* (2007–), to then outline curatorial responses to the commercialisation of the networked environment of the second half of the 2010s, such as *Gallery.Delivery* (2018).

Experiments with the Network

The network experiments that preceded the public availability of the web happened after DARPA (Defence Advanced Research Projects Agency) developed ARPANET (1969), a technology that enabled remote communication through computer networking. Artists and art collectives, often in collaboration with critics, theorists and technologists, initiated projects that explored the new artistic opportunities arising from operating online. Because the networked space was not mediated by ready-to-use visual interfaces and required specialised skills and hardware, artists started to create online environments for 'sharing server space to host and disseminate work' independently from existing infrastructures.[6] Such a community-oriented understanding of the technology counterbalanced the art world's lack of interest in supporting and displaying internet-based art.[7]

One of the first projects offering artistic space to other artists was *ARTEX (Artists' Electronic Exchange System)*. Initiated by Robert Adrian in Vienna in 1980 in collaboration with I.P. Sharp Associates,

6. Sarah Cook and Marialaura Ghidini, 'Internet Art [Net Art]', Dictionary, Grove Art Online — Oxford Dictionary, 2015. http://www.oxford-artonline.com/groveart/view/10.1093/gao/9781884446054.001.0001/oao-9781884446054-e-7002287852.

7. Julian Stallabrass quoted artist Robert Adrian to discuss the art institutions' neglect of art on the internet at that time: 'The older traditions of art production, promotion and marketing did not apply' — these projects did not have tangible outcomes and were often collaborative in nature — 'and artists, art historians, curators and the art establishment, trained to operate with these traditions, found it very difficult to recognise these projects as being art.' Julian Stallabrass, *Internet Art. The Online Clash of Culture and Commerce* (London: Tate Publishing, 2003).

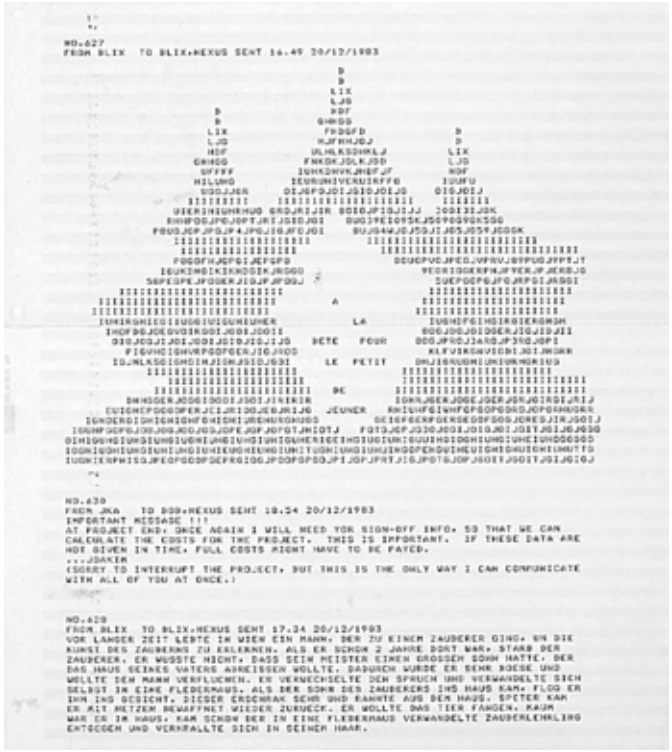

Figure 1: *La Plissure du Texte*, 1983. Screenshot of computer printout of a participant's contribution. © Roy Ascott via http://www.chronusartcenter.org/cac-atelier-asciiart/.

ARTEX was an 'intercontinental, interactive, electronic art-exchange program designed for artists and anybody else interested in alternative possibilities of using new technologies'. It incubated international artistic networks and the production of artworks that used networked technologies to create non-hierarchical exchanges, such as *La plissure du texte* (1983) by Roy Ascott — a project that adumbrates the communication patterns of the later social media platforms [fig. 1].

Over the course of three weeks, the artist's initial input ('Once upon a time ...') developed into a 'planetary fairytale' through the contribution of participants who, by being present in one of the fourteen nodes set up across the world (from France to Hawaii), added to the story by following a set of instructions. This generated a collaborative 'asynchronous storytelling project' that existed in an environment made of servers, computers and people — the only traces in the gallery were print-outs of the exchanges — and offered an understanding

of art on the internet as an art form[8] inherently different from the defined, authored and unique object presented in gallery spaces.

ARTEX and the later initiatives, such as the *Art Com Electronic Network* in the US and *Cybercafe* (1994) in the UK, are significant because they introduced the idea of the art platform as an open online environment that functions as an ecosystem for the production of artworks outside the institutional art world. In this scenario, curating becomes a response to a networked and shared environment, shifting the role of the curator to that of a node in the system, along with the project's members, their local contexts of reception and the artworks.

Experiments with the Web Browser and Interface

With the advent of the web browser (Mosaic in 1993) and the first blog spaces (Links.net and Yahoo in 1994), surfing the net — a phrase coined by librarian Jean Armour Polly in 1992 — became an activity not only for technologists and experts. The web browser was a new, more accessible[9] medium for making and displaying art; a medium 'composed by a network of heterogeneous media objects'[10] that included audio-visual material. A new generation of artists — the net.art artists[11] — along with critics such as Josephine Bosma and Natalie Bookchin, started to explore the properties and language of this technology (HTML protocols and hypertext), and the opportunity

8. Maria Miranda used the notion 'unsitely' to indicate artworks and practices that use the internet as 'a site of production and reception' and whose 'audience is spread across the globe in a "local" context of reception.' 'Unsitely' artworks 'disrupt our common notions of place and being in one place at one time', asking for different types of art historical categorisation. Maria Miranda, 'Uncertain Practices. Unsitely Aesthetics', PhD Diss., Sydney: Macquarie University, 2009.

9. Java, released by Sun Microsystems in 1995, allowed users to experience interactive and dynamic web content in browsers such as Netscape Navigator.

10. Vito Campanelli, *Web Aesthetics. How Digital Media Affect Culture and Society — Fictions, Invisible Processes* (Amsterdam: NAi Publishers, 2010).

11. The term net.art (coined by Pit Schulz in 1995) indicates a group of artists (such as Heath Bunting and JODI) who were predominantly based in Europe and met through the mailing list Nettime in the mid-1990s. They explored the possibilities of the internet and web technology as a 'new communication space' (Josephine, Bosma, Nettitudes — Let's Talk Net Art (Amsterdam: NAi Publishers, 2011)), and 'fostered new independent art organizations and approaches to evade traditional structures'.

Figure 2: *äda'web*, 1995. Screenshot of Context page, 2022. © äda'web via Internet Archive — Way Back Machine.

it offered to create spaces for displaying art that was web-native. Indeed, the interface was another source of experimentation because of its mediating role in creating different types of interaction.[12] Artists and curators responded to it by devising projects that foregrounded viewers' online navigation patters and behaviours. Despite the 'power struggles'[13] resulting from a hierarchical understanding of art online and in the gallery, the opportunity to create new exhibition spaces triggered the interest of several curators — either in their role inside institutions or independently.

A case in point is *äda'web* (1995–98), the 'digital foundry' co-founded by Benjamin Weil and John Borthwick as part of the enterprise Digital City, Inc [fig. 2].

Not only did *äda'web* sustain artistic explorations with the browser, but it also offered a multifunctional space and a curatorial framework that

12. Christian Ulrik Andersen and Søren Bro Pold, *Interface Criticism: Aesthetics Beyond the Buttons* (Aarhus: Aarhus University Press, 2011).

13. Josephine Bosma, 'Constructing Media Spaces', *Medien Kunst Netz*, 15 February 2007, http://www.medienkunstnetz.de/themes/public_sphere_s/media_spaces/.

reacted to the specificity of the web — a hyperlinked multi-mediascape. Navigating *äda'web* was like journeying in a labyrinthine environment that was constantly changing and asked viewers to actively interact with the content that it presented in various sections of the website in a randomised manner. In the Projects section, *äda'web* housed site-specific commissions by artists who, although rarely web-savvy, experimented with the networked environment at their disposal — *äda'web's* programmer Vivian Selbo offered technical support. An example is the artwork *Please Change Beliefs* (1995) by Jenny Holzer, who transposed her interest in disseminating statements in public spaces onto the web page. Holzer created a choice-based textual interface that developed through interaction with an audience, now making use of a public space that was networked and interactive. *äda'web* was an innovative curatorial platform because it included activities beyond the exhibition, from an online forum to an e-store. The curatorial model was that of a multifunctional platform where the exhibition acquired meaning through the viewers' interaction and was part of a socio-technical ecosystem that nurtured a community of interest beyond medium-specific practices and geographical boundaries.

It is significant that *äda'web* also explored the relationship between the web space and the offline space in the *Influx* section of the website, foregrounding some of the issues around the connection (and later hybridisation) of online and offline spheres. The artworks in *Influx* existed both online and offline. Antoni Muntadas' *The Internet Project* (1997), for example, was a development of his ongoing project *On Translation* that continued to grow over time through gallery installations. The curatorial choices made for *Influx* are indicative of Weil and Borthwick's understanding of the website as a display that is complementary to that of the gallery, whereby these exhibition spaces could build onto each other.

This period was also characterised by curatorial experimentation from within art organisations (mostly in the US), such as *Gallery 9* (1997–2003), conceived by Steve Dietz for the Walker Art Center in Minneapolis [fig. 3], the *Web Projects* (1995–) curated by Lynne Cooke and Sarah Tucker for the Dia Art Foundation under the helm of director Michael Govan, and the later *Whitney Artport* (2001–) conceived by Christiane Paul at the Whitney Museum in New York. If the curatorial approach of *Gallery 9*, akin to *äda'web*, seized the

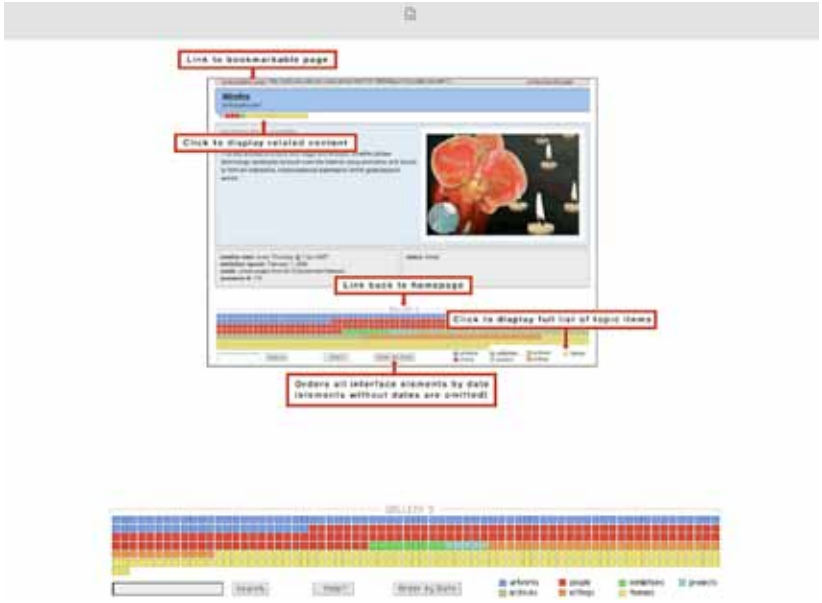

Figure 3: *Gallery 9*, 2003. Screenshop of the Help? page, 2022
© Walker Art Center via Internet Archive — Way Back Machine.

opportunity to create a multifunctional platform — one that was often revamped to revisit its interface and hosted not only artists' commissions but also 'interface experiments, community discussions, hyperessays, and guerrilla raids into real space' — the *Web Projects* took another turn. Similarly to many institutional endeavours of that time, it provided audiences with 'direct and unmediated experiences with artworks',[14] giving life to an archival platform of site-specific commissions that would exist, rather than perform, over time.

As mentioned above, net.art artists played a key role in the experimentations with the browser, and the project *Art.Teleportacia* (1999) by artist Olia Lialina deserves a mention for its approach to exhibition-making. Using the browser as a hyperlinked visual canvas, *Art.Teleportacia* presented exhibitions of artworks that were

14. R. Visser, 'Interview with Sarah Tucker (Dia)', PACKED (blog), 2009, https://scart.be/?q=en/content/interview-sarah-tucker-dia.

15. Olia Lialina, 'Net Art Generations', artist website, *Art Teleportacia*, 19 November 2013. http://art.teleportacia.org/observation/net_art_generations.

accompanied by a service of 'on-demand net.art works over the Internet',[15] along with certifications and critical essays to authenticate them and corroborate their market value. Apart from referencing the 'power struggles' of those years, the project paved the way for later experimentations commenting on the increasing commercialisation of the web — the first online marketplaces and advertisement services, such as Amazon, eBay and Craigslist, launched in 1995.

Experiments with the Proprietary and Scripted Web of Platforms

In the first decade of the 2000s, artists and curators began to respond to the introduction of increasingly lightweight and user-friendly interfaces that provided free online services in a rapidly evolving scenario — the Web 2.0. These new privately owned internet platforms for publishing, broadcasting and socialising allowed any internet user to create and disseminate content with little intermediation and expertise, turning them into content producers and self-publishers — the so called 'prosumers'[16] — who produce while consuming online (in exchange for their data). Thus, the experiments of that time revolved around the functions and socio-cultural role of ready-to-use platforms, which provided artists and curators with 'an already scripted space to play around with and have a good time', as Lialina put it.[17] Artists and also curators often appropriated such scripted spaces for artistic use, repurposing them as production tools and exhibition sites. In doing so, they counterbalanced the popularisation of online creative production and community-building[18] methods with the formation of sub-communities of interest that created art within their own distributed systems and according to their own 'rules'. Such repurposing added another function to the art platform, which was that of a space that nurtured a reflection and critique of the very same technologies, and the socio-cultural habits they triggered, adopted by artists and curators for their projects.

16. Curt Cloninger, 'Commodify Your Consumption: Tactical Surfing/ Wakes of Resistance', February 2009, http://lab404.com/articles/commodify_your_consumption.pdf.

17. Lialina in Campanelli.

18. An early social media tagline of a proprietary platform stated: 'Facebook is a social utility that connects you with the people around you', along with 'It's Quick and Easy.'

Publishing Platforms

Artists[19] engaged with the proliferation of personal blogs (Wordpress and Blogger in 2003, followed by Tumblr in 2007) and the type of content distribution they introduced — along with their diary-style communication, blogs used tags to index textual and visual content and feeds to track users' frequent updates. By establishing collectives that were fluid in their structure and scattered across the world, these artists explored the mechanisms of blogs and gave form to art platforms that used posting, reposting and tagging to create and share visual material, resulting in projects where the curatorial framework was collective, informal and discursive. Indeed, while blogs consolidated the function of the post as a publishing format for displaying different forms of internet art, the introduction of the comment feature in the mid-2000s offered artists a relational ecosystem (among bloggers, readers and user-produced content) with which to experiment.

An example is the *Surf Clubs* — from *Nasty Nets* (2006) to *Loshadka* (2009–2014). They explored the socio-technical context of internet-generated cultural material (GIFs and .swfs files), its existence in the online environment, and display mechanisms that would 'legitimise' its value across online and offline spaces, proposing solutions for overcoming the hierarchical understanding of art on the internet that characterised the previous decade. *Surf Clubs* put forward a new mode of artistic work online — post-internet art — whereby art on the internet was not just 'context-dependent',[20] but was part of a system of relationships that created connections across contexts of display and engagement. If *Club Internet* (2008–09) [fig. 4] by Harm van den Dorpel investigated these ideas by hosting exhibitions curated by various artist-members, such as Constant Dullaart's *K.I.S.S*, *Dump.FM* by Ryder Ripps, Scott Ostler

19. Most of the experiments with blogs were made by artists, but several curators experimented with them too, such as Sarah Cook and Sabine Himmelsbach with the project *My Own Private Reality: Growing up online in the 90s and 00s* (2007).

20. Christiane Paul, 'Flexible Contexts, Democratic Filtering, and Computer Aided Curating — Models for Online Curatorial Practice', in *CURATING IMMATERIALITY: The Work of the Curator in the Age of Network Systems*, ed. Joasia Krysa (New York, NY: Autonomedia Press, 2006), 85–105.

Figure 4: *Club Internet*, 2008–09. Screenshot of index page, 2022. @ Club Internet via Internet Archive — Way Back Machine.

and Tim Baker operated as an 'image-based chat room for real-time communication'[21] and exchange, where the process of selection was replaced by a chain of responses.

Surf Clubs also proposed a blurring of art-historical categories in that the GIF or .swfs files would often become art objects on display in gallery spaces, changing the assumptions about low and high art[22] — an instance is the exhibition *Surfing Club* (2010) by Raffael Dörig at plug.in, Berlin.

With a similar approach to blogs, *VVORK* (2006–12), a project founded by Aleksandra Domanovic, Christoph Priglinger, Georg Schnitzer and Oliver Laric, commented on both the increasingly visual environment of the internet and the role of tags and their circulation in creating public awareness of artistic practices and artworks, as well as forming aesthetic trends — curators from all over the world used *VVORK* as

21. Lindsay Howard, 'DUMP.FM IRL Press Release', Art organisation, 319 Scholes, 2010.

22. Gene McHugh (2001) stated that with post-internet art, the documentation of an artwork was 'more widely dispersed than the object itself'.

23. Paul Slocum, 'Catalog of Internet Artist Clubs', *Rhizome Archive*, 2016. http://archive.rhizome.org/surfclubs/.

a database for their research,[23] often influencing the 'preferences' of the more institutional art world. *VVORK*, as a display, archival and distribution platform, proposed a form of collective and mainstream historicisation that put into question the roles of the art curator and critic as imparters of value.

Social Platforms

Artists and curators also started to appropriate social platforms, along with their vast databases of user-produced cultural content, such as broadcasting services like YouTube (2005) and Facebook (2004). While examining the mechanisms of these services to conceive their projects, these curators often morphed the way they were commonly used to comment on the role of both the interface and algorithm in shaping artistic production and users' socio-cultural behaviours — the vaster the amount of content available, the more scripted the users' interactions.[24] By doing so, curators responded to the growing seriality of production and communication on social platforms,[25] and to the contentious changes occurring in the online environment, whereby private and public, work and leisure, consumption and production merged inextricably.

The project *CuratingYouTube* (2007–present) by historian-curator Robert Sakrowski is an example of adopting a platform's functions to foreground a new curatorial approach to exhibition-making. By using the YouTube features as tools inherent to the curatorial process of selection and display (the 'related video', the 'share' button, and the 'embed' tool), *CuratingYouTube* [fig. 5] became a public platform to create video assemblages of material sourced on YouTube — the 'HTML soundbank' — and display them as audio-visual mixes on the project website.

24. In those years, it became increasingly difficult to directly reference content across platforms, so that they started to be called 'walled gardens'. This phenomenon went hand-in-hand with the introduction of new 'social' features, such as the 'like' button.

25. Issues pertaining to seriality were also explored in connection to broadcasting platforms, as in the instances of Mitch Trale's *Idle Screening* (2012–14) and Rebecca Birch and Rob Smith's *Field Broadcast* (2011–17).

Figure 5: *CuratingYouTube: 3 hours in 1 second — Constant Dullaart, Hello Mother*, 2010. Screenshot of artwork page, 2017 © CuratingYouTube and Constant Dullaart.

This was enabled by an open-access 'tool for curation'[26] that Sakrowski devised with artist Jonas Lund, the *Gridr*, which, in turn (and in a twist), dictated 'the choices of material and then the conditions in which one plays' and curates. Operating as a multifunctional platform that included a blog for contextualising the exhibitions and interviews with artists and curators, *CuratingYouTube* inserted itself into an existing service, providing an insightful commentary on cultural and curatorial production in the age of algorithmic services.

Other projects relied more heavily on the infrastructure of the platform appropriated by their curators, as in the instance of *Gallery Online* (2012–18) by Ronen Shai and Thomas Cheneseau [fig. 6]. The curatorial approach of *Gallery Online* was to parasitically inhabit an existing online environment — that is, the infrastructure of Facebook.

26. Robert Sakrowski, 'Interview About CYT and An Acoustic Journey Through YouTube', interview by Marialaura Ghidini, 24 March 2013, in Marialaura Ghidini, 'Curating Web-Based Art Exhibitions: Mapping Online and Offline Formats of Display'. PhD Diss., Sunderland: University of Sunderland, 2015, 188-97.

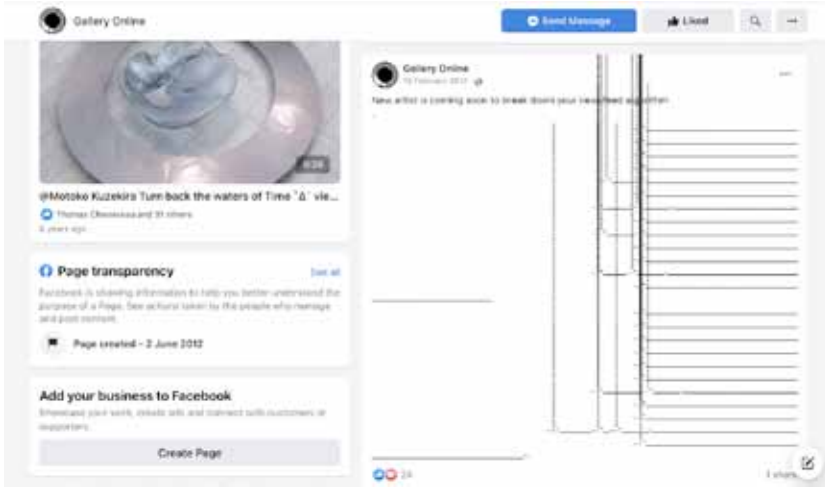

Figure 6: *Gallery Online*, 2017. Screenshot of Facebook feed, 2022. © Ronen Shai and Thomas Cheneseau.

While offering digital artists a platform to display and organise their work 'as they wished',[27] the project also directly confronted the increasing commercialisation and consequent manipulation of user's behaviours on social platforms.

Artists were invited to exhibit their works 'as live performances' — whether screenshots, glitch art or GIFs — and interact with an audience in real time; opening up the exhibition to the fluid occurrences of the larger platform it inhabited, as in the instance of the exhibition *Joyfully mutating curiosity* (2012) by William Wolfgang Wunderbar, whose work was scattered across various Facebook pages and groups.

Bespoke Platforms

The user-friendly interfaces of the Web 2.0 did not weaken curators' fascination with creating bespoke websites to commission and showcase web-based art. Often with an emphasis on exploring the

27. Ronen Shai and Thomas Cheneseau, 2012, 'Gallery Online — About', Art project, *Gallery Online*, 2012, https://gallery0nline.wordpress.com/about/.

web browser and site-specificity, these curatorial projects differed from the 1990s experimentations (see Section 2.2) for their focus on creating interfaces that were easily navigable. Here, artworks were showcased in 'neutral' environments that did not require negotiation of space with user-generated material on the internet, nor did they conform to the viewing patterns imposed by proprietary platforms and their algorithms. In this sense, the curators of these projects provided formats to lessen the 'disorientation and confusion' that online viewers would often feel when browsing the vast array of content available on platforms, which often 'overloaded [viewers'] short-term memory' and prevented them from forming a 'mental model of the information space.'[28]

Among these projects, which multiplied in number and variety, were *Why + Wherefore* (2007–11), curated by Nicholas Weist and Lumi Tan in New York; *or-bits.com* (2009–15), curated by myself in London; and *Temporary Stedelijk* (2011–12), curated by Amber van den Eeden and Kalle Mattsson in Amsterdam [fig. 7]. While projects like *or-bits.com* and *Why + Wherefore* put an emphasis on the themed exhibition — the former by inviting artists to use the website page as a hyperlinked 3D canvas, and the latter by presenting a series of group shows that were housed in pop-up windows, *Temporary Stedelijk* explored new tools for displaying artworks by using iFrames to allow 'the artworks to interact with each other, and become a whole, a unity in one show.'[29]

By working with bespoke websites and devising their own interfaces, these initiatives created curatorial platforms that confronted the 'demise' of the curatorial profession in the online environment, where anyone was a content producer, archivist and self-publisher. They also experimented with expanding the function of the exhibition and with processes of translation between online and offline spheres by devising new exhibition, archival and engagement formats across contexts of display. While *Why + Wherefore* explored how the distribution,

28. Julie Ault,'Remembering and Forgetting in the Archive: Instituting "Group Material" (1979–1996)' (Lund: Lund University, 2011).

29. Amber van den Eeden, 'Interview about Temporary Stedelijk', interview by Marialaura Ghidini, 19 April 2014. Personal email correspondence.

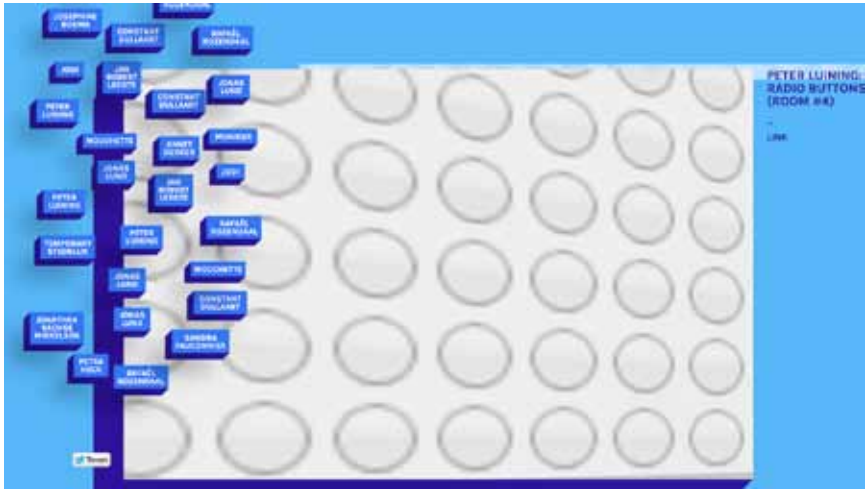

Figure 7: *Temporary Stedelijk*, 2011–12. Screenshot of index page, 2021. © Amber van den Eeden and Kalle Mattsson via Internet Archive — Way Back Machine.

Figure 8: *The IDEA — 2nd gazette*, 2000. Screenshot of index page, 2021. © Shankar Barua via Internet Archive — Way Back Machine.

production and consumption of culture were evolving through experimental exhibition formats in gallery spaces, such as *In Real Life* (2009), organised by Laurel Ptak — the *Offsite* projects of *or-bits.com* explored the travelling and morphing of exhibition formats across online and physical spaces — the radio, the gallery and print.

It is worth mentioning that in the first decade of the 2000s, there was a decrease in the number of institutional initiatives online. *Gallery 9* closed in 2003, and new projects, such as Genco Gulan's *Web Biennial/ Net-Art Open Exhibition* (2002–2014) for the Istanbul Contemporary Art Museum (Türkiye), were rare. Such discontinuation coincided with the rise of initiatives outside Western art capitals, which was significant because it offered renewed perspectives on online cultural production. Projects such as *The IDEA (The Indian Documentary of Electronic Arts)* (2000–2004) by Shankar Barua [fig. 8] and *Open Place (Sarai Interface Zone)* (2001) by Sarai in New Delhi highlight the limits of a universal understanding of online technologies. Less focused on experimenting with proprietary platforms, both projects created art spaces (with offline spin-offs) that addressed production, distribution and archiving in relation to local digital and socio-cultural contexts. socio-cultural contexts. They also nurtured a community of artists who, as in the instance of *Sarai*, explored online technologies in connection other ecosystems, such as the urban environment.

Experiments with Networked Services

From the mid-2010s onwards, further developments in the 'platformization of the internet',[30] thus its centralisation,[31] greatly altered usages and interaction with online technologies, so that artists and curators

30. Anne Helmond, 'The Platformization of the Web: Making Web Data Platform Ready', *Social Media + Society*, Vol.1, no.2, 2015, https://doi.org/10.1177/2056305115603080.

31. Trebor Scholz described the mid-2010s internet as 'today's network of networks', which, due to its centralisation that heavily relied on cloud computing and surveillance, 'had hardly any resemblance [to] what the creators of the Internet or Tim Berners-Lee had in mind when designing the Internet and consequently the World Wide Web', that is 'the "vendor neutral and altruistic contribution to society" that Berners-Lee had imagined.' Micah L. Sifry, 'Trebor Scholz on the Rise of Platform Cooperativism', Research organisation, P2P Foundation (blog), 11 January 2016, https://blog.p2pfoundation.net/trebor-scholz-on-the-rise-of-platform-cooperativism/2016/11/01.

responded more directly to the commercialisation of the networked environment. They developed strategies of intervention aimed at interfering with the assumptions and logic of online technologies, that increasingly embraced the new market of on-demand services encouraged by the proliferation of mobile devices. Such projects understood the web-based exhibition as a strategy to 'disturb' the functionality of web services and tools, along with the 'design' of user's expectations. With the expansion of the operations of multinational technology companies across sectors and contexts of adoption — these were the years of the vast array of Google services and Amazon expanding its online marketplace to IRL shops and an algorithmic assistants — the art platform morphed into a space where curators, artists and users-viewers started to exercise their agency over existing technologies and their larger (often opaque) infrastructures.

While the commercial art world exploited the interconnectedness of online tools to launch platforms for selling and collecting digital art in a manner that reinstated age-old system of gatekeeping,[32, 33] as in the instance of *s/edition/* (2012–) in London, artists and curators, often working independently, offered critical alternatives. They turned into nodes of a networked ecosystem that now spanned online and offline spheres (as did the interests and operations of the digital industry). This marked a distinctive shift in the practice of curating on the web, whereby earlier experimentation with interfaces, platforms and users' behaviours were now interwoven with an analysis of the economic and political role that online technologies were playing in the day-to-day life of their users — whether clients or service providers.

Exemplary of such a shift are the projects *Projected.Capital* (2018) and *Gallery.Delivery* (2018–) by Sebastian Schmieg [fig. 9] — the former conceived with Silvio Lorusso. Both projects functioned as platforms that intervened in processes of value creation and the role that online technologies play in them. They generated open and

32. Platforms like *s/edition/* created 'scarcity' of digital artefacts (the numbered limited editions), along with virtual storages for collectors (secure vaults) by using cloud computing and IP tracking.

33. Ruth Catlow and Marc Garrett, 'Spring Editorial 2018 Blockchain Imaginaries', Art organisation. Furtherfield (blog), 22 January 2018, https://www.furtherfield.org/blockchain-imaginaries/#easy-footnote-bottom-4-38513.

Figure 9: *Gallery.Delivery*, 2018. Screenshot of index page, 2021. © Sebastian Schmieg.

distributable systems that were instructional and whose exhibitions could be replicated in different locations, online and off. If *Projected. Capital* allowed artists to buy a piece of a website via a Paypal button so their artworks would be displayed online as well as on the walls of Roehrs & Boetsch gallery in Zurich — a commentary on the workings of the commercial art system — *Gallery.Delivery* presented 'a group exhibition and a performance that could be ordered online'.

The significance of these projects is in the fact that they addressed the internet and the web as technologies that have slipped into all the aspects of people's lives. As Schmieg observed,[34] 'algorithms guide' users both within and outside a platform — from people's 'bodies through digital spaces' to 'geographic ideologies, such as that of the Silicon Valley'.

A similar comment on value creation was made by *#exstrange* (2017) [fig. 10], which Rebekah Modrak and I curated using eBay as a site of production, display and distribution of artworks. With the intention to explore the types of artistic and cultural exchanges that could

34. Sebastian Schmieg, 'Translating networked interfaces and what we expect from them with Projected.Capital and Gallery.Delivery', interview by Marialaura Ghidini, 2021, https://www.curating.online/interview/sebastian-schmieg/.

Figure 10: *#exstrange* — Business & Industry category page, 2017. Screenshot of archive page (partial), 2018 © Marialaura Ghidini and Rebekah Modrak.

occur in an online marketplace, artists and designers were invited to create artworks following a set of instructions and present them as seven-day auctions on eBay — the *artwork-as-auction*.

They were encouraged to explore the language of eBay, the role that categories play in creating contextual framing, as well as the functioning of algorithms. Through the transactions between sellers and buyers, as well as the curators and artists, *#exstrange* generated an ecosystem based on exchanges that negotiated both the platform's features and the limitations embedded in its workings, which were in turn impacted by local policies. The artworks by Joana Moll (*Google Trackers in North Korea* official webpage) and by Ajit Bhadoriya, Chinar Shah, and Surabhi Vaya (An Apology for Sale), for example, highlighted the limits of the platform's terms of use in different socio-political contexts.

The centralisation of the networked environment, indeed, raises issues about control and surveillance also exerted by local governments, and it is interesting to observe how curators develop strategies of

circumvention. A distinctive response came from Miyö Van Stenis with the project *Beautiful Interfaces: The Deep in the Void* (2013) in Bogotá. Not only did Stenis explore exhibition-making outside the institutional art world, but also outside the 'world' of proprietary services and their terms and conditions. *Beautiful Interfaces* happened on the Tor Network and proposed a reflection on the intricate relationship between online technologies and the local socio-political contexts in which they are employed. This project stressed the idea of the curator as a node in a hybrid ecosystem, where online and offline are partial concepts and the production of art and culture is an activity that has to contend with external power dynamics.

Concluding Remarks

Less than a year after a version of this study was published in the Arts Journal, the COVID-19 pandemic led to yet another phase of renewed interest in curating on the web. Because of the social restrictions implemented to various degrees across the world, art galleries and museums turned to the web and proprietary platforms to keep their activities going. This time, the term 'online exhibition' made it into the mainstream, giving rise to a mass-migration of exhibition programmes online.

Despite the fact that this migration was unprecedented in scale and scope, the evolution of curatorial approaches to the specificities of the online environment faced a setback in 2020, particularly within the institutional art world. The temptation to maintain continuity with pre-pandemic practices led to replicating the experience of viewing art in a gallery space online — often in isolation, encouraging contemplation without interference from the 'outside world'. When not presented this way, art was instead shown live, through broadcasting, or via social media posts. The proliferation of online curatorial activities led me to assume that curatorial work on the web (at least as I define it in this study) had reached its endpoint.

Yet again, as in the mid-1990s, independent curatorial voices started to devise renewed approaches to explore online technologies and the realities that surround them, bringing to the fore the fragility of our reliance on web services and platforms. Instances of this include the art platform *Greencube.Gallery* (2017–) by Guido Segni and Matías

Figure 11: *Emotional Interfaces*, 2019. Screenshot of index page for the Wrong Biennale, 2021 © Virginie Tan and Astrid Lours-Riou.

Reyes in Italy, which halted its activities during the lockdowns under the tag 'URL is not enough', to resume them, with a stress on dialogue and community building, with the exhibition *The Struggle is Real* (2022) curated by the collective Clusterduck. With the exhibition *UNCERTAINTY-19 × EP7* (2020) [fig. 11], Virginie Tan and Astrid Lours-Riou transposed the web interface onto the façade of a gallery building to nurture an encounter with passers-by during the lockdown in Paris.

The COVID-19 pandemic produced a restructuring of our reality and, in the light of this, the historical overview presented in this chapter will hopefully help readers to look at the present — and the role that curatorial work has online — in relation to its past.

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Curating Platforms for Shanghai Biennale

Mi You

The experience of the pandemic has deeply shaken the way in which the art world functions. With Andres Jaque as chief curator, Marina Otero Verzier, Lucia Pietroiusti, myself as curators and Filipa Ramos as head of research, we were mandated to curate the 13th Shanghai Biennale (2020–21) in the middle of the pandemic. Under the theme 'Bodies of Water', the Biennale looked at how water mediates and interconnects bodies of diverse scales, from the planetary to the microscopic, from biological, ecological entities to collectivities or social bodies, thereby activating forms of liquid solidarities. Along the way, we were interested not only in deriving poetics and reflections from the experience of the pandemic but also alternative operational modes of extending art into the social fabric.

The director of the Biennale proposed that we work with Meituan, a leading food and grocery delivery platform based in Shanghai that provided critical food supplies to millions of people under lockdown.[1] The idea was to find a dispersed venue for art through the delivery network. While we didn't pursue this collaboration, it opened up the questions, how could curators relate to tech platforms and what does it mean to curate platforms? Rather than focusing on works *about* platform economies, our interests expanded into social media and platforms in their organisational and operational forms. I will reflect on two artistic projects I commissioned as part of the Biennale that

1. See more on the role of platforms in the first wave of COVID in China in Mi You, 'The social support networks stepping up in coronavirus-stricken China', *openDemocracy*, 2020, https://www.opendemocracy.net/en/oureconomy/social-support-networks-springing-coronavirus-stricken-china/.

tap into the infrastructural conditions of platforms. Here, I follow what Olga Goriunova defines as 'art platforms', i.e. cultural productions on the internet that may not self-conceptualise as art but rather point to art as a 'collectively distributed social practice that forms society.'[2]

Art and Curation, platformised: Jimeimen

The first project is by theatre-maker Sun Xiaoxing and a multidisciplinary team (theatre-maker Qiu Zhen, researcher Zhao Kunfang, architect Huang Siyao) called Jimeimen, or 'Gate of Beauties', a word taken from the colloquial language of the short-video platform Kuaishou. Unlike its rival TikTok, Kuaishou utilises what seems to be a much less biased algorithm, and tends to push more diverse content to its users, resulting in the emergence of an eccentric grass-roots culture. Kuaishou is embraced by the vast populace in small cities and rural China and is most widely associated with the wretchedness but also the earthiness of countryside or small-town life, featuring unapologetically raw content such as excessive eating, village youths ranting about schools, or farmers doing acrobatic stunts and inventing strange instruments.

One hugely popular format on the platform is the so-called *shenhui yao* (society shake) — a brute form of dance to lo-fi disco music. The term shehui (society) signals variably the characteristics of shouldering responsibilities at a premature age, ample experiences in society, the 'tough guy' look and using brute force to solve problems and survive against all odds, all aspirations of small-town youths. Studies on this 'society' genre have focused on such subcultures being inherently embedded in the urban-rural class divide.[3] Certain colloquial choices of words, often spoken with an exaggerated accent and forged puns, make their way through Kuaishou as a new lingua franca, such as the mispronunciation of *jiemeimen* (sisters) into *jimeimen* (gate

2. Olga Goriunova, *Art Platforms and Cultural Production on the Internet* (London: Routledge, 2012), 9.

3. Miao Li, Chris K.K. Tan and Yuting Yang, 'Shehui Ren: cultural production and rural youths' use of the Kuaishou video-sharing app in Eastern China', *Information, Communication & Society* Vol.23, no.10 (2020/08/23 2020), https://doi.org/10.1080/1369118X.2019.1585469.

of beauties). Once invented, such modes of dance, use of props and language are widely adopted across Kuaishou, where one video can be viewed by hundreds of thousands of people, with many of the viewers mimicking and sharing their own versions, thereby triggering a network effect.

The artists have chosen a series of symbols from viral short videos on Kuaishou and turned them into sculptures, including a 'flower hand' — a gesture taken from a 'shehuiyao' dance — tacky LED shoes for shuffle dancing, and an RSZ motorcycle — an economic model from Yamaha often refitted with flashy accessories, popular among low-end racers, among others. These objects are displayed on pedestals in a purpose-built black-box space, lending them a certain artistic aura [fig. 1].

Jimeimen were well aware that the polished objects as symbols of grass-roots creativity cannot convey the social meanings of Kuaishou in which they are so interested [fig. 2]. Critics would rightly point out that the grassroots creative stunts, though seemingly meaningless, feed into the reputation economy — or a seeking of recognition that is based on an 'inwardly generated identity,'[4] a modernist construct. But what if instead of the inwardly generated identity, there is something 'outward' and communitarian going on? Can we read this appreciating, mimicking and making of content as the self-expression of a subaltern collectivity?

At the outset, I asked the artists to take a social and infrastructural turn by expanding the artistic manifestation into the 'real' social spaces of Kuaishou. They originally came up with a proposal to collaborate with Kuaishou on a quasi-competition of short videos that would be marketed to all Kuaishou users. However, if we were to communicate the competition as an art contest, we would only reinforce the perceived elitism of the art world and betray the spirit of Kuaishou. I then came up with idea of framing the campaign under the banner 'Is it art?' The rationale was, we needed something in line with Kuaishou's ethos and that plays into the double bind of

4. William Davies, 'The Politics of Recognition in the age of Social Media', *New Left Review*, Vol.128 (2021).

Figure 1: Sun Xiaoxing et al., *Jimeimen*, resin sculptures.
Photo: Huang Zhihao.

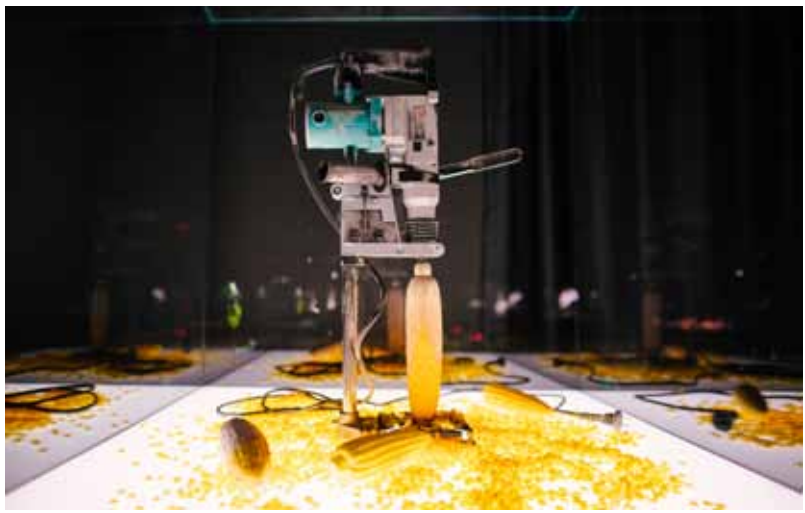

Figure 2: Sun Xiaoxing et al., *Jimeimen*, resin sculpture of 'electric drill corn' (a Kuaishou user invention to facilitate eating corn). Photo: Huang Zhihao.

senselessness and seriousness. This rhetorical question would shake off the burden of institutionalising art, and instead encourage unexpected and aberrant reactions. The massive user base of Kuaishou would then participate simply as themselves — not as aspirational artists — and we expected all kinds of eccentric manifestations that would potentially expose art to its own discontents. Thinking along the organisational lines of grassroots creativity, repetition and gifting, the network effect would augment this social moment and attract repetitions and mutations, and a collective exploration of art embedded in life would emerge.

The Biennale organisers were not keen on this idea, since they wanted to launch their own thematic video contest with Kuaishou, but this didn't come to fruition. Instead of utilising just the infrastructure of a platform for the purpose of art dissemination, what I proposed as a curator was an aesthetic engagement with the platform. This requires taking seriously the experimental social and organisational forms thriving on Kuaishou, while remaining critical of the platform itself — in short, working with platform economies from within and without, for 'it takes a network to analyze a network.'[5]

For a Different Kind of Platform: ReUnion

The second case study is ReUnion,[6] an art and social design project that aims to reunionise people through peer-to-peer (P2P) care. While utilising digital infrastructures, it imagines a different kind of platform that is commons-oriented. At the Biennale, this imaginary takes the form of a role-playing game.

ReUnion aims to build an alternative social-welfare system with long-term, interpersonal care relations. Both participants in a trusted care relation — whether elderly care, childcare, or digital nomads moving to a new city — can enter into long-term, qualitative caring relations. Over time, the two people in a caring relationship can take it to a new level by endorsing Composite Coins (CC) together, which will be

5. Wendy Hui Kyong Chun, 'Networks NOW: Belated Too Early', *Amerikastudien/ American Studies*, Vol.60, no.1 (2015).

6. ReUnion Network, "Commoning by P2P Care," accessed 20 October 2025, https://www.reunion-network.org.

Figure 3: ReUnion × DMaS (Dinghaiqiao Mutual Aid Society), *Lilies on the Water*, making a Composite Coin with personal tokens in the role-play game. Photo: ReUnion.

Figure 4: ReUnion × DMaS (Dinghaiqiao Mutual Aid Society), *Lilies on the Water*, inaugurating a 'community project' through players in the role-play game. Photo: ReUnion

logged on Decentralized Ledger Technology or blockchain [fig. 3]. The CC functions as a complementary currency that can be exchanged for goods and services in places such as the local co-op, which studies have shown to boost community economies.[7] Over time, what grows out of the interpersonal relationships can develop into a 'family of choice'. The long-term ambition of ReUnion is to get the government to endorse long-term interpersonal care relationships as a valid complementary form of welfare, and to subsidise CC.

So far, the work is at the proof-of-concept stage. As the curator, I felt it would be insufficient to display the project as a speculative design project with diagrams and illustrative videos. Rather, I wanted to overcome the daunting gap between an artistic vision of a future society and a fully fledged, implementable social programme, and to render the vision experienceable. This is where I stepped in to help set up a residency for ReUnion at the Dinghaiqiao Mutual Aid Society, a space run by a group of artists, architects, social researchers and activists in a working-class neighbourhood in Shanghai. During the residency, the artist and collaborators designed a Live-Action Role-Play game to test the social and economic mechanisms of ReUnion. The game starts with the players being assigned characters from different social backgrounds, whose biographies they will imagine and enact. As the game progresses, players follow personal pursuits and also establish friendships and care relationships with each other. Events such as illness, relocation, changes in social, political and economic conditions change the course of one's life. The players try to weather these uncertainties with the help of each other or the collective, discover themselves and find meanings in their characters' biographies [fig. 4].

The role-playing method performatively suspends the dominant market logic of individualised needs and solutions for individualised risks, and instead allows for an activation of interpersonal relations based on trust and reciprocity to become the foundation of a social network. This care-based society in the game enacted a 'collateral

7. Marie Fare and Pepita Ould Ahmed, 'Complementary Currency Systems and their Ability to Support Economic and Social Changes', *Development and Change*, Vol.48, no.5 (2017), https://doi.org/10.1111/dech.12322.

reality'[8] that reveals realities as culturally constructed and malleable. The care relations are prefigurative in that they are not yet real, but many players find them fully plausible. Hundreds of players participated and co-shaped the game before and during the Biennale; a number of dedicated players became NPCs (non-player characters) to help new players into the game, and an amateur theatre group grew out of the game.

Care as a scarce resource is being platformised, further exacerbating the atomisation of individuals. ReUnion embodies both a form of critique and an activist transformation of the platform economy. Though algorithms are seeping into every aspect of our lives, it is important to remember, as Geert Lovink emphatically argues, that infrastructures do not equal society.[9] The curating of this project entailed actively channelling a social and infrastructural design into a world-making project, folding and transforming real and imagined social relations into the process. Art and curating can play a role in prefiguratively enacting such social imaginaries.

Afterthoughts

For a long time, art curating has operated with a kind of 'indeterminacy', allowing open-ended encounters between the artworks and the audience, not assuming positions, sometimes to the point of escapism.[10] It is in the face of domains beyond its sovereignty that art curating appears indeterminate in its positioning, often apologetic for not working on 'real' issues. Yet the very indeterminate space opened by art, such as in the role-play game and in user-generated culture on Kuaishou, is exactly where alternative world-making potentials reside. Curation of these projects was motivated by situating art cautiously in the creative tension between the two poles of indeterminacy and activism, pointing to small openings towards an alternative. By doing so, these projects create a space for critical thinking as part of activist engagements and tap into other infrastructures and networks

8. John Law, 'Collateral Realities', in *The Politics of Knowledge*, ed. Fernando Dominguez Rubio and Patrick Baert (London: Routledge, 2011).

9. Geert Lovink, 'Principles of Stacktivism', *tripleC*, Vol.18, no.2 (2020).

10. Tirdad Zolghadr, *Traction* (Berlin: Sternberg Press, 2016).

such as online platforms and alternative social networks in order to nurture experiments that allow latent social and artistic potentials to manifest.

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Crash Blossoms/ IF & ONLY IF: A Lo–Fidelity AI Newspaper (2020)

Nathan Jones, Tom Schofield and Sam Skinner

IF & ONLY IF

VOL 1. NO. 1 MONDAY SEPTEMBER 21 2020 TORQUE EDITIONS

DESTRALE OF THE PANDEMBER CHARD AND THE ALLEGED

A POSSIBLE FUTURE – OR A GAP IN THE PAST – IS RENDERED AS LOW-FIDELITY LANGUAGE IN THIS HEADLINE.

As the author Stanislaw Lem has a character in The Futurological Congress observe: 'By examining future stages in the evolution of language we come to learn what discoveries, changes and social revolutions the language will be capable, some day, of reflecting.' If and only if the future = (the past + the present) *entropy, then might the neologism be a time machine, an active agent of transformation?

Or perhaps as language falls apart, it falls into unspoken moments of the past?

IF & ONLY IF works with a recursive neural network (RNN) to exaggerate and accelerate the falling-apart-recombining-elsewhining process that language undergoes in today's increasingly rapid post-informational culture.

As with any object that is far-distant, the view this headline affords us of the future, is impoverished and blurry. A vision that decrands your imagination. Rather than 'big data' the IF & ONLY IF headline generator is instead on a small set of data which you can read and digest for yourself on this page. Starting out with a small British Library archive of C18th headlines, a RNN was taught the statistical likelihood that one letter follows another. Each day we re-train IF AND ONLY IF's RNN on its own outputs, editing by hand some corrupt entry and possible future examples. You can add your own suggestions below to help us train the model over the coming weeks.

Though the form of its historical source still shape the outputs you see, their content will become an increasingly distant memory over the coming weeks, distorted by the likelihood of letter-combinations such as 'ynne', 'hvne', 'hve', 'ae' that dominate today's headlines. Because there is no corrective mechanism, the process does not result in increasing accuracy, but rather opens up the field of possibility and disorder in a way that is akin to the entropy that characterises our experience of time passing.

'MARKETS', 'HIGHOUT COULD MECHETER', 'BULLOVING', 'AUSTRALIAN HAVE FIVEL AND MONETARY', 'COURT', 'SEVNEOUNS THT SOARS WORLD ORDER RULES', 'NEWSPAWPE DEAL', 'ANNUAL STONESS AND THE BRITS', 'ALL AND TELEGRAPHIC MEWS', 'LOTS – IT'S POINE IN CORRESPONDENCE', 'LATEST AND TRADE LANG THE PARRISTALLY INDEFIRST CALLS TO PRESIDENT TRUMP AND THE BRUTISH ASIAS PRESIDENT TO HEE OCKENNE PROTEST AID OF THE SALE OF AMERICAN COMMISSIONERS', 'PENGY 'HEALY IN RESPOLAN AND THE CORRESPONDENCE', 'LATEST AND TRADE REPORT AND CHITUARIES ', 'KENTIC, 'MANCES', 'DOLING FOUND THE EARTHS AND THE REPOLICE', 'LATEST AND THE REPULST TO MORNISH ASSAMED TO EAGTED BY THE BOOK, CONCERNATIONS TO AMERICAN COMITISH ASSASING THE WORKER OF THE SPECTRUST CLOSESDENT TO FAIL', 'ARTS AND OBITUARIES', 'LATEST AND TRACE JUDER DEMOCTING STOVERY HAS IN HOPS RASSIOT PUBLIC AND MONETARY'

YOUR HEADLINE HERE

Help us to train our RNN by typing in your own speculations on the headlines of the future. Who and what will dominate our news in the decades to come? What new conglomerations of politics, technologies and events will we come to know? How might the language of headlines and the news change? What neologisms will be commonplace?

CONFUSION CAUSED BY CRASH BLOSSOMS

Here's a further sample of some of the suggestions made by you, our readers, helping to train the IF & ONLY IF RNN to look into the future and combine with headlines from the past and the present to create the top headline. Your own contribution could be published here, alongside these:

'DAILY MAIL FORMS ARMY', 'SWANS UNDER ATTACK', 'BARAGE SINKS', 'COVID 19 GIVEN PEERAGE', 'SCHOOLS REOPEN UNDERWATER', 'PM SLAMS SLAMMING', 'SPECULATION ABOUT CRASH BLOSSOMS', 'ZOMBIES LAND', 'SQUIRRELS ATTACK', 'FAKE DEGREE CLAIMS DOG PROMINENT SPANISH POLITICIANS', 'MAN WHO URINATED ON WOMAN AT DRAKE CONCERT BEFORE DRINK-DRIVE KILLER GIRLFRIEND STARTED BRAWL OVER JOOHDS JAIL', 'DECAPITATED MEMBERS ARRESTED ON ALLEGED KIDNAPPING CHARGES', 'QUEEN MOTHER TRIED TO HELP ABUSE

"MACHINE MISBEHAVIOUR" IS CLICK BAIT TO-COME

IN LATENT SPACE NO-ONE CAN SEE YOU TYPO.

The notion of latent space is integral to forms of machine learning where data in a data set are used to produce a mathematical 'spatial' representation of the set as a whole.

The only language IF AND ONLY IF knows is headlines that exist within the archive. Each example headline from the corpus is a coordinate from which the AI constructs a continuous world. You can yourself in the columns below, read the material from which the AI draws its coordinates. But we can ask the generator to 'explore' its archive-world and draw us what language possibilities exist "between the (headlines". The latter combinations that you see above are locations possibilities within the latent space of the archive. The neologisms (new-words, new-logics) that the generator spits out are therefore not only intended as speculations on the future, but of the gaps in the archive. What has been left unsaid.

As well as synthesizing the statistical possibilities of historical sets of headlines with more contemporary examples, we also train IF & ONLY IF on its own errors. We also introduce our own vernacular examples. This is what is called 'poisoning' the set, but we might also think about it as bringing the archive back to life. This human intervention in the synthesis set is a "pharmakon", both poison and antidote. It obsesses and distorts the "truth" of the archive, by presenting a range of possibilities that is between it, and beyond.

In this way, making becomes divination: Uncertainty and contingency in computational glitch-events. Remi Mkamoko observes similar potentials - perhaps even necessities - in contemporary design practice. Mkamoko asserts that a glitch is the event that "reveals the potential of the digital in processes of computational making". The IF & ONLY IF algorithm is trained on such moments in its own language glitches, it is encouraged to make errors that articulate its own potential. The glitch poetics are phantasological moments in language, where broken, impoverished and corrupted words are imbued with literary potential. The era of the digital means that errors increasingly reveal the entanglement of our language with computational means, a process that is accelerating us into the future.

'Ambiguity is difference engine of the eternal return.', 'No 'syntax directive', just grains stirred in a certain way.', 'Error is divination.', 'Glitch (the tangible evidence of autonomous capacities of digital matter.', 'True picture of the past whitens by.', 'History repeats itself as different bodies.', 'Crash Blossoms. Post truth. Linguistic Metallurgy.', 'Splinters of error shot through present moment show light.', 'Each line of headlines in a for as a possibility.', 'Digital encryption as manifesting ongoing differentiation.', 'Cracked oracle. Synthetic projection. Gibberish machine.', 'Storm drives language irresistibly into the future.', 'Hyou cut open the present the future leaks out.', 'Return of the same: to re-played on a different statistical array.', 'Open the archive to find new semantic ground.', "machine misbehaviour" is click bait tomorrow.', 'We trained an AI on 1930 headlines from the C18th, and made it bleak.', 'First time as truth, second as unspeakable.'

FAKE DEGREE CLAIMS DOG PROMINENT SPANISH POLITICIAN

A crash blossom is a syntactical error-ambiguity in a headline, for example: "Violinist linked to JAL crash blossoms" or "Red Tape Holds Up New Bridge". These errors are often the result of the tendency in 'headlinese' to use a noun as a verb. As in "Fake degree claims dog prominent Spanish politicians".

The crash blossom opens up a latent space in language, in which multiple interpretations are true of a single headline. Such headlines also spiral into the space of the kind, producing cartoonish visions of a world in which subjects hover in a state of dramatic action. "Man who urinated on women at Drake concert before drink-drive killer girlfriend started brawl over suicide jail", "Decapitated Members Arrested on Alleged Kidnapping Charges","Queen Mother tried to help abuse girl", "Chinese Cooking Fat Heads for Holland", "Women Abandoned as Newborn Searches for Birth Mother."

THE TRIAL OF DR JAMESON AND HIS OFFICERS

The above headline is taken from The British Library archive of 19th century newspapers, mostly newspapers that have been newly digitised, which were the inspiration for this project. IF AND ONLY IF's RNN was trained using just 1000 examples from this data-set, in conjunction with contemporary and speculative future. Each one of the headlines from the archive was the title of a local or national news story, with regular features such as "Births, Marriages and Deaths" predominating in the first iterations of our trained model. Unlike with "big data" AI models, our original set is provided here as a human-digestible scale. It is of note that the sensationalist language of contemporary headlinese is a later invention, which is merely present in the raw 1800 headlines we have used. The British Newspaper Archive holds over 20 million searchable pages from more than 700 newspaper titles. http://www.bl.uk/collection-guides/british-newspaper-archive

HOW TO OVERLOAD INFORMATION OVERLOAD IN ACTS OF RECUPERATION?

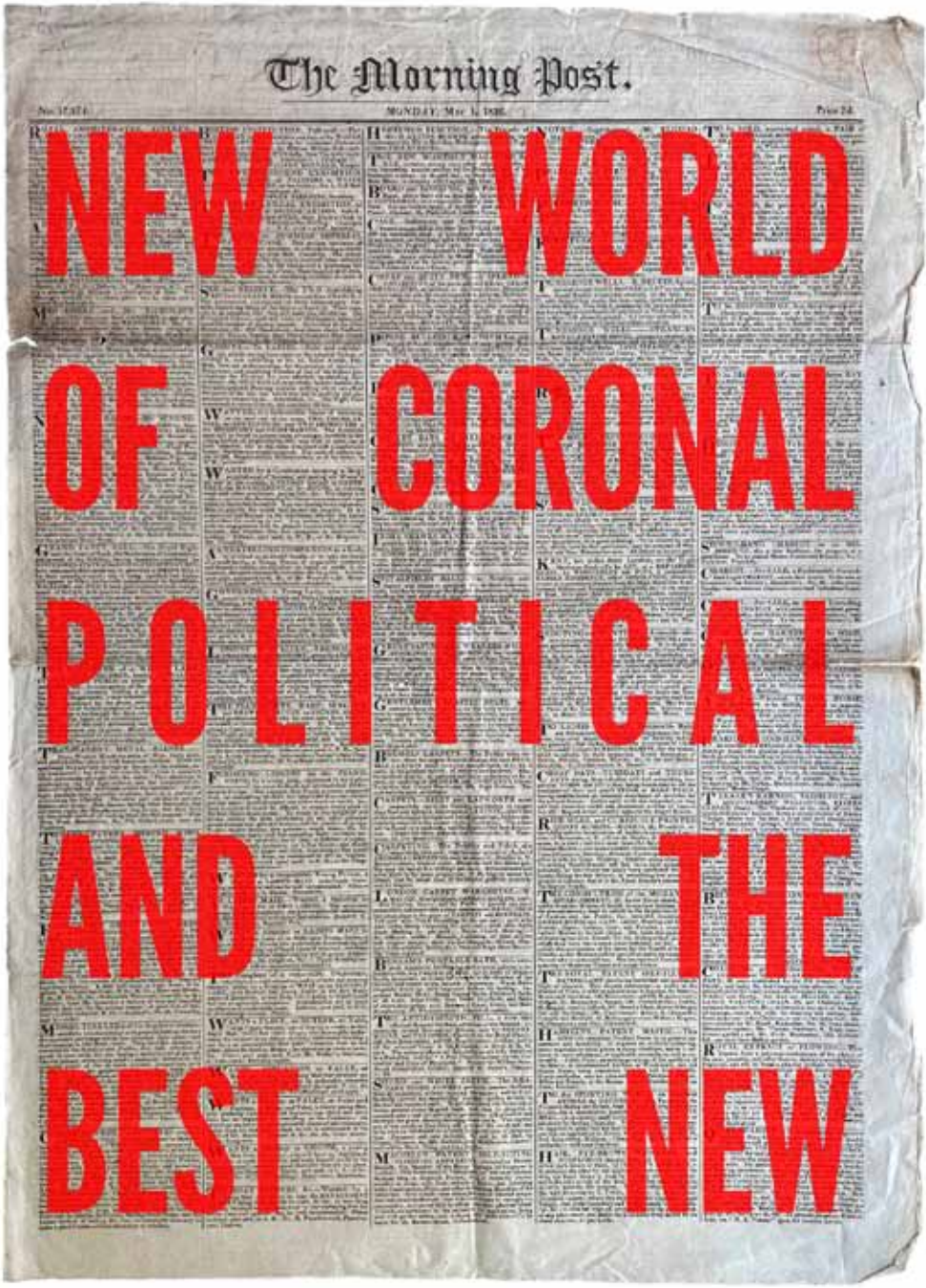
This project explores headlinese - the strange language of headlines - and broader contexts, including the migration of news from paper to radio to screens, and how today's news has become increasingly participatory and automated. Forwarding, retweeting, commenting, hashtags and memes have collectively produced a news that is in a constant process of mutation and self replication. How we experience this news today is inherently open to revision, so much so that we are all variously working or lurking in a global newsroom. But, in this new world of citizen journalists and freedom to publish in an instant, misinformation can spread online like wildfire, breeding and legitimating conspiracy theories, and ushering in a 'post-truth' age.

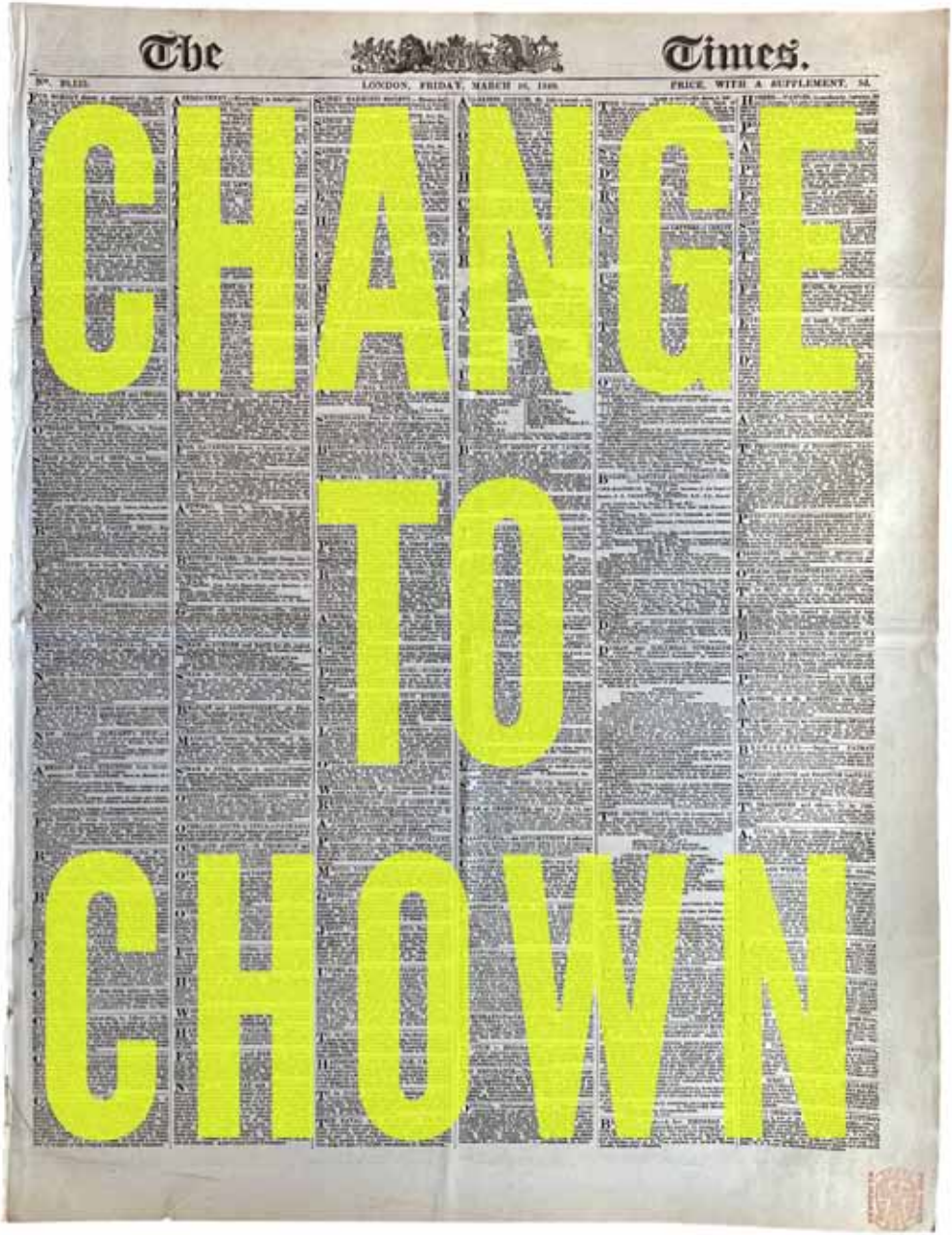
Within the history and culture of headline writing lies the seeds of the hyperbolic language that defines so much online news and communication today. Whitney Phillips has written that algorithms act as editors, which "incentivize certain types of sensationalist content ... [and] it is simply not the case that all voices carry equally on social media, or that all information carries equally."

Furthermore, in working with a news archive as we have done with this project, it should be noted how the archive, like the news, prioritises certain voices. As Michel Foucault has argued, the archive "defines at the outset the system of its enunciability". This project seeks to put the news archive of the past into dialogue with its present and future, using the possible characteristics of AI text generation software as a tool to mediate relations, and create an experience for readers that is at once familiar and strange.

The artist Steve McQueen once said in an interview that "artists develop a language in response to a crisis of freedom," but how might we develop a freedom in response to a crisis in language? As artists we are not interested in 'knowledge navigation tools' that assert 'control and mastery' of the informational and linguistic excesses of today. Rather, we seek to produce artefacts and encounters which both revel in and defamiliarise the infosphere. John Cage once wrote: "I am trying to be unfamiliar with what I'm doing" and we attempt this too, asking 'what role does the imaginary have within the evolution of media and technology, from postcards filled bubbles to how we might converse with AI. We ask: what is the inner life of language, as it twists between the engines of the web and the archive, how do words create worlds, how can we overload information overload with acts of recuperation, and how might we learn to crash blossom?

Commissioned by The British Library and Leeds Digital Festival. A collaboration between Nathan Jones, Tom Schofield & Ben Bickmore // IF & ONLY IF // CRASH BLOSSOMS


The Morning Post.
NEW WORLD
OF CORONAL
POLITICAL
AND THE
BEST NEW


The Times.
LONDON, FRIDAY, MARCH 16, 1866
PRICE, WITH A SUPPLEMENT, 5d.
CHANGE
TO
CHOWN

Daily Mirror

MON MAY 22 1950

ONE PENNY

FORWARD WITH THE PEOPLE

No. 14,471

Registered at G.P.O. as a Newspaper

A Govt. inquiry reports on—

THE ONLY WAY TO MORE AND CHEAPER HOUSES

Build in terraces

Cut down on size

Cut out the frills

DAILY MIRROR REPORTER

GOLFERS' DANCES ON THE COURSE

'Tornado' leaves a trail of roofless houses

TWO men were killed by a single flash of lightning and a whirlwind ripped roofs from houses in three shires that swept over England yesterday, which was also the hottest day of the year.

Housewives' Choice is now Labour plan

Continued on Back Page

'QUAKE WRECKS A MOUNTAIN CITY OF 46,000 PEOPLE

Biro ballpoint pens

Biroette ladies' choice

Biro the ballpoint pen

HEADLINES FORGOTTEN FAREWELL

Your Echo

Welcoming you to a great new era with your new, handier sized paper, we offer you a look back at our greatest stories, a look forward to our future challenges, and a look around the present-day Echo.

1945 IN SIX PARTS WITH YOUR NEW-LOOK ECHO. PART FIVE: POST-WAR WORLD 1980

HOUR OF HOUTING AN AND AND

Lincolnshire Echo

FINAL CITY

30 FEARED DROWNED IN FLOOD HAVOC ALONG LINCS. COAST

ALL MABLETHORPE UNDER WATER

Heavy Damage On Foreshore At Skegness

FIRE AND FLOOD

DISASTERS involving flooding and fire dominate the news in times during the Post War era.

Flooding followed heavy snow in Lincoln in 1947 (see Page 9) and in 1953 came the great East Coast floods (Echo front page illustrated here and see Page 2).

Fire struck for the second time within a few years at Lincoln Co-op. Our picture

ALSO INSIDE:

MORE PICTURES, ARCHIVE CUTTINGS, GOSSIP, SPORTS SPECIAL

Crash Blossoms/ IF & ONLY IF is a playful online artwork that uses a type of artificial intelligence — recursive neural nets (RNNs) — to generate new headlines from a mix of historical and user-submitted news sources. The project was first shown at Leeds Digital Festival on 24 September 2020. Drawing on newspaper archives from the British Library and fictional headline submissions from users, the project synthesises past, present and future into an ever-shifting feed of headline fragments. The name *Crash Blossoms* refers to a type of ambiguous headline produced by compressed journalistic language also known as 'headlinese'. An example is 'McDonald's fries the holy grail for potato farmers', which can be interpreted in multiple conflicting ways. The linguistic slipperiness central to headlines is at the heart of the project's exploration of AI-generated news and meaning-making. In the essay that follows, we unpack how *Crash Blossoms/ IF & ONLY IF* uses a deliberately low-fidelity, small-data AI approach to critique dominant narratives around machine intelligence. We focus on how the project explores 'headlinese' as a linguistic form, the concept of fidelity in AI-generated outputs, and how data 'poisoning' can open up new imaginative and speculative possibilities.

The *Crash Blossoms/ IF & ONLY IF* web page draws stylistic cues from print newspapers and online news sites. New sets of headlines were generated daily by an AI trained on a mixture of nineteenth-century and recent headlines lifted from British newspapers accessed via the British Library archive, and imaginary headlines uploaded to the site by users. In its default state, headlines emerge in a blank text box, akin to how text is written from the 'insertion point' on a word processor. These animating headlines cause the html to flow unceasingly, stretching and shrinking sections, bumping words to the following line and creating new aleatoric combinations of headline and body text. As such, the piece is durational, with many cycles interacting according to their own temporal demands. The long life-cycle of creation, classification, maintenance and disposition of data is reflected in the rapid destruction and recreation of the headlines and the infinite scroll of the ticker-tape at the base of the page.

Rather than 'big data' power, the plodding IF & ONLY IF headline generator is trained on a series of small sets of examples that you can read and digest for yourself on the webpage. We deliberately invite users to compare the input and output of our RNN as a pedagogical

and critical gesture — an alternative to the typical glorification of AI technology. The low-fidelity language spat out by our RNN and its setting in the IF & ONLY IF page reveals and obfuscates some of the unknowables of AI. We reveal partial sources and poison others, employing behind-the-scenes magic and front-of-house announcements for a stage set with a troupe of varied actors.

The rest of this short essay discusses the role of 'headlinese' as a textual unit that derives its style from its enmeshment in the media apparatus resulting in a uniquely odd diction, 'fidelity' as a term to describe the relation of AI authored things to their human equivalents, and 'data-poisoning' as a method for degrading fidelity in return for speculative or data-critical outputs.

Headlinese

Headlinese reflects how news is becoming increasingly participatory and automated, forming a lineage of language corruption. The history of headline writing contains the seeds of the hyperbolic language that defines so much online news and communication today. Whitney Phillips has written that news algorithms act as editors that 'incentivise certain types of sensationalist content... [whereby] it is simply not the case that all voices carry equally on social media; or that all information carries equally'.[1] As we have seen again and again, in AI applications, not only do algorithmic decisions amplify existing inequalities, but they performatively reproduce them. In this case, the best performing stories develop an audience. The audience demands the stories that require an audience and so on, performing recursive loops, not unlike those in a neural net. AI and the news are kindred spirits thriving on difference and repetition.

How we experience the news today is inherently open to revision and the concision of the automated and user-generated headline — so much so that we are all variously working or lurking in a global newsroom, gabbling headlinese. Forwarding, retweeting, commenting,

1. Whitney Phillips, *The Oxygen of Amplification, Data & Society*, 2018, https://datasociety.net/library/oxygen-of-amplification/.

hashtags and memes all contribute to a kind of catch-all news-speak that is in a constant process of mutation and self-replication. In the new world of citizen journalists and freedom to publish in an instant, misinformation can spread online like wildfire, breeding and legitimising conspiracy theories and ushering in a 'post-truth' age. However, within this ambient glut, we find the promise of a deconstruction of the notion of a primary source among various temporally and conceptually distant alternative sources.

Like newsroom hacks, we revelled in remixing the venerable British Library news archive with the more silly, hyperbolic headlines of the contemporary and the imagined to titillate our audience. As Michel Foucault wrote, the archive, like the news, prioritises certain voices and 'defines at the outset the system of its enunciability'.[2] In our small experiment, we used the text box of the headline as a kind of portal to play with the temporal limits of enunciability, inscription and ideological constraints of news and the archive. By enabling visitors to the site to add their own headlines and see how the RNN processed these and generated new headlines, we were also trying to create an opportunity for audiences to experiment with and observe AI technology first hand, in the making.

AI Fidelity

The fact that the site resembles print newspaper renders it a 'skeuomorphism', a term used to describe digital tools that resemble analogue comparisons, and commonly recognised as lousy design practice. However, although our skeuomorphic website resembles a newspaper, it frustrates any attempt to read it as such: the columns on the page move and contain untimely combinations of theory and cut-up text. The headlines authored by the AI[3] are a strange jamming of old and new languages corrupted by the misspellings and syntactic misplacements that are the result of its 'small-data' resources. Though published some months ago, IF & ONLY IF's 'crash blossoms' are an example of the projective, predictive quality of data-based AI,

2. Michel Foucault, *The Archaeology of Knowledge* (London: Routledge, 1969), 129.

3. The AI we used is Torch-RNN, an open-source recursive neural net for torch7 using character-level language modelling similar to char-rnn. https://github.com/jcjohnson/torch-rnn.

resulting in phrases that are *newsy* and *new*, but not news.

The project's blend of skeuomorphism and untimeliness raises the question of *fidelity* in digital media. IF & ONLY IF's outputs are low-fidelity: it types out headlines that are infested with the textures of the glyph-scale text-sampling of the RNN and gestures vaguely at the space triangulated between past, present and future proposed by its data-set and users. As with any far-distant object, the view this headline affords us of its between times is impoverished and blurry. However, if you squint, there is something there to see.

Fidelity has fallen out of fashion to describe the degree of media. This is a shame because it combines several linked issues relating to AI ethics in a way that synonymous terms such as 'resolution' do not: namely, how the believability of the AI's output (how passably human it seems to us) relates to its faithfulness to the data-set (usually based on the layers of training that have taken place), and the level of definition or scale achieved (how big, smooth, or shiny the output is). Our new headline language demands our faith in it precisely because it fails to read as fully human; it is delightfully promiscuous, ambiguous, suggestive and strange. Fidelity as believability, faithfulness and definition in AI-generated art does not have a simple relationship to ethics. Still, we could say, along with Hito Steyerl's commentary on the poor image, that the hi-fidelity AI output is 'brilliant and impressive, more mimetic and magic ... more rich', whereas the 'poor', imperfect lo-fidelity AI image contains a more militant, affective potential and carries less baggage.[4]

In language, the issue of fidelity is perhaps even more complex than with the image. The sheer quantity of data used by GTP-3 (in effect, everything written online, accessed via the Common Crawl service, plus content from digitised books), means that the output is both more believable, less specialist, and less error-prone than present-day visual versions of the technology. As well as the apparent dangers of phishing, impersonation and other scams, temptation for commercial

4. Hito Steyerl, *In Defense of the Poor Image*, e-flux.com, 2009, https://www.e-flux.com/journal/10/61362/in-defense-of-the-poor-image/.

copywriters and lazy authors will surely be too much to bear, and we will be drowned in linguistic simulacra, faithful, stale reproductions of the written as-it-was at the beginning of the twenty-first century.

Poison and Divination

Seeking to avoid this repetition of the same, as well as synthesising the statistical possibilities of historical sets of headlines with more contemporary examples, we train IF & ONLY IF on its own errors. We call this process 'poisoning' the dataset, but it might equally be thought of as bringing the archive back to life. It obscures and distorts the 'truth' of the archive by presenting a range of possibilities that is between and beyond it. Though the texture of its historical sources still shaped the outputs you see, content became an increasingly distant memory over fourteen days of its first 'volume', published during Leeds Digital Festival 2020, distorted by the likelihood of letter-combinations such as 'coro', 'trum', 'brex', 'ai' that dominate today's headlines and vernaculars. Without any corrective mechanism, the process sacrifices accuracy in favour of an expansion of possibility and disorder. In a sense, the headlines that IF & ONLY IF authored can be thought of as a form of historical fiction, framed by humans but realised by machinic logic. The neologisms (new-words, new-logics) that the generator makes are therefore not only intended as speculations on the future but of the imagined gaps in the archive. What could have been left unsaid?

As a character in Stanislaw Lem's *The Futurological Congress* observes: 'By examining future stages in the evolution of language we come to learn what discoveries, changes and social revolutions the language will be capable, some day, of reflecting.'[5] In 'When Making Becomes Divination', Betti Marenko observes similar potentials in contemporary design practice. Marenko asserts that a glitch is an event that 'reveals the potential of the digital in processes of computational making'.[6] The IF & ONLY IF algorithm is trained on such moments in its own

5. Stanisław Lem, *The Futurological Congress* (Tel Aviv: Schocken, 1981).

6. Betti Marenko, 'When making becomes divination: Uncertainty and contingency in computational glitch-events', *Design Studies*, Vol.41, 2015: 110–25.

language glitches; it is encouraged to make errors that articulate its own potential. Our news-headline generator operates like experimental fiction or speculative design because it seeks and finds imaginal possibility in its lack of fidelity to now, exchanging this for a grasp on what is to come. Following this, we ask: if and only if *the future = (the past + the present) × entropy*, then might the lo-fi headline operate like a time machine, or an active agent of transformation?

Alongside the creative potential of a glitch, there exists its counterpoint: predictability and fit. Our approach works hard to find a ground of possibility through the performance of a familiar style. We put the news archive of the past into estranged dialogue with its present and future, using the peculiar characteristics of AI text-generation software as a tool to mediate relations. It aims to create an experience for readers that is at once familiar and strange: familiarising audiences with some aspects of the process-source relation and estranging the default language of headlines.

As artists, we are not interested in knowledge navigation tools that assert 'control and mastery' of the informational and linguistic excesses of today. Instead, we maintain a kind of freedom through the misappropriation of the skills of our profession and those parallel to ours in the media industry. In this specific misuse, we hope the work opens onto several questions: what is the inner life of language as it twists between web and archive empires? How do words create worlds? How can we overload information with acts of recuperation? How might our future survival depend on our ability to crash blossom with machines?

Image Captions

Page 194: Layout of IF & ONLY IF web page.

Pages 195–198: IF & ONLY IF output sketches, using scanned historic papers overlaid with generated headlines (2020).

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Curating in the Wild: Taming the Indeterminacy of the Networked Image

Nicolas Malevé, Katrina Sluis and Gaia Tedone

Over the past two decades, the computer sciences have endeavoured to tame the world 'wild' web and solve the technical, economic and cultural problem of image ubiquity. The planetary-scale circulation of photography has produced an increasingly automated field of visual production that exceeds the limits of human attention and perception. Networked images live their lives in computational infrastructures simultaneously as photographs to be consumed by the human eye and as blobs of data to be mined by algorithms. This condition opens what computer scientists call a 'semantic gap': a gap between human and machine understanding of a visual image. The sheer difficulty of bridging this gap renders the networked image indeterminate and undecidable. The undecidability of the networked image threatens the automated flow of images and their valorisation — aberrant examples must be identified and hidden, filtered or cleaned; they must be given ontological stability as they become tied to an objective regime of big data. Under these conditions, the quality, aesthetic value, relevance and meaning of images — once the domain of the museum curator, art critic or humanities professor — has become the concern of technologists in order to produce more efficient products, seductive interfaces and larger revenues. This has played out primarily in the development of two interconnected fields that seek to curate

computational visual culture: computer vision on the one hand, and aesthetic computing on the other. Whilst computer vision seeks to solve the problem of scale through the curation of datasets to train machines to see, filter and 'read' images, aesthetic computing seeks to answer the question of what makes a beautiful or successful image.

In this chapter we are interested in precisely this contamination of curation and its discursive flight from the museum to the computer lab and tech startup. In what follows, we position the computer vision researcher as a highly significant, yet overlooked, curatorial agent in contemporary visual culture. Today's technologists are faced with a paradox: to curate image ubiquity requires the curating of massive amounts of images and the development of curatorial pipelines. In these pipelines, algorithms are both products and agents of curation. As we argue, in the data practices of engineers, curating is an activity that 'cures' or stabilises the undecidability of the networked image in a form that makes it algorithmically tractable. From the perspective of computer vision, curating is a process that, firstly, reduces the polysemy of the image in the dataset and secondly, offers a discursive camouflage that enables value extraction for the algorithm.

The Curatorial Discourse of Machine Vision

With machine vision, platforms and software become able to perform tasks like filtering and ranking images according to aesthetic criteria; they pre-select images and suggest improvements to human operators. Behind the interfaces of social media platforms, human and machine curation ensures that visual trends are identified, specific aesthetics are valorised and given prominence. In the image marketplace, AI curation is set to be the next 'killer app', aided by technologists engaged in a race to optimise models that will help outsource the 'care' of images to machines. These tasks are now marketed as cutting-edge AI, camouflaged by the friendly face of a human: the Berlin start-up EyeEm promises its EyeVision algorithm can deliver 'on-demand curation' and 'can do just what photo curators do, but within milliseconds',[1] whilst the photography mobile app VSCO celebrates its AI 'Eva', who can look at art 'like a human'.[2] The curatorial imaginary now promoted by Silicon Valley promises to 'cure' the volatility of the networked image: its instability, its social latency, its uselessness, its semiotic opacity. From the position of curatorial

practice and discourse, this raises an interesting set of questions: What does it mean to curate photography at scale? What models of human-machinic curation arise from computational infrastructures? How does this form of curation serve the public, as creators and consumers of images? Which mode of value extraction does this form of curating enable?

From the museum to the lab, 'curation' has become a critical response to the scale of image production, a symptom of a wider crisis of cultural value. Struggling under the burden of 'surfacing beautiful images at scale', Flickr introduced its Interestingness algorithm in 2006, injecting computational connoisseurship to the platform by mobilising user activity such as tagging, commenting and popularity to evaluate images.[3] The 2009 release of ImageNet, a computer science dataset of fourteen million images,[4] accelerated advances in machine vision by orienting the field away from a methodological focus on the optimisation of algorithms and towards the curation of training data. The same year, scientists at Penn State University developed ACQUINE,[5] a platform for evaluating the aesthetics of

1. See, for example, EyeEm's Blog, *Market Trends: On-Demand Curation*, https://www.eyeem.com/blog/on-demand-curation, and also Factory Berlin's interview with EyeEm's CEO and CTO, *Machine With Taste — A closer look at EyeEm's groundbreaking technology*, https://web.archive.org/web/20181021031233/https://factoryberlin.com/magazine/machine-with-taste-a-closer-look-at-eyeems-groundbreaking-technology/.

2. See, for example, *Photo-Sharing Phenom VSCO Is Teaching Computers To Interpret Art Like A Human*, FastCompany: https://www.fastcompany.com/40428527/vsco-is-teaching-computers-to-interpret-photos-like-a-human.

3. See, for example, on Flickr's US Patent application for Interestingness, Daniel S. Butterfield, Caterina Fake, Callum James Henderson-Begg and Serguei Mourachov, 'A1. United States Patent Application: 0060242139 — Interestingness ranking of media objects', 20060242139, filed 26 October 2006, and issued A1. https://appft1.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PG01&p=1&u=%2Fnetahtml%2FPTO%2Fsrchnum.html&r=1&f=G&l=50&s1=%2220060242139%22.PGNR.&OS=DN/20060242139&RS=DN/20060242139.

4. Jia Deng, Wei Dong, Richard Socher, Li-Jia Li, Kai Li and Li Fei-Fei, 'ImageNet: A Large-Scale Hierarchical Image Database', in 2009 *IEEE Conference on Computer Vision and Pattern Recognition*, 248–55. https://doi.org/10.1109/CVPR.2009.5206848.

5. Ritendra Datta and James Z. Wang, 'Acquine: Aesthetic Quality Inference Engine — Real-Time Automatic Rating of Photo Aesthetics', in *Proceedings of the ACM International Conference on Multimedia Information Retrieval*, 2010, 6.

photographs, a pioneering project in the field of computational aesthetics. Whilst the optimisation of image quality (that is, the extraction of a recognisable image from sensor data) has been a concern of computing (in the field of signal processing) for at least forty years, in the last decade the aesthetic assessment of images has become an emerging focus of scholarship and practice. Today, from Instagram to visual search, computer vision is valued precisely for its capacity to scale and as a means to filter and curate ubiquitous photography.[6] From this perspective, we argue, the computer scientist operates in an emerging socio-technical curatorial ecosystem that includes social media users and influencers, amateur photographers, data scientists, digital archivists and software agents engaged in practices of data collection and visualisation, sorting and selection of content, recommendation, labelling and tagging of images.[7]

Computer vision in its current form is said to learn from examples. To perform a given curatorial task, computer-vision algorithms need to be trained with large collections of images called datasets that exemplify the desired results.[8] To categorise images of cats and dogs, interesting pictures or authentic snapshots, computer-vision algorithms need to

6. For further discussion of curating photography and computational aesthetics, see Katrina Sluis, 'Photography Must Be Curated!', *Still Searching: Fotomuseum Winterthur* (blog), 15 September 2019, http://www.fotomuseum.ch/en/explore/still-searching/series/156409_photography_must_be_curated. For the photographic politics of the dataset, see Nicolas Malevé, *Algorithms of Vision: Human and machine learning in computational visual culture*, 2021, PhD Diss., London: London South Bank University.

7. In this respect, our argument builds upon the work done in recognising a certain porosity concerning the agents partaking in curatorial processes and the activities that such process entails by Joasia Krysa, *SOFTWARE CURATING. The Politics of Curating in/as (an) Open System(s)*, PhD Diss. (Plymouth: University of Plymouth, 2008); Magdalena Tyżlik-Carver, 'Curator | Curating | the Curatorial | Not-Just-Art Curating: A Genealogy of Posthuman Curating', *Springerin, The Post-Curatorial Turn*, no.1 (2017). https://www.springerin.at/en/2017/1/kuratorin-kuratieren-das-kuratorische-nicht-nur-kunst-kuratieren/; Annet Dekker and Gaia Tedone, 'Networked Co-Curation: An Exploration of the Socio-Technical Specificities of Online Curation', *Arts* Vol.8, no.3: 86 (2019), DOI: 10.3390/arts8030086; and Gaia Tedone, *Curating the Networked Image: Circulation, Commodification, Computation*, PhD Diss. (London: London South Bank University, 2019).

8. For an introduction to datasets, see Nicolas Malevé, 'An Introduction to Image Datasets', 2019, The Photographers' Gallery: *Unthinking Photography*, November 2019, https://unthinking.photography/articles/an-introduction-to-image-datasets.

be fed with images of pets or photos tagged and ranked according to aesthetic criteria. And because their precision increases with the scale of their training sets, computer-vision algorithms require the curation of impressive amounts of photos upstream. For machines to learn, datasets must contain data whose variations reflect those encountered by algorithms when they are used in production (in the so-called 'real world'). Here, scale matters and leading datasets use millions of samples. Until recently, datasets for machine vision were produced either in-house by engineers, who would take their own photos or commission professional photoshoots. With the scaling up of popular online image production, computer scientists turned to the internet. Key datasets such as Pascal VOC (2005), ImageNet (2009) or COCO (2014) draw extensively from the resources offered by photo-sharing platforms. Datasets from the last decade collected a significant portion, if not the entirety, of their contents from Flickr, making amateur photography a defining trait of machine vision's photographic culture.[9] Search engines were another popular source of visual samples because they reached a wide range of sources of images with a single query. The switch from self-made photos and photo shoots to Flickr albums and search results made the networked image the de facto object of interest for machine vision. Therefore, the curation of the networked image gradually became an epistemic problem of the discipline of computer vision.

From this perspective, the appearance of the term 'curation' in computer vision's literature is illuminating. Since the mid-1960s, computer-vision scientists have relied on datasets that were said to be 'assembled' or 'built', not curated.[10] In that period, datasets typically

9. Datasets commonly used in aesthetic computing have been harvested from photography communities including behance, photo.net, gurushots and dpchallenge.com. In dataset discourse the semi-automated, spontaneous, everyday snapshots made by 'amateurs' is mobilised as 'real world' photography whilst professional photography — with its established genres, and codes — risks the introduction of sampling bias. The mobilisation of photographic snapshots as 'real world' photography in the YFCC100M Dataset is discussed further in Katrina Sluis, 'The Networked Image after Web 2.0: Flickr and the "Real-World" Photography of the Dataset', in *The Networked Image in Post-Digital Culture*, ed. Andrew Dewdney and Katrina Sluis (London: Routledge, 2022).

10. As an indication, Sergey Karayev, Aaron Hertzmann, Holge Winnemoeller, Aseem Agarwala and Trevor Darrell, 'Recognizing Image Style', 2013, *CoRR*, abs/1311.3715 http://arxiv.org/abs/1311.3715 is the first paper listed in the category 'computer vision' on the preprint repository

presented a selection of images to test an algorithm in action. For example, a line detector would use a dataset to test whether it would correctly detect the position of lines. But the line detector would not learn the concept of line from the data. In contemporary machine learning, the role of the dataset dramatically changed, and images became tools for training algorithms. Today, algorithms learn from the regularities contained in photos: a face detector learns the concept of face from the regularities of the visual samples with which it is being fed. To include a selection of images in a dataset therefore conditions what an algorithm will be able to detect or not. The coding of the algorithm already starts with the act of image selection.

The Curatorial Pipelines of Machine Learning

Training an algorithm with a series of images is a choice that is never innocent and has an impact on the algorithm's deployment in production. In computer vision, the question of dataset bias has historically been primarily understood in statistical terms, where the accuracy of the algorithm is a product of sampling and distribution across the dataset. The question of dataset curation initially arose in response to this problem. More recently, a significant body of work by activists, artists and scholars has highlighted how algorithms trained on a problematic set of data can classify in ways that are offensive, racist or discriminatory.[11] Computer scientists increasingly realise that their choices have consequences that exceed the limits of their discipline in and outside the lab. Some have resigned from their positions[12] due to ethical concerns, others have joined activist campaigns

Arxiv, whose abstract describes the dataset as 'curated'.

11. For example, Safiya Umoja Noble, *Algorithms of oppression: how search engines reinforce racism* (New York, NY: New York University Press, 2018); Joy Buolamwini and Timnit Gebru, 'Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification', 2018, *Proceedings of the 1st Conference on Fairness, Accountability and Transparency. Conference on Fairness, Accountability and Transparency*, PMLR, 77–91. https://proceedings.mlr.press/v81/buolamwini18a.html; Ruha Benjamin, *Race After Technology: Abolitionist Tools for the New Jim Code*, 1st edition (Medford, MA: Polity, 2019); Adam Harvey and Jules LaPlace, 'Exposing.ai', 2021, https://exposing.ai; and Abeba Birhane,and Vinay Uday Prabhu, 'Large image datasets: A pyrrhic win for computer vision?', 2021 IEEE Winter Conference on Applications of Computer Vision (WACV). Waikoloa, HI, USA: IEEE, 2021, 1536–1546. https://doi.org/10.1109/WACV48630.2021.00158.

12. R. Van Noorden, 'The ethical questions that haunt facial-recognition research', *Nature*, 587

or efforts towards dataset de-biasing. As attention has grown around the technical importance and social responsibility involved in creating these datasets, developers began to describe them as 'curated'. The introduction of the term 'curation' in the profession's vocabulary appears in parallel with the realisation of the ethical and social responsibilities that arise when software leaves the lab, or operates 'in the wild'. The agents of curation tasked to make selections and take decisions are distributed over what computer scientists call curatorial pipelines.[13] A pipeline, in this context, can be understood as a diagram that defines the different stages of extraction, filtering, classification and annotation of networked images that find their way into a dataset. It defines the periodicity and the agents involved in the process, as well as the scope of their intervention.

Curatorial pipelines are engineered to solve a double curatorial challenge. To curate effectively the millions of images produced by their users, computer scientists need to curate millions of images to train their algorithms. Curation therefore presents itself to platform developers as a problem defined by its circularity (to solve curation, they need to curate) and its scale (it takes millions of images to curate millions of images).[14] This circularity imposes a heavy constraint on the curatorial pipeline. To scale up human curating, computer vision needs to incorporate the scale of photography's ubiquity, which leaves little room or time to negotiate the complexity of the photographic image, from the politics of representation they embody, to their circulation and context. Furthermore, there is a politics embedded in the infrastructure that computer-vision engineers create to select, label, annotate and categorise candidate images where scale raises pressing questions. In short, machine vision is both the result of and an agent of curation.

(7834) (2020): 354–358, doi:10.1038/d41586-020-03187-3.

13. See Agathe Balayn, Bogdan Kulynych and Seda F. Gürses, 'Exploring Data Pipelines through the Process Lens: a Reference Model for Computer Vision', https://arxiv.org/pdf/2107.01824.pdf

14. Sarah Kember in her study of face recognition, using Foucault, interprets the circularity of computer vision as a feature of biopower, a milieu in which 'a circular link is produced between effects and causes'. Sarah Kember, 'Face Recognition and the Emergence of Smart Photography', *Journal of Visual Culture*, 13 (2), (2014): 182–199, DOI:10.1177/1470412914541767.

In this respect, curation in the computer vision's pipeline is far from the etymological roots of curating as *curare* — an ethical practice of caring — or its popular understanding as the safeguarding, selection, historical contextualisation and display of cultural objects. Rather, we have a scale that demands the outsourcing of attention and visual perception in order to 'cure' the contemporary illness of image ubiquity. Under the constraint of scale, dataset creators, platforms and software companies are submitted to violent economic pressure: results must be produced with increasing speed to keep up with the demands of industry and generate returns on financial investments. Scale conditions and enframes the politics and aesthetics of machine curation, whilst the paradigm of curation is both a selling point and requirement for computer vision.

From here, it becomes possible to glimpse the first aspect of what we term 'curating in the wild'. It is a paradoxical condition that is characterised by its double circularity: to curate photographs, algorithms need curated photographs; and to engage with the ubiquity of the photograph, it requires large-scale datasets. In practice, curating in the wild is bound to curatorial pipelines that stabilise the networked image and resolve the gap between its instantiation as a grid of pixels and a visual surface available for human perception. Curating here means selection at scale and semantic stabilisation.

From Careless to Careful Extraction: the Case of EyeEm

We have concentrated on one part of the curatorial pipeline in which photographs are extracted and compiled into datasets. We now turn to the second part of the process, and consider what happens when algorithms are deployed in production. We draw upon the example of EyeEm, a leading tech startup and photo app that deploys techniques of machine vision alongside an intensive discourse of creativity and care. Once considered a European rival to Instagram, EyeEm was founded to champion the work of 'serious' mobile photographers and create a 'photography marketplace for the generation smartphone.'[15] Unusually for a tech startup, this involved cultural programming more conventionally aligned with a cultural institution: organising exhibitions, festivals, symposiums, publications, running workshops and founding Berlin Photo Week. After receiving Venture Capital

funding, EyeEm's monetisation strategy triggered a pivot to the stock photography business, which the company hoped to disrupt by selling the 'authentic' images generated by its community. With this came the problem of maintaining the quality of images it hosts, leading to a further transformation into a machine-learning platform for 'intelligently searchable imagery'.[16] Depending on your position, EyeEm is either a photo community, a stock photography marketplace or an AI company.[17]

In EyeEm's environment, human curation is considered the gold standard or ground truth. Human curators detect trends; they surface beautiful content and ensure that the work of the community is highlighted in exhibitions, catalogues and newsletter features. EyeEm's algorithms are mobilised as assistants to their human curators: they extend their capabilities, they 'augment' the platform's curators and 'put them at scale'.[18] These curators are employed to manage the community and by doing so, also curate the content that will form the dataset the algorithms will feed upon. In this sense, they curate for humans and machines simultaneously. At this level, human curators are considered as the reference because, as one EyeEm engineer suggests, models are 'only able to identify what has been taught to them. They follow guidelines, they are not inventing what aesthetics are'.

This form of curation enables various mechanisms of value extraction. In its role as an intermediary between photographers and the stock photo industry, EyeEm's commercial survival depends on its success as a curatorial interface that matches brands with visual stock. EyeEm's developers take trained aesthetic models and mix them to

15. Emil Pakarklis, 'How Flo Meissner Created EyeEm Photo Sharing Network', iPhone Photography School, 3 July 2014, https://iphonephotographyschool.com/eyeem/.

16. Ibid.

17. During the preparation of this text, EyeEm was acquired by Talenthouse. The press release announcement described EyeEm as 'rich data that offers valuable insights into the future of creativity, surfacing trends and artistic directions way before they hit the mainstream, which helps brands to stay one step ahead and come up with new and exciting ways to engage audiences'.

18. All quotations in this section refer to interviews undertaken by the authors in 2021 with employees of EyeEm conducted in the framework of the SNSF research project *Curating Photography in the Networked Image Economy*.

reflect the client's brand identity, in a process likened to 'a DJ mixing different music, adjusting the balance for a specific brand'. In its role as an AI company, EyeEm has sold the same curatorial technology to LG to enhance the AI capabilities of their camera phones.[19] Crucially, what is extracted here is the value of the technological development of 'taste' resulting from the collaboration with photographers, curators and stock agencies. This relation consolidated in a software product finds its way into new devices where it automagically adjusts camera parameters, optimises photoshoots and assists phone users in their daily tasks of photo creation and curation.

EyeEm's curatorial pipeline mobilises a narrative of creativity and curatorial care, which camouflages the underlying mechanisms of value extraction at play. Because users feel taken care of, are given exposure and their content is respected and celebrated, they upload images to the platform and benefit from passive income from sales to stock agencies. Here, EyeEm positions itself in contrast to the toxicity of platforms such as Instagram, by providing an online space where what matters is sharing a passion for photography far from the hostile environments in which adtech and trolling have become the norm. EyeEm seeks to develop what it sees is a principled approach that avoids the pitfalls of platforms relying on revenues from advertising tech built on user surveillance. There is an awareness of the toxicity of the scale at which tech giants operate, yet EyeEm cannot operate outside of it. Curation must scale and EyeEm represents an attempt to address this issue without turning into an ad platform. The monetisation of user photographic production through the sale to stock agencies is an attempt to find a (relatively) transparent solution to this problem. EyeEm, a photo-sharing platform, is 'also' a business.

Yet there is a dimension of camouflage in this 'also'. The EyeEm 'community' is addressed constantly as a community of creatives, of enthusiasts eager to 'break rules'. This community is never addressed as the producers of samples for datasets or aesthetic fodder for algorithms. What allows EyeEm to scale up is not only the monetisation

19. M. Burns, *LG turns to EyeEm to add AI to its cameras*, *TechCrunch*, 2018, http://web.archive.org/web/20180302190737/https://techcrunch.com/2018/02/24/lg-turns-to-eyeem-to-add-ai-to-its-cameras/.

of its partnerships with Getty, but 'also' its ability to develop technical products that congeal the curatorial dynamics of the platform into models and automated procedures. EyeEm stops short of educating its users or confronting them with the multiple levels of their interaction with the platform and their intimate relation with the many algorithmic agents that partake in the curation. Instead, what arises from the example of EyeEm is the mobilisation of curation and its discourse to camouflage problems of scale and accountability and sustain narratives of quality and aesthetic value of networked images. In this example the historical paradigm of curating as care can be operationally disavowed, yet selectively deployed to evidence a 'safer' ambience for the user community, a healthier atmosphere, a more personalised experience. In the curatorial pipeline, something is always also something else: a photograph is always also data, a service is also a product, a community is also ground truth, a relation is also an asset.

Curating in the Wild

This is the paradoxical condition we name 'curating in the wild', the taming and simultaneous exploitation of the indeterminacy of the networked image. As we have seen, to be able to interpret huge quantities of images, computer-vision algorithms need to be trained with vast amounts of photos. At first, 'in the wild' can be understood as an expression that indicates a change in the provenance of computer-vision data. Images are 'out there', outside the lab, in the chaotic wilderness of an unconstrained environment represented by the internet. Since the inclusion of the networked image in the computer-vision pipeline creates epistemic problems and political controversies, there is a need to stabilise its selection process. To respond to this problem, computer-vision scientists engage in a form of curating. This is the first meaning of 'curating in the wild': to cure the undecidability and indeterminacy of the networked image and stabilise it in such a way that algorithms are able to extract regularities from visual content.

Once these regularities are extracted, algorithms become able to inspect, label, evaluate, modify or emulate photographs. In computational aesthetics, they are used to assist or improve the curation of users' photos and suggest tips or transform images according to learned aesthetic rules. This is the second meaning of 'curating in

the wild'. This time curation does not happen at the training stage, but is the task performed by the algorithm. At this point, curating enables different strategies of value extraction. Users' photos are curated and sold to stock agencies, algorithms and models developed through user interaction are sold to hardware manufacturers. And finally, users' photos are turned into datasets to improve the curation of the next wave of creative input and launch a new cycle of extraction. At this level, the curatorial pipeline establishes how users are served by the platform as much as how they serve it. This double relation to curation is a defining trait of the curatorial condition of machine vision: algorithms are both products and agents of curation; and so are the users involved in the pipeline. To study 'curating in the wild' means to question the multiple layers of curation involved in the machine-vision pipeline, how they nurture and limit each other and which ways of seeing they enable.

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Virtual Exhibits: Museum Infrastructures and the Management of Artworks' Presence

Gabriel Menotti

On 24 October 2019, the Louvre Museum presented a Virtual Reality (VR) experience for the first time. *Mona Lisa: Beyond the Glass*[1] was made by the French studio Emissive in collaboration with Taiwanese company HTC through their VIVE Arts initiative. The piece was part of a special exhibition commemorating the 500th anniversary of Leonardo da Vinci's demise. Paying visitors could watch it in a gallery adjacent to the main show using headsets provided by the museum. A free, extended version of the experience was also released online, upon the opening of the exhibition.

The Louvre is arguably the world's most traditional art museum. Its foray into VR — focused on the most famous piece in its collection — stood in tacit recognition of the technology's cultural legitimacy. But *Mona Lisa: Beyond the Glass* does not represent a radical shift in the museum's agenda. As Mary Anne Staniszewski remarks,[2] new media systems often enter the art institution through the backdoor of education and exhibition design. Accordingly, *Mona Lisa: Beyond*

1. https://store.steampowered.com/app/1172310/Mona_Lisa_Beyond_The_Glass.

2. Mary Anne Staniszewski, *The Power of Display: A History of Exhibition Installations at the Museum of Modern Art* (Cambridge, MA: MIT Press, 1998).

the Glass mobilises virtual reality as a vehicle for museal discourse and cultural promotion. What the experience means to offer is an addendum to exhibition infrastructure, multiplying configurations of public contact with the artwork. Designed according to the cinematic logic of attractions, VR advances the museum as a spectacle of pedagogical novelty, enticing new audiences while renewing the institution's popular appeal.

But in this specific case, the technology also seems to respond to issues of access. Mona Lisa's viewing conditions are infamously precarious. The fruition of the work as a singular aesthetic object collapses under its extraordinary popularity. Audiences must cope not only with a reinforced security apparatus, but also with one another — the anecdotal swarms of tourists the painting attracts. VR, in comparison, supplies a privileged encounter with the artwork. Videos promoting *Mona Lisa: Beyond the Glass* describe how it recreates the painting as a hyperreal aggregate made from different sources of imaging data, including infrared, X-ray, and reflectography.[3] Such replicas are not a mere imitation of the painting, but rather a form of post-indexical visualisation. Within the VR experience, the painting appears against dark void, floating in an extraordinarily clean *mise-en-scène* that the museum could never afford to the physical object.

Mona Lisa: Beyond the Glass thus invites the viewer to a one-to-one, exclusive connection with the artwork. The virtual gallery, emptied of other people and paintings, encapsulates the exhibition approach that Nicolas Serota described as a shift from curatorial interpretation to audience experience.[4] Moving away from historical and aesthetic displays, modern art museums began to privilege a more direct presentation of individual artworks. The paradox underlying VR exhibitions, however, is that any effect of unmediated proximity relies on heavy technological mediation. To meet the painting 'beyond the glass', users have to be strapped to a headset, eyes glued to a pair of Fresnel lenses bending the light beamed by small monitors 90 times

3. Emissive, 'Mona Lisa VR Project.' *Emissive*. https://emissive.fr/en/project/mona-lisa-beyond-the-glass, 2019.

4. Nicolas Serota, *Experience or Interpretation: The Dilemma of Museums of Modern Art*, Walter Neurath Memorial Lecture 1996 (New York, NY: Thames & Hudson, 1996).

per second, while their head's position and orientation is calculated based on an optical tracking system that recognises the surroundings and provides a computer with the necessary data to update real-time renderings of 3D geometries in a purpose-built application provided by a closed platform running on proprietary devices.

Figures 1&2: *Mona Lisa: Beyond the Glass* promotional images. © Musée du Louvre/ Emissive.

Mona Lisa: Beyond the Glass does not sustain a pretence of pure contact with the painting, in any case. On the contrary, it fully employs the plasticity of computer simulation to exact upon the viewer a conspicuous feeling of immersion in an information environment. A voiceover guides the visit, narrativising the encounter with the

artwork. Other pictures are conjured out of thin air while the disembodied gallery educator unpacks the painting's history and iconography. The experience proceeds in a succession of spectacular twists, as the viewer comes to meet La Gioconda herself, gets teleported to the *loggia* of her residence, and soars above an expansive rendering of the painting's background in one of da Vinci's flying machines. A museum exhibit by way of amusement park ride, *Mona Lisa: Beyond the Glass* draws from cinematographic techniques to provide yet another layer of mediation to the already contrived virtual encounter with the painting. The narrative arc of the experience conveys a feeling of dramatic accomplishment that conforms the viewer's expectations to a perceptual script. Subsumed to cinematic time, the fruition of the artwork becomes a deed to be objectively done. Conveniently, the limited duration of the experience also enables the museum to better accommodate the flow of visitors to the restricted number of VR headsets available.

The virtual exhibit thus performs a highly interpretative presentation of the artwork. In so doing, it expands the institutional apparatus dedicated to the study and reproduction of artistic canons by means of collecting, preserving and exhibiting their material traces. One could argue, nevertheless, that the hypermediation supplied by *Mona Lisa: Beyond the Glass* still delivers VR's promise of direct contact, albeit by misdirection. The painting could not be made available by a reproduction of its visual features alone, as high as its fidelity might be. As Oliver Grau states, the image's capacity to convey presence 'is increased still further through illusionism in the service of an immersive effect.'[5] By intensifying feelings of immersion, the experience distracts the viewer from the contingencies of representation and adds to the apparent reality of the virtual replica.

The da Vinci exhibition was scheduled to close on 24 February 2020, just when the COVID-19 pandemic began to take hold of Europe. As social-distancing protocols forced institutions to shut down, museums and galleries scurried to come up with solutions to serve the public

5. Oliver Grau, *Virtual Art: From Illusion to Immersion* (Cambridge, MA: MIT Press, 2003), 14.

remotely, bringing virtualisation to the top of their agenda. Building on earlier audiovisual forms, software applications such as *Mona Lisa: Beyond the Glass* support the operation of museums across an increasingly displaced attention economy. Used for the exhibition of institutional collections, VR could lead to a more flexible technopolitics of presence. Museums' commitment to the reproduction of tradition, however, seems to inhibit an application of these systems for the performance of other kinds of institutionality and cultural history. Hence the contradiction: while allowing artworks to become more accessible, VR exhibitions also provide museums with a powerful channel to keep their circulation under control.

The Museum as Medium

Presence, along with the auratic weight it imposes, is a central tenet in the humanistic fiction of the modern art museum. As a signifier of authenticity, it moors art history as a forensic discipline while enabling the art market to construe genius and originality as commodifiable assets.[6] Just as an archaeological artefact transmits the circumstances that engendered it, the presence of an artwork conveys the subjectivity of its creator. When the artwork lacks persistent traces, institutions seek to enact the metaphysics of its presence through a series of authorising devices — official documentation, certificates of authenticity, signed contracts, non-fungible cryptotokens etc. In the absence of an unequivocable autographic object, these devices provide means for the inscription of the artwork within collections and other systems of material exchange. The continuity of presence across every instance of the work's appearance produces order among them. Highly specialised networks of transportation and insurance thrive by allowing artworks to circulate without their presence ever becoming scattered. By relying on this networked infrastructure, an artwork can become manifest anywhere in the planet while remaining impermeable to the contingencies of its own appearance.

6. See Carlo Ginzburg, 'Clues: Roots of an Evidential Paradigm', in C. Ginzburg, *Clues, Myths, and the Historical Method* (Baltimore: John Hopkins University Press, 1989).

The role of the museum as a custodian of precious and unique objects condemns the institution to an economy of experience based on exclusivity. Being the place where the work of art is witnessed first-hand obfuscates the museum's more abstract, but equally active function in storing, reproducing and distributing *tradition*. European museums, bred amidst the totalising aspirations of nineteenth-century modernity, were instrumental for the crystallisation of discursive orders that naturalised colonial hierarchies and particular configurations of collective memory. Drawing inspiration from Foucault and evoking the Louvre by name, Douglas Crimp underscores the constitutive role of these institutions in the modern epistemology of art.[7] Museums are made to impart the sense-making procedures proper to archives and libraries directly over objects of all sorts. By propagating the most diverse forms of aesthetic expression under a system of universal equivalence, the modern art museum ultimately subsumes these expressions to the discursive practices of art history.

As vehicles of disciplinary power-knowledge, museums operate outwards, through public and private media channels, as much as within the confines of their own edifices. The museum building is just a small part of the total museal infrastructure. By means of press and institutional relations, educational and outreach programmes, as well as other forms of publishing, a museum seeks to inform cultural values at large. James Putnam evokes an early report by Alfred Barr, MoMA's first director, that frames the institution's mandate completely in terms of information exchanges: 'the museum "produces" art knowledge, criticism, scholarship, understanding, taste. [...] Once a product is made, the next job is distribution. An exhibition in the galleries is distribution. Circulation of exhibition catalogues, memberships, publicity, radio, are all distribution.'[8] Within these communication efforts, presence is both a boon and a burden. Insofar as it keeps the artwork entangled with the museum, the primacy of presence upholds the institution's discursive authority. It is therefore in the institution's best interest that presence is carefully managed. There is a delicate balance between promoting contact and withdrawing

7. Douglas Crimp, *On the Museum's Ruins* (Cambridge, MA: MIT Press, 1993).

8. James Putnam, *Art and Artifact: The Museum as Medium*. 2nd ed. (New York, NY: Thames & Hudson, 2009), 28.

access. Representation must convincingly deliver the relevant qualities of the artwork while compounding their essential inseparability from an original.

But, even in its immediate presence, is an artwork ever directly presented? When Serota described the curatorial paradigm that champions the experience of individual works in depth and isolation, he betrays the fact that the works are not experienced on their own.[9] Rather, it is their dilated relation with time and space, in the conditions of partial autonomy allowed by the modern art museum, that becomes the nexus of exhibition. In every show there is a continuing interplay between revealing and concealing that begins with the choice of which objects to bring out of storage and culminates in how to install them together. Most items in a museum collection, let alone those in private ones, rarely ever see the light of day. An artwork on display is subject to active mediation, its presence contingent not only on the institutional agencies that brought it into view, but also on the elements of design that modulate its appearance. The artwork's presence is, in other words, an environmental effect. Containment devices enact the work's legibility in ways almost as explicit as paratextual components such as wall labels. Putnam remarks how, in their capacity as physical barriers, unassuming vitrines create an assertive presence that 'transforms the most humble object into an attraction.'[10] These and other display fixtures perform the interplay of secluded disclosure that govern most art exhibitions. In so doing, they profess the object's auratic condition and crystallise any relations a viewer may establish with it.

The distension of the museum as a communication system, while dependent on technical conditions, broadens the institution's capacity to articulate cultural values through the management of artwork presence. In the very modern words of Andrè Malraux, 'reproduction is the most powerful means for our intellectualization of art.'[11] In a 1947 essay, Malraux famously proposed the concept of the 'imaginary museum' to address how technical media supplements museal rationality. Within the institution, proxies and other forms of reproduction

9. Serota, *Experience or Interpretation*.

10. Putnam, *Art and Artifact*, 14.

11. André Malraux [1965], *O Museu Imaginário* (Lisbon: Edições 70, 2011), 92.

work around the fact that a museum remains deprived 'of what is not transportable, what cannot be easily exhibited, what it cannot acquire.'[12] In the world at large, they enable an unburdened dissemination of a museal logic that 'only recognizes the image of things, rather than things themselves'.[13] Malraux identified photography as the primary medium of these operations. Photographs may be deployed to dilate the work's presence, to make it more supple or persistent. By extricating an object's appearance from its immediate experience, photographs foster intellectual interpretation over entranced awe, thus consolidating a more distanced, informational engagement with the artwork. This power comes not from fidelity alone, but also from the large degree of discursive mobility that photographs enable between the objects they represent. Arranged in albums or art books, photographs may be used to identify patterns and produce relations across different geographical, historical and cultural realities. Thus photography enables a system of universal equivalence that is even broader and more powerful than the traditional museum's.

The commanding influence of Instagram in the contemporary art world leaves no question that the museum has been swallowed by photography — a state of affairs anticipated by Malraux's proclamation that the history of art, 'from the moment it escapes specialists, is the history of that which is photographable'.[14] For Malraux, this reconfiguration of disciplinary practices carries large revolutionary potential. By expanding the scope of classification and comparison, information technologies could reveal that which hegemonic narratives overlook, and provide the conditions for 'minor arts' to rival the 'major ones' in attention. This subversive mobilisation of visual reproduction had already been exercised by Aby Warburg's pioneering *Bilderatlas Mnemosyne*, preceding Malraux by about two decades, just as it continues to be on internet image boards. By enabling a more interactive treatment of collections, this social dimension of photography displaces established canons. While the museum was an affirmation, Malraux stated, the imaginary museum could be a question.

12. Ibid., 11.
13, Ibid., 10.
14. Ibid., 121.

Virtual Galleries as Simulation and Framing

Mixed-reality technologies add to the imaginary museum's toolbox for representing existing artworks. Virtual replicas generated for this purpose are often composites made from volumetric scanning, drawing information from photographic datasets or other forms of optical sensing such as LIDAR. These software operations deliver textured 3D meshes that correspond in topology and appearance to the actual objects. 3D-scanning best practices advise for the use of pre- and post-processing techniques to clean the model both from image artefacts and features such as shadows, which might betray the environmental conditions of data acquisition. The resulting models consist in a hyperreal form of post-indexical representation, at once continuous with the object's physical traces and absolved from the circumstances of any specific appearance. Optimized for computer manipulation, these simulacra can be plausibly articulated across a wide range of media contexts.

Virtual replicas would fall under a category of objects that Kwan Min Lee calls 'para-authentic', comprising those that are experienced as having 'authentic connection with the corresponding actual physical objects and environments' (2004: 41). The notion of 'digital twin', native to the field of product design and engineering, has been increasingly used to address these kinds of models. An advantage of para-authentic replicas for artwork documentation is their capacity to convey dimensions of relationality and performativity otherwise absent from photography. A photograph relays a view of the artwork from a specific point in space at a given interval of time. The virtual replica, on the other hand, may be used to communicate a much broader range of sensations. Mobilised by interactive interfaces, a replica enables multiple perspectives on the same object. Animated, it recuperates the object's intrinsic movements and ways of reacting to external stimuli. Seen through stereoscopic devices or placed in a coherent space, it transmits the object's volume to scale. In sum, *more* of the artwork can be made available.

Besides their more obvious use for the depiction of eminently tridimensional artworks, virtual replicas can be deployed in the staging of specific display configurations. Not only does the rendition of an artwork within a corresponding environment add to their effect of

presence, but it also allows for a portrayal of the complex ecologies that hold the object in place. In that sense, in comparison to photography or even video, VR exhibits seem to constitute a mode of documentation both more imposing and more informative. As *Mona Lisa: Beyond the Glass* illustrates, VR exhibits combine the replica's indexical authority with the medium's sensorial impact to create particularly compelling representations. The impression of a realistic, first-hand experience is offered as an extraordinary means of knowledge about the actual object. It ultimately promises access to the inaccessible — the possibility of apprehending things removed in time or space.

As far as artwork representations go, however, what VR exhibits do is not unprecedented. Underneath the patina of hyperrealism lie relatively conventional operations of framing, which have always been integral to the articulation of artworks' self-determination. 'Any market and first of all the picture market', suggests Jacques Derrida, 'presupposes a process of framing', which liberates surplus value by enclosing labour.[15] Derrida evokes the notion of the 'parergon' to address structures that, though not internal to the representation of the object, prescribe its decodification. The term 'parergon' originally refers to the embellishments that go alongside a work: clothes on a statue, columns in a building, the frame of a painting. In his deconstructive reading of Kant's aesthetics, Derrida assimilates these elements to his own logic of the supplement and entertains a connection between the formal modulation they effect and the criteria of aesthetic judgment. He posits 'parerga' as stand-ins for a place-deprived place, disentangled from subject-object oppositions, where one 'distinguish[es] between the internal or proper sense and the circumstance of the object being talked about.'[16] This atopic field of mediation encompasses not only the frame, but also other elements around the work that legislate over its circulation, including the museum and occasional processes of reproduction. As that which keeps the work in place and makes it addressable, parerga give rise to art in our cultural imaginaries. Essentially, they perform the quasi-philosophical function of allowing for the recognition of the artwork in its individuality.

15. Jacques Derrida, *The Truth in Painting* (Chicago: University of Chicago Press, 1978), 71.

16. Ibid., 45.

Derrida's call for a discourse on the liminality of the art object could inform our examination of VR exhibits as extensions of museal infrastructure. Virtual reality's sensorial affordances entail a promise of phenomenological emancipation. At first, the VR exhibit may seem to liberate the work from the exclusive economy of experience prescribed by the museum. In truth, however, it supplements this experience, further extending the curatorial management of presence across other technologies. Any re-presentation of the work is, after all, another occasion to authorise its reality. Photography, affirms Crimp,[17] has historically co-operated with the museum in the constitution of the epistemic field underpinning art history and modernism. As McKenzie Wark would later add, the modern understanding and valuation of art takes place not despite technical means of reproduction, but because of them.[18] Even before the creation of public art institutions, plaster casts have been used to multiply and provide access to sculptural and architectural artefacts across Europe, cementing a common Western canon among the elite.[19] Reproductions can make the work an object of social knowledge while reinstating its framing, which adds to the metaphysical primacy of originality. There is no better example than the Mona Lisa itself, narrated into legendary status completely in *absentia*, by the newspaper gossip and public drama surrounding its theft in 1911.[20]

Postmodern informatisation has consolidated media systems as the predominant kind of parergon. It is often by the means of PR that artists and institutions alike assert their work within the cosmopolitan realities of the art world. Given the relative scarcity of direct encounters, technical reproduction provides opportunities to elaborate on an artwork's attributes. Concept images of a computer animation rendered *in situ*, including mock-ups of the potential audience, are archetypical of this operation. They consist in a form of representation

17. Crimp, *On the Museum's Ruins*, 98.

18. McKenzie Wark, 'Digital Provenance and the Artwork as Derivative,' *e-flux Journal*, no.77, Nov, 2016. https://e-flux.com/journal/77/77374/digital-provenance-and-the-artwork-as-derivative.

19. Brendan Cormier (ed.), *Copy Culture: Sharing in the Age of Digital Reproduction* (London: V&A Publishing, 2018).

20. Sheena McKenzie, 'Mona Lisa: The theft that created a legend', *CNN World*, November 19 2013, https://cnn.com/2013/11/18/world/europe/mona-lisa-the-theft/index.html.

that conveys the physical dimensions of a work that still does not have any, as well as perform its categorisation as an installation rather than a video, for example. Such media gestures actualise the work through discursive circulation. As self-fulfilling prophecies, they occasionally feed into institutional loops that bring their vision to fruition. But even if they never do, the reality they impart might be legitimate enough for an economy of experience based on the implausibility of access, in which the contact with the artwork takes place chiefly by proxy. TV channels conspicuously adding virtual crowds to empty stadiums, in attempts to recreate the normalcy of live sport transmission during the COVID-19 pandemic, testify to our faith in falsifying representation to convey authenticity.

VR has that same power, as it marshals the tangible becoming of volumetric images in order to reclaim auratic persuasiveness in new medial terms. Even though what is done to replicas rarely feeds back into the objects they represent, it still affects how these objects circulate by apprehending public attention. In that sense, by delivering what is omitted from other reproductions, VR exhibits could expand the way in which an artwork is made common, while scrutinising the socio-material conditions that hold it in place. But they could just as likely deploy the affordances of simulation to reinscribe the work in the order of tradition: the imaginary museum as an imagination deterrent.

The way in which the pandemic has cemented proxies within the business of cultural circulation urges us to examine the political aesthetics of VR exhibits. One should pay attention, firstly, to how the *public* is ostensibly written off from most of these spaces. Despite the medium's much flaunted interactivity, virtual galleries often handle the viewer's body as a passive device. While virtual replicas may be touched, they remain nonetheless impermeable, yielding to a state previously codified in the application. By recalling this transcendental presence whenever the simulation resets, the VR exhibit defers to relations fixated in the museal archive, while refusing any meaningful agency that the audience might have over the work. Conversely, the VR exhibit seems to incorporate the public as a form of parergon themselves, which involuntarily adds to download statistics and animates the headsets that render replicas visible.

Figure 3: Personal archives workshop taking place at a free recreation of the Espirito Santo Art Museum in Mozilla Hubs, encruzilhada.png, (cc-by-sa). Project *Você é a Encruzilhada das Suas Memórias*, by Para a Terra Volta Toda Corpa em Matéria, museusemparedes.com, 2021.

Figure 4: Snapshot made with 'Our Collections,' a set of AR filters for social media that facilitates the appropriation and recontextualization of artwork replicas by the public, ourcollections.jpg, (cc-by-sa) museusemparedes.com, 2021.

This enclosure of the artwork within the simulation repeats and relies on the VR exhibit's own embedment in the socio-technical networks that enable its development, distribution and operation as software. By focusing chiefly on the photographs, Malraux's vision for the imaginary museum downplays the role of the albums and artbooks — the *tables* — where pictures come together. In the face of a global information economy progressively driven by vertical integration, it is hardly possible to do the same. Platforms rule. Facebook/ Meta's sudden request for users to merge their Oculus VR (currently Quest VR) and social media accounts, locking many people out of their own devices with no explanation,[21] reveals infrastructural dependencies on technological innovations and hints at the dangers of trusting our heritage to the digital marketplace.

There is no reason for VR exhibits to reproduce only the most exclusive kind of museal institutionality. The affordances of simulation may as well enable environments that emphasise exhibitions as social or informational spaces, and perform artwork presence beyond the orthodoxies of documentation, reclaiming the virtual for its a generative potential. While navigating their own technological contradictions, VR exhibits may play out as stacktivist interventions,[22] aimed at rewiring cultural and epistemic infrastructures. As such, insofar as they subvert archival protocols and actualize the transindividual character of art, VR exhibits could advance the larger struggle to unsettle the museum.

21. Adi Robertson, 'Facebook is accidentally locking some users out of their new Oculus headsets', *The Verge*, October 15 2020. https://theverge.com/2020/10/15/21518194/oculus-quest-2-headset-facebook-account-suspension-problems.

22. Lovink, 'Principles of Stacktivism'.

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Beyond Ownership: Sustaining Art as Practices and Processes

Ashley Lee Wong

This text explores the convergence of art and commerce in the creative industries, and presents an expanded notion of what might be considered 'art' and 'the market'. It does not seek simply to reject the creative industries as a field whose only end is creative destruction — the facilitated exploration and acceleration of capitalism's fragilities to strategically steer its crises into its ongoing triumphs.[1] Instead, it seeks to understand them as the field that is increasingly being made to frame art as its context, fixing it in its relation to social media, corporate interest, online and immersive experiences, all of which also contribute to a proliferation of practices. The aim is to act on this contradiction and foster practices that better enable artists and the possibilities for their work in an emerging technological milieu.

The reflections in this text represent a collection of thoughts on the emerging milieu that are in the process of coming together through practices, gathered from my experiences in the field and my work with MetaObjects,[2] a studio I co-founded in Hong Kong for facilitating digital production with artists and cultural institutions. MetaObjects works closely with artists and institutions in their engagement with advanced technologies while simultaneously reflecting upon them through sustained conversations. To consider the diverse realms in

1. John Hartley, Jason Potts, Terry Flew, Stuart Cunningham, Michael Keane and John Banks, *Key Concepts in Creative Industries* (London: Sage Publications, 2013), 51–52.

2. See www.metaobjects.org.

which art circulates is to think about how art is constituted not only as objects and commodities, but as shared artistic experiences. It is important for artists and practitioners to consider how art exists collectively in thought and practice beyond individual ownership of unique and scarce objects or notions of the artist as genius, to develop a greater understanding of how art is sustained in culture, society and technology.

Art circulates in diverse economies, online and offline, as objects for sale in the art market, but also as immersive and virtual experiences within the wider creative industries. The multi-layering of temporalities in the contemporary condition[3] means there is a proliferation of meanings and forms of the work of art.[4] Artists necessarily engage diverse economies to sustain their artistic practices by circulating works as material, conceptual and digital objects.[5] Works of art exist as conceptual works in galleries and museums; as high-valued material objects; as limited-editions sold in gift shops; as immersive art experiences; as displays on public media facades; as images shared on social media; and as financial assets and NFTs. As culture and creativity become the driving forces of the global economy, there is a pluralisation of not only practices and contexts, but also the economies for sustaining these practices.

Art acquires different meanings and values for artists, collectors and audiences according to the different 'cultures of circulation' in which it is constituted.[6] In the post-media condition,[7] art can take multiple forms across diverse media. With rapid technological innovation, there

3. Peter Osborne, 2018, *The Postconceptual Condition: Critical Essays* (London: Verso, 2018, 18–19.

4. This text draws from my PhD thesis on 'Emergent Economies of Art and Technology: Modes of Making, Circulating and Organising in the Contemporary Condition' (2021), and monograph titled, *Ecologies of Artistic Practice: Rethinking Cultural Economies Through Art and Technology*, The MIT Press (2025).

5. Ashley Lee Wong, 'Emergent Economies of Art and Technology: Modes of Making, Circulating and Organising in the Contemporary Condition', PhD Diss. Hong Kong: School of Creative Media, City University of Hong Kong, 2020, 214.

6. Benjamin Lee and Edward LiPuma, 'Cultures of Circulation: The Imaginations of Modernity', *Public Culture* 14 (1), 2002: 191–213.

7. Rosalind Krauss, *A Voyage on Art in the Age of the North Sea: Post-Medium Condition* (New York, NY: Thames & Hudson, 1999); Peter Weibel, 'The Post-Medial Condition', *Arte ConTexto* no.6, 2005: 11–15.

is a diversification of technologies for the creation of artistic work. While there are attempts to define models for artists and practitioners to follow, practices have the potential to expand beyond established conventions of the art market, where the context for art is also contingent on the form of the work and vice versa. It is necessary to consider social, economic and technological systems in which work circulates as part of the artistic process itself. It is within these cultural practices that we as artists and cultural practitioners collectively constitute and give meaning and existence to the work of art.

Art in The Metaverse: Shared Experiences Over Mere Transaction

The COVID-19 pandemic only accelerated digital developments to bring more art online, with and without a physical equivalent. An online exhibition may be accessed at any time from anywhere in the world, creating an individualised experience similar to VR. What constitutes a work is its shared experience and understanding. While the digital experience suggests the immaterial existence of a work, the word 'immaterial' can be slightly misleading: to discuss the immateriality of digital objects suggests that they do not have a material existence. It is possible to consider instead a 'neomateriality'[8] as a form of 'digital materiality',[9] connected to a 'sociomaterialty',[10] where objects are defined as part of social and cultural processes with data, systems and machines. As such, virtual experiences, engagements on social media, as well as real-world interactions with a work in a gallery, all contribute to the conception of the work as a whole. At times, digital objects are viewed as derivatives of original physical artworks (such as NFTs as excerpts of longer videos) or are understood as separate artworks in and of themselves, circulating in different economies and communities online and offline.

8. Christiane Paul, 'From Immateriality to Neomateriality: Art and the Conditions of Digital Materiality', *Proceedings of the 21st International Symposium on Electronic Art*, Vancouver, 2015.

9. Paul M. Leonardi, 'Digital materiality? How artifacts without matter, matter', *First Monday*, Vol.15, no.6, 2010. https://doi.org/10.5210/fm.v15i6.3036.

10. Wanda J. Orlikowski, 'The sociomateriality of organisational life: considering technology in management research', *Cambridge Journal of Economics*. Vol.35, no.1, 2010: 125–41. https://doi.org/10.1093/cje/bep058.

Figure 1: Cao Fei (SL avatar: China Tracy), *RMB City: A Second Life City Planning*, 2007, Machinima, Single channel video, 4:3, colour with sound, 5min 57sec. Courtesy of the artist, Vitamin Creative Space and Sprüth Magers © Cao Fei.

With time-based media, from film and video to performance art, exhibitions become spatial-temporal experiences. Even as one moves through a gallery the experience of artworks in space becomes an experience, just as in a 3D virtual gallery. Artworks can also now be sold both online and offline as equivalent spaces for the experience and purchase of art. Such visions are those embodied in the concept of the metaverse, a term coined by Neal Stephenson in his science-fiction novel *Snowcrash* (1992). The metaverse today is a techno-utopian vision to replicate the real world in the virtual realm, including all of its audio, visual and haptic possibilities of the corporeal senses, but also the economies and systems for trade of digital commodities. Our imaginaries, however, seem limited if our vision of a utopian world simply replicates the capitalist realities in which we live [fig. 1].

The metaverse involves the creation of avatars and 3D environments for our virtual existence. These fantasies of the future have risen alongside the growing interest in NFTs, which add a mechanism for the verification and ownership of digital assets, used alongside cryptocurrencies. These developments are spearheaded by an exuberance

purported by the industry and governments such as Hong Kong's Art Tech initiatives, leading to rampant investment in the field.[11] However, multiplayer environments and the monetisation of digital assets are not new.

Cao Fei's *RMB City* (2007–11),[12] built in Second Life, allowed real-world art collectors to be 'mayors' of the city. Users could purchase and own property in the city. The idea of a metaverse has gained more widespread attention with digital currencies and the growth of massive multiplayer online games like Fortnite, which has been used to host virtual concerts with music artists like Travis Scott.[13] Digital objects for sale in virtual spaces are as real and valuable as material objects in a gallery. The false conception that digital is immaterial and therefore less valuable has eroded. In fact, digital assets can and will acquire value, just like any financial asset on the stock exchange, or ephemeral forms of conceptual and performative art, such as the work of Tino Sehgal. Anything can be monetised in the virtual realm and have tangible social and material effects in the world, such as one's status of wealth and prestige.

RMB City is a commentary on the fantasies (and realities) of contemporary China, the art market and capitalist societies in the digital age. It created a means to stage events both virtually in Second Life, as well as in real life with exhibitions and *RMB City Opera*, an experimental theatre play.[14] In many ways, it predicted the emerging realities of the metaverse, however speculative and distant the current efforts remain. Social interactions become defined by transaction and exchange value, where the work blurs boundaries between fiction and reality [fig. 2].

Beyond a conception of the virtual realm as a new frontier for monetisation and gamification, there are efforts to create online works that do not emphasise transaction, but rather the artistic experience as 'born digital' works. Initiatives include *Slime Engine*[15] from Shanghai,

11. See https://www.info.gov.hk/gia/general/202102/24/P2021022400540.htm.
12. See http://rmbcity.com.
13. See https://www.youtube.com/watch?v=wYeFAlVC8qU.
14. See https://anthology.rhizome.org/rmb-city.
15. See https://www.slimeengine.com.

Figure 2: *Afterlife:ev20f1*, NAXS Corp. & Meuko!Meuko! 2020, screenshot, http://afterlife.zone, ©Han-Yu Feng.

a collective of digital artists creating virtual exhibitions; NAXS Corp[16] in Taiwan, who created *Afterlife*,[17] a fly-through immersive experience in collaboration with musicians like Meuko! Meuko!; and DiMoDA[18] (Digital Museum of Digital Art), virtual museum spaces for exhibiting digital 3D artworks, where each portal takes the user on a new spatial-temporal experience with different forms of 3D environments, objects and sounds.

Afterlife was presented as a multiplayer experience through a one-off durational event with Unsound Festival in Poland. After the event, as audience traffic subsided, the environment returned to being an individual experience. As with many of the virtual raves emerging during the pandemic, there was a desire to find shared spaces for the experience of culture in the virtual realm. They do not seek material equivalences as a 'digital twin', but rather attempt to expand the potential of digital environments beyond what is physically possible. The idea of 'born-digital' suggests creating artistic forms and shared spaces made in and for experience exclusively in the virtual realm. Artistic experiences in an online space are as ephemeral as live performances and ticketed events. It is the collective memories shared in

16. See http://naxs.tech.
17. See http://afterlife.zone.
18. See https://dimoda.art.

conversations, online chats, social media, reviews and artistic communities that contribute to the meaning and existence of the work of art as a temporal experience.

Service Provisions, Moving Beyond Ownership

While the virtual realm sees rampant commercialisation through the metaverse, cryptocurrency and NFTs, we have also seen the increasing commercialisation of art in general. In the UK, the art and cultural sectors have faced increasing privatisation since the 1980s.[19] The 2008 economic crisis only accelerated the convergence of art and commerce as public funding was cut during long periods of austerity. Artists and institutions had to find new ways to support artistic practice. The corporate sector became more open to artistic collaborations as part of their marketing agendas. Corporate sponsorship is not new: fashion brands like Chanel have a history of collaborating with artists, while technology companies like Bell Labs and their engineers have supported art and technology collaborations through programmes like Experiments in Art and Technology (E.A.T) since the 1960s.[20] Commercial collaborations have proliferated with initiatives like BMW Art Journey Award, HTC Vive Arts, Facebook Artist-in-Residence etc. Art plays a role in diverse commercial agendas contributing to branding, innovation and corporate social responsibility. This includes decorating the Facebook offices, while employees may also engage with artists to enrich their worldview.[21] These commercial opportunities provide important resources for artists to continue and sustain their practices. Rather than transforming artworks into commodities as products for sale and purchase, art becomes a 'service provision', as Andrea Fraser (1994) put it, as a way of engaging artists in a labour process [fig. 3].[22]

19. Chin-tao Wu, *Privatising Culture: Corporate Art Intervention since the 1980s* (London, UK: Verso, 2002).

20. E.A.T. was founded in New York in 1967 as a non-profit to facilitate collaborations between artist and engineers from Bell Laboratories. Their large-scale experimental immersive projects included the Pepsi Pavilion at Expo '70 in Osaka, Japan, which is among the early examples of technology companies and commercial corporations facilitating art and innovation through research and funding.

21. See https://www.artsy.net/article/artsy-editorial-artist-residence-facebook.

22. Additional artwork credits: 3D-printing support: Andrew Crowe © MetaObjects; Engineering: Raymond Chan and Ivan Lai © Crevice Design

Figure 3: Samson Young, *Big Big Company (Mini Golf)*, 2019, 3D-printed PLA, resin, plywood, artificial turf, single-channel video, K11 Musea, Hong Kong, Photo ©MetaObjects.

The private sector is playing a larger role in patronage through artist commissions and residencies,[23] creating opportunities for artists in lieu of public funding. While art brings symbolic value to luxury products, artists also gain from a wider audience for their art and often larger fees. Sponsorship often provides a more secure funding mechanism in contrast to under-funded non-profit institutions, who may expect artists to work for low fees on a 'labour of love'.[24] While there are expectations to make work that appeals to a wide audience or that are easily marketable, there are equally expectations for projects financed with non-profit funding to benefit the aims of social inclusion and

Studio; 3d models: 'Venus de Milo (Aphrodite of Milos)' & 'Discobolus (The Discus Thrower)', SMK National Gallery of Denmark © Turbosquid; 'The Three Graces at the Hermitage Museum, Russia' & 'Michelangelo's David in the Accademia di Belle Arti of Florence, Italy', Peter Edwards (Cool3DModels) © Thingiverse & CC by 2.0; 'Robin the thinker', lampmaker © Thingiverse, CC by 2.0; 'The Thinker at the Musée Rodin, France', Bruce Stevens © Thingiverse, CC by 2.0; 'Marsyas', The Metropolitan Museum of Art © Thingiverse, CC by-sa 3.0.

23. See https://www.theatlantic.com/business/archive/2018/10/brand-patrons/568153/.

24. Miya Tokumitsu, *Do What You Love: And Other Lies About Success and Happiness* (New York, NY: Regan Arts), 2015.

diversity. Disillusionment with government arts funding is reflected in Hong Kong in the face of increasing censorship, but also a general frustration with bureaucracy. The application process over-determines the outcomes of a project, often hindering an open-ended creative process. Digital studios and artists like onformative, Andreas Nicolas Fischer and FIELD, whose practices straddle the design field, find greater possibilities working commercially with brands, rather than seeking validation from museums and institutions or the competitive and comparatively small amounts of grant funding.

In Hong Kong and Mainland China, art malls have become a model for the exhibition of art. This phenomenon emerged partly as a means to bring art to the public who may not be accustomed to visiting museums. In particular, K11's culture-retail empire created a role for contemporary art as a means to target aspirational socially networked millennials. Just as malls are looking more like museums, museums are looking more like shopping malls with gift shops, restaurants and blockbuster exhibitions. Artworks add to the experience of malls as objects of wonder to share on social media. In the case of K11, artists are paid significant sums to produce new work[25] in ways that many public funders do not. While art serves as marketing and promotion of products, brands are becoming more attuned to the interests of artists by providing creative freedom to produce, while recognising how 'authenticity' sells. The K11 Musea opened in 2019 for instance, features public artworks and installations throughout the mall. The works range from public art sculptures by renowned artists like Katharina Grosse, to commissions by artists, such as Samson Young's 3D printed mini-golf course, as works that are playful and accessible to wide audiences as just one part of their practice.

Another example is Will Benedict's Summer 2020 campaign for Balenciaga[26] with music by experimental music group, Wolf Eyes, whose cyber-dystopian newscasts unsettle more than they sell. Commercial

25. In my PhD thesis, I discuss the work of Samson Young and his view on collaborating with enterprises like K11. In the face of situations where artists are often exploited, K11 has a reputation for paying artists well and on time to produce work. It also cares for the presentation of the work by collaborating with experienced curators, and has a deep understanding of the artistic process, though will generally only accept work that is accessible to wider audiences.

26. See https://www.vogue.com/article/balenciaga-spring-2020-campaign-news-will-benedict-artist.

Figure 4: Will Benedict, Balenciaga Summer 20 Campaign, 2020, screenshot by Ashley Lee Wong.

collaborations provide important opportunities for artists to create new work. An interest in corporate aesthetics and branding by post-internet artists is a response to this convergence of art and commerce. The double ontology of the artwork is where the image exists both as branding and as an artwork in and of itself. Art participates in perpetuating the market whether it acknowledges it or not. It has become fully entwined within our contemporary economies [fig. 4].

While we often do not consider the images of artworks circulating on social media as artworks in and of themselves,[27] these images continue to participate in the understanding of what constitutes the work of art. These are the only encounters with an artwork that many people will have. An image circulating online contributes to the recognition of the work and its cult value. It builds cultural significance for an artwork in our collective memories as something that exists as user-generated content. This interest in the ability to circulate on social media is what Hito Steyerl refers to as the 'poor image'.[28] The potential of an

27. Though there are situations where images on social media are artworks, forms of internet art or social media interventions, such as Amalia Ulman's *Excellences and Perfections* (2014).

28. Hito Steyerl, 'In Defense of the Poor Image', *e-flux Journal*, no.10, 2009, https://www.e-flux.com/journal/10/61362/in-defense-of-the-poor-image/.

image to go viral begins to influence the form of artworks conceived of as highly Instagrammable installations and selfie-friendly exhibitions. The power of images to circulate in a promotional economy is shaping today's cultural landscape, where art plays a role in personal brand-building, alongside a potential to produce differential effects. To hone our senses is to understand the different existences that a work may have for different people in different contexts. An image may simultaneously operate as an advertisement and an artwork with complex beings participating in different registers of image-making. How can we enable images to circulate, while cultivating and sharing experimental art and ideas in a hyper-mediated society?

The traditional art market of material objects continues to exist within museums, galleries, auctions and art fairs. However, an economy of temporal agreements through licensing exists alongside the art market of objects. License agreements allow for the reproduction and distribution of copyrighted images (or concepts) for a limited period of time. These may be for specific exhibitions or as reprints of images on posters or T-shirts. Conceptual art also employs licensing in the artist contract[29] to define the artwork and dictate the terms of use of work such as restaging the work in an exhibition or its resale. Due to the reproducibility of digital media, licensing is better suited for digital works, where copies are just as original as the original. NFTs essentially act as a contract and licence to own and use a work. They are the financial objects that constitute and legally define the artwork and its ownership. The materiality of the work becomes less important than the terms. The proof of ownership or certificate of authenticity becomes separated from the art objects, which are able to circulate freely as 'poor images' online, but also as highly valued works in galleries and ownable digital assets [fig. 5].

Beyond an economy of ownership, media-based works may be licensed for screenings or display on large media facades, such as Times Square's Midnight Moment in New York, or commercially supported displays by brands like Samsung. Art may be mistaken for advertising, just as advertising is also becoming closer to art. Art may serve as advertising

29. Such as Seth Siegelaub and Robert Projansky's *The Artist's Reserved Rights Transfer And Sale Agreement*. See https://primaryinformation.org/product/siegelaub-the-artists-reserved-rights-transfer-and-sale-agreement/.

Figure 5: *teamLab Borderless: MORI Building DIGITAL ART MUSEUM* in Odaiba, Tokyo, which closed in August 2022 prior to its reopening in central Tokyo as part of the Azabudai Hills project expected to complete construction in 2023. Credit: teamLab, Universe of Water Particles on a Rock where People Gather © teamLab.

in the promotion of a potential 'creative city' in municipal agendas. It provides a highly accessible canvas for artists whose practices are better suited to large screens than the white cube gallery. These displays are a form of licensing, which simply permits the showing of a work. They do not engage the artist further in a process of creation, unless they require site-specific modifications or are presented as specially commissioned works.

Moving away from an economy of the ownership of objects, galleries are presenting installations as experiences. While some may be presented as ticketed experiences with paid entry, such as with international art collective teamLab's immersive museum[30] teamLab

30. teamLab Borderless in Tokyo opened in 2018 as a 10,000 square metre immersive museum, where audiences were free to wander the space filled with interactive digital artworks and become part of the work. Following its closure in 2022, the museum has reopened in central Tokyo. Artworks respond to users' movements and interactions with different spaces, as well as with other artworks. The work is colourful, playful and child-friendly, creating works akin to spectacular entertainment. See https://borderless.teamlab.art/. The teamLab Borderless museum opened in Shanghai in 2019, in Jeddah in 2004, and opens in Hamburg in 2026.

Figure 6: Andrew Luk × Samuel Swope: *Ready|Set|Fulfill*, 2021 © Andrew Luk © Samuel Swope, courtesy De Sarthe, Hong Kong.

Borderless and the *Rain Room* by Random International,[31] they follow a model closer to cinema and theme parks. While individual objects may be sold from an installation, an economy of licensing the entire exhibition becomes a way to move beyond the centrality of objects in the art market. An example is de Sarthe Gallery in Hong Kong, whose exhibition *Ready/ Set/ Fulfill* (2021) by Andrew Luk and Samuel Swope[32] features a drone racecourse, packaged as a touring exhibition with accompanying race events. The artists are paid to reinstall and present the work as site-specific installations. As a form of service, this provides artists with a legal framework to defend their labour conditions, rather than abstractions of value of art objects. The cost of purchasing the entire installation would be much higher,[33] and only a museum would have the knowledge and resources to care for such a work, which creates greater uncertainty

31. In 2013, Random International presented the highly popular *Rain Room* at MoMA, New York, https://www.moma.org/calendar/exhibitions/1352. The work features rain falling in a room where users are tracked while walking in the space so that the water does not fall on their heads, but surrounds them with drops.

32. See https://www.desarthe.com/exhibitions/readysetfulfill.html.

33. Through conversations with former Director of de Sarthe Gallery at the time Willem Molesworth, who described how the work was to be distributed and sold.

around its sale and remuneration. Licensing initiates a process of restaging the work as a site-specific display [fig. 6].

While commercial commissions and sales come with their own limitations, we must also consider how they may enable artists to pursue experimental and non-commercial practices within a wider art ecology. Whether the practice is commercial or non-profit becomes less important as diverse economies are mutually entwined. Commissioning remains connected to a labour process; money retains its 'use value' (Commodity-Money-Commodity or "C-M-C")[34] where artists are 'put to work', rather than solely for the accumulation of capital. Money is not an end goal in and of itself, but something that enables the continuation of a process. Commissioning in this sense is more valuable for artists because it provides an opportunity for them to continue their practice. Selling work is a transaction that does not necessarily lead to a continuation of a process (nor does licensing for display on a facade). Artists may 'cash out' where money is the end goal as 'exchange value' (Money-Commodity-Money or "M-C-M").[35] Proceeds may also be used to support an artist's living, but this does not require the artist to make new work, instead serving for individual benefit. Licensing has the potential to enable a process of restaging a work to sustain artistic activities as a collective endeavour. Rather than encouraging the collecting of art to be held in vaults, it ensures that art acquires cultural value when it is shared. Art collecting becomes meaningful when collectors participate in stewardship in displaying the work in exhibitions, or in developing a supportive relationship with artists. Collecting art can be more than a mere transaction, where the meaning and conception of art is constituted in relationships. To take care is to tend to these possible relations, constituting art and people and their roles and identities, enabling its existence.

Through this lens, we can also look at how residencies and commissions enable and sustain a process of art making. An example is the Thoughtworks Arts Residency[36] in New York, which 'incubates artists

34. Karl Marx, [1867], *Capital: A Critique of Political Economy*. Ben Fowler trans. (London: Penguin Books, 1976), 247–48.

35. Ibid.

36. See https://thoughtworksarts.io/. Thoughtworks is a multi-national technology company founded in 1993 in Chicago. The three pillars of the company, as mapped out by the

and technologist collaborations to investigate the impacts of emerging technologies on industry, culture and society'.[37] Thoughtworks' engineers support art and technology projects that engage with topics such as AI bias and social justice in collaboration with industry. To be able to negotiate between the interests of artists and the corporation can be challenging, though there are ways to continue to find and create spaces where art projects can be supported and thrive. As such, our work with MetaObjects is fluid, bridging gaps in knowledge and between sectors of art, technology and academia. Through a shared process of discovery, we aim to support artists and institutions in iteratively and collectively learning with technologies along the way. Our work is not defined by what we are as a studio, but by how we find ways of working within an emerging milieu.

Concluding Thoughts for Future Reflections

Beyond an economy for the ownership of commodities, the creative industries can be treated as a framework to tactically consider how to support artists in continuing their practices and enabling an engagement with art that can endure in time. This includes an engagement with technologies as a long-term commitment that can deepen the possibilities not only for art but that can pose critical questions for technology that challenges irrational exuberance. It can also challenge concepts of the art market centred around finite, commodifiable and unique art objects and open up possibilities outside of the modernist conceptions of art that these objects affirm. Objects and objecthood become less important than the social and cultural processes surrounding the work and the infrastructures and protocols beneath it. Art becomes participation in processes of care by which we sustain and nurture the practices and communities that can orient us differently in relation to large-scale technological advances. An economy of objects can still play a role in these processes if we consider how we congregate around objects, including digital objects as commodities, and the relations between artists and collectors. It must also

company's Chief Scientist Martin Fowler, include: Sustainable Business, Software Excellence and Social Justice. See https://martinfowler.com/bliki/ThreePillars.html.

37. https://thoughtworksarts.io.

necessarily involve passing on knowledge or skill about the creation of the work through generations, where the sale of artworks operates to sustain artistic practices over time, rather than as an end in itself.

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Smart Contracts and the Becoming–Curatorial of Digital Works of Art

Martin Zeilinger

From fiat money to artefacts of religious worship, from game pieces to promises of the heart there have always been tokens. In their various guises, they have served as stores of value, as markers of identity, and as the infrastructural corner stones of many transactional systems. In digital contexts, tokens are everywhere: think of browser cookies, URLs, database entry IDs, or one-time online access codes. Artworks, too, often manifest as tokens, and in this form have played crucial roles in the cultural and socio-economic contexts to which art-making responds. In art-historical discourse, aesthetic evaluation and judgment have long relied on a differentiation, borrowed from the semiotician Charles Sanders Peirce, between artwork *types* (e.g., the mould for a sculpture, the notation for a piece of music) and their *tokenised* instantiations (e.g., a cast of the sculpture, a performance of the composition).[1] Traditionally, tokenised artworks have relied on human intermediaries for curating the links and interactions between works, audiences, institutions and markets. But following the rise in popularity of blockchain-enabled technologies such as NFTs (non-fungible tokens) since roughly 2020, there have been promises of a radical break from this reliance on human intermediaries, since digital art objects can now be rendered as decentralised, non-interchangeable and, thanks to algorithmic 'smart contracts', programmable and

1. For example Jay E. Bachrach, 1971; Linda Wetzel, 'Types and Tokens' (2006), https://plato.stanford.edu/entries/types-tokens/.

self-governing. In what follows, I explore some of the ways in which this impacts curatorial practices. In particular, I want to suggest that with the rise of the NFT and the smart contracts that govern them, digital art objects themselves can take on curatorial agency.

What can tokenised digital art objects be, and what can they do, once they are blockchain-enabled and non-fungible, and when they begin to implement smart contract functionality? Over the past five years, the first two characteristics — NFTs are non-interchangeable and linked to blockchains — have resulted in relatively predictable impacts, including the rampant financialisation of digital art,[2] and a reorganisation of some of the gatekeeper hierarchies of the traditional art world. The third element, namely the use of smart contracts, has the potential to produce new, highly complex effects. The term refers to executable code encoded in digital tokens, which can semi-autonomously enforce complex rules and equip digital art objects with new kinds of self-governing behaviours that audiences may experience as exhibiting autonomy. This makes digital art 'programmable', and with a nod to this volume's theme, 'curating superintelligence', my main argument is that such programmability points towards a 'becoming-curatorial' of digital art objects themselves.

Displacement of Curatorial Agency

The technologies that power NFTs signal shifts of agency from human to computational agents: on the blockchain, consensus is determined algorithmically, transactions are computationally verified, and powerful code-based protocols can, in theory, replace untrustworthy human intermediaries. The resulting shift — or displacement — of agency has also made itself felt in digital art contexts. Here, the use of computational systems that function more or less autonomously can destabilise the artist's agency as originator of a unique artwork; the audience's agency to shape its experience of a work; the socio-economic agency of art market gatekeepers; and, last but not least, the curator's agency to shape and control the situatedness, 'behaviour', and experiential dimensions of artworks. In other words, NFT-bound

2. Martin Zeilinger, 'Digital Art as "Monetised Graphics": Enforcing Intellectual Property on the Blockchain', *Philosophy & Technology*, Vol.20, no.3, 2018, 1–27. doi:10.1007/s13347-016-0243-1.

digital art objects can rearrange the entangled roles of artist, audience, collector and curator, such that the result is a displacement of human curatorial agency.

'Displacement' is here not meant in the negatively connoted sense of a forceful removal of someone or something from a territory they rightfully inhabit. Instead, I use the term to invoke the kinds of shifts that occur in dynamic environments when the volume of something new rearranges the distribution of elements that previously inhabited the environment... a pebble drops into a pool of water, and the displacement caused by its volume rearranges the constellation of all the other elements in the pool. In this sense, the emergence of NFTs in digital-art contexts has the power to displace the roles that curators have traditionally held, including those of creating and shaping human audiences' experiences of digital art works. In the following sections, my examples of NFT art projects that take on curatorial agency include Sarah Friend's *Lifeforms* (2021),[3] [fig. 1] in which digital art objects gain the power to shape the behaviours of their human owners, and Harm van den Dorpel's *Mutant Garden Seeder* (2021),[4] [fig. 2], which uses records of human-blockchain interactions as the basis for mutating the appearance of individual NFT-based artworks. In emphasising the becoming-curatorial of NFT-based digital art objects in these projects, I will speculate on the emergence of more-than-human art ecologies, in which decisions about how to look at art, how to display it, and how to position it in discursive spaces are no longer made by human agents alone.

Three Characteristics of NFTs

The non-fungible token burst onto the landscape of digital art and the cultural mainstream in early 2021. Within the span of little more than a year, the technology turned at least some aspects of the art world upside down and inside out. Undeniably, NFTs shifted how digital art is made, distributed, valorised, collected and exhibited. For better or worse, NFTs achieved this with extraordinary vehemence, on an unprecedented scale, in extremely polarising fashion, and often

3. Sarah Friend, *Lifeforms* (2021), https://lifeforms.supply/.

4. Harm van den Dorpel, 'About Mutant Garden Seeder', https://seeder.mutant.garden/about.

with a gigantic carbon footprint. In essence, an NFT is simply a uniquely identifiable data unit that can store information such as the online location of a digital image, a certificate of authenticity, or an ownership record. But there are at least three important characteristics that distinguish an NFT from other digital tokens: NFTs are stored on blockchains, are non-interchangeable, and can implement smart contract functionality.

Blockchain-Enabled Art

A blockchain can be understood, most basically, as a digital ledger that is decentralised across large numbers of independent computer nodes, creating a system in which the integrity of all ledger entries are continuously verified through complex cryptographic operations carried out by all participating network nodes. The verification and maintenance of blockchain entries rely on computational processes and consensus between machines, so that no human trust intermediaries are required for ensuring the correctness of a blockchain ledger. Because it is exceedingly difficult to fraudulently alter blockchain-stored data (such as transaction records), the technology is considered to represent a secure digital storage solution for valuable data, and to be ideally suited for the development of new types of transactional systems. While blockchains can be used for storing all kinds of information and for facilitating any type of transaction, it is not surprising that they are most widely employed as a financial technology that can function, in theory, without a need for banks or regulators.

In digital art contexts, these core characteristics of blockchain technology can enable the displacement of human intermediaries such as curators and gallerists, and replace traditional gatekeepers with decentralised, non-hierarchical organisational structures that are maintained computationally. On the one hand, this results in the emergence of exciting new blockchain-based, community-oriented curatorial collectives that strive to empower artists, such as decentralised autonomous organisations (DAOs) dedicated to funding and commissioning art projects.[5] But on the other hand, new gatekeepers

5. Ruth Catlow & Penny Rafferty, *Radical Friends: The Chronicles of Decentralised Autonomous Organisations in the Arts* (Torque Editions, 2022).

and control structures are also quickly appearing, for example in the form of proprietary NFT marketplaces. Here, platform-inherent tech requirements can function as a kind of algorithmic 'curation' that imposes the use of specific blockchain protocols and smart-contract standards on artists. The platformisation of digital art that comes with blockchain technology can also result in a homogenisation of virtual exhibition spaces, auction houses, sales platforms and digital storage solutions. Across these elements, curatorial expertise and activities are becoming more and more integrated in a hyper-financialised web3 metaverse.

The gallery Unit London, for instance, which had previously relied on social media (e.g., Instagram, Twitter) to cultivate audiences and collectors, responded to these developments by placing more focus on proprietary and members-only virtual environments. This included the creation of a bespoke virtual exhibition and sales platform called Institut (now defunct), and the channelling of relevant community engagement towards the online chat platform Discord, where Unit London ran a members-only server for artists and collectors. In such virtual environments, curatorial insight and selection processes, previously expressed in exhibitions, viewing rooms and promotional materials, became displaced by quasi-curatorial recommendation systems that respond to user metrics. Other platforms are more blunt in their computationally framed approaches to gate-keeping, taste-making and promotion. The online community Friends With Benefits (FWB), for example, dedicates itself to promoting, co-developing and selling blockchain- and web3-enabled content, digital art and platform infrastructure solutions, and is structured entirely around the concept of 'token-gated' access. This means that the ability to observe or join community activities is itself tokenised, and the underlying token system serves both to curate activities within the community and to curate the membership body. In this system, participation is only possible if a user possesses units of the platform's own 'social token' (units of the $FWB crypto currency), and the level of access available to each user depends on the specific amounts of token units they hold. While such a system could, in principle, be described as a 'social network' and a 'decentralised' infrastructure (in the sense that participation and access is in principle equally available to everyone), it must be noted that in the FWB ecology, a user's wealth (i.e., the amount of tokens held) quite literally functions as a proof-of-stake

verification that determines the value of the user's contribution to the community (whether as peer, promoter or buyer). Here, the value of tokens held directly translates into the power of curating content.

Non-interchangeable Digital Art Objects

In many token systems, fungibility is a desirable and highly useful feature. Fiat currency is a good example: a coin functions as a discrete placeholder of a very specific value, while its fundamental interchangeability ensures that it can be replaced with any other coin of the same denomination. The same applies to cryptocurrency tokens such as bitcoin, ether, tezos or doge coin. But the logic underlying NFTs is fundamentally different. Here, the baseline assumption is that fungibility is a problem that needs to be fixed. Specifically, it is assumed that if one instantiation (or copy) of a digital artwork is just as good as the next one, it can be difficult to verify authorship and, therefore, to incentivise ownership.[6]

It is certainly true that in digital art contexts, many concepts conventionally invoked to determine the value of aesthetic artefacts — such as originality, uniqueness or authenticity — have become destabilised.[7] A few decades ago, net-art practices tended to embrace this destabilisation in order to resist assimilation into traditional property regimes.[8] NFT-enabled art projects, by contrast, tend to manifest much more property-oriented perspectives that consider fungibility as a bug, rather than a feature. The core logic underlying such projects is that if digital objects are easily copyable, and if different copies cannot be reliably differentiated and verified, they may not be worth owning. The non-interchangeability of the NFT as a unique identifier promises to solve this dilemma by making it possible to render discrete instantiations of digital artworks as unique.

6. Laura Lotti, 'Financialization as a Medium: Speculative notes on post-blockchain art', in *MoneyLab Reader*, Vol.2 (Amsterdam: Institute for Network Cultures, 2018).

7. Zeilinger, 'Digital Art as "Monetised Graphics"'; Domenico Quaranta, *Surfing With Satoshi: Art, Blockchain and NFTs* (Ljubljana: Aksioma, 2022), https://aksioma.org/surfing.with.satoshi.

8. Jennifer Chan, *From Browser to Gallery (and Back): The Commodification of Net Art 1990–2011* (Syracuse: Syracuse University, 2012).

But the high security and non-interchangeability of blockchain-stored data are not in themselves good indications that NFTs are in fact suitable for safeguarding the authenticity of digital artworks. Almost as soon as NFT online art marketplaces began to appear, artists started to notice that their work was being 'minted' and traded without their approval. Rosa Menkman, for instance, found tokenised versions of some of her glitch-based digital artworks sold on NFT platforms such as Open Sea.[9] As it turns out, the commitment to transparency on which many blockchain protocols pride themselves is not very helpful when the publicly available identity of an NFT creator defaults to the anonymous cryptographic hash address of a cryptocurrency wallet, and when the prized incorruptibility of blockchains makes it nearly impossible to remove fraudulent NFT data once it is inscribed on a ledger. Here, it became clear that when web-based digital-art platforms adopt a kind of 'auto-curation' of content that is based on the metricisation of transactional data and web visitor behaviours, this may fail to protect the interests of artists, precisely because such tendencies displace the traditional curator figure as a trust intermediary between artists and audiences.

This also serves as a reminder that NFT technology does not prevent copying, even when, as a new type of digital rights management (DRM) framework, it makes it possible to link authorship, ownership or originality claims to specific digital objects. Instead, NFTs produce a kind of scarcity in which the perceived value of an artwork might be derived from the massive distribution of many copies of a work across the digital landscape, while nevertheless remaining tied to a uniquely identifiable tokenised version of the work.[10] If the staggering growth of the digital art market in 2021–22 is any indication (one study estimated it to be at 21,000%), NFTs certainly seemed to succeed in rendering non-fungibility as a convincing foundation for digital ownership. As a result, digital artworks that might previously have been seen as unsellable and uncollectable became sought-after

9. Rosa Menkman, 'Remarks on Crypto-Art' (2021), https://networkcultures.org/moneylab/2021/03/03/remarks-on-crypto-art-by-rosa-menkman/.

10. See McKenzie. Wark, 'My Collectible Ass', *e-Flux*, 2017; Rachel O'Dwyer, 'Limited edition: Producing artificial scarcity for digital art on the blockchain and its implications for the cultural industries', *Convergence: The International Journal of Research into New Media Technologies*, Vol.26, no.4, 2020, 874–94, doi:10.1177/1354856518795097.

commodities and speculative assets. To give just one example: Rafael Rozendaal was once best known for works such as *ifyesno.com* (2013), which addressed the difficulty of selling and archiving digital art, but during the height of the NFT boom the artist sold individual works from his regular NFT releases for as much as 140ETH (over £270,000 at the time).

All things told, blockchain-based data storage and non-interchangeability, the first two characteristics of NFTs briefly discussed here, delivered enough momentum to produce a world of 'crypto art' (a definite art-historical terminology has yet to settle into place) in which limited editions of digital artworks 'drop' like the latest sneaker line-ups of mainstream fashion brands, and in which some artists who once might have struggled to pay their studio rent became high-priced OGs ('original gangstas'), fluent in the fintech and meme culture lingo of 'floor prices', 'air drops', 'allowlists' and 'pump-and-dump' schemes. In this landscape, the traditional role of curation in establishing aesthetic and commercial value is considerably diminished. In the process, it also became more and more difficult to distinguish popular NFT art curators from social media influencers, brand promoters and commercial platform proprietors.

Smart Contracts as NFT Art

It was with the ability of NFTs to use smart contracts that some of the crypto art world's more radical promises — including democratisation and decentralisation of the art market, and the rejection of infrastructures of exclusivity — came within more direct reach of digital artists. As discussed, at minimum NFTs function as tradeable authentication tokens that can record information including ownership claims associated with discrete digital artefacts. But NFTs of certain types, for example tokens that follow the Ethereum blockchain's ERC-721 standard, can also function as considerably more complex computational assemblages. In this form, NFTs can represent full-fledged programmes capable of running executable code, which allows them to carry out a wide range of instructions, to generate specific outputs, to determine and change the appearance and 'behaviour' of digital objects, or to monitor details about a token's circulation.

Technically, a smart contract is a programme hosted at a specific address on a blockchain. The account at this address is controlled by rules and behaviours encoded in the smart contract, but is otherwise no different from an account controlled by a human user: the account can hold a balance of tokens used to convey transactions, and interact with other accounts on the blockchain. Most commonly, smart contract functionality is triggered when the corresponding account receives transactions. In NFT art contexts, this can trigger actions and behaviours that may resemble the conditions set out in a traditional contract governing sale and reproduction of a work of art. But because smart contracts do not rely on human intermediaries to carry out functions, this can give the appearance that the digital artwork itself is exhibiting self-governing behaviours. This can mean, for example, that whenever an NFT-based artwork is sold, the identity of the new owner is automatically recorded and linked to the token, creating an up-to-date and incorruptible ownership record. More advanced behaviours can also be encoded: for instance, with every resale, a fixed fraction of the sale price can be transferred to the cryptocurrency wallet of the original artist, or to the chain of previous owners, or to anyone else specified in the smart contract. (For some, the emergence of an artist-controlled secondary royalty market was among the most important advances of NFT technology.)[11] This type of functionality can represent a displacement of curatorial agency, since it enables artists to encode incentives for circulating, displaying or sharing the artwork without having to rely on the services or goodwill of traditional agents such as curators, gallerists or auction houses.

By making NFT-based art programmable, smart contracts add a performative dimension to the 'behaviour' of artworks. At first, this may appear as a reinvention of the kinds of generative behaviours we have seen in algorithmic art for decades. But as the following two examples show, smart contracts can do more than cause artworks to self-generate, iterate, mutate, degenerate and so on. Like all contracts, smart contracts govern interactions between agents, and can enforce certain conditions tied to or triggered by these interactions. This

11. See Charlotte Kent, 'Artists Have Been Attempting to Secure Royalties on Their Work for More Than a Century. Blockchain Finally Offers Them a Breakthrough', 2021, https://news.artnet.com/opinion/artists-blockchain-resale-royalties-1956903.

means that in addition to shaping what a specific digital artwork might look or sound like, a smart contract can also enforce instructions, requirements and limitations concerning how the artwork interfaces with the world, including what can or must be done with it. If designed appropriately, not only can a smart contract therefore assume quasi-artistic or quasi-curatorial agency, but it can also intervene in the broader 'cultural life' of a digital artwork, including social and economic aspects of how it may be collected, bought, sold, or exhibited. The implication is that smart contracts can augment digital artworks such that they become empowered to participate more fully in the complex ecologies of social, aesthetic and economic signification and value that art always inhabits. (Elsewhere, I have described similar constellations of human artist, generative artwork and blockchain functionality as posthumanist agential assemblages.)[12]

Plantoid (2015–) and *terra0* (2016–) are two well-known examples of blockchain-enabled artworks that experiment with code-based, semi-autonomous, self-enforcing behaviours. In both projects, smart contracts enable the artworks to 'make choices' that can be considered to fall within the domain of curatorial agency. *Plantoid* is a blockchain-based sculptural work designed with behaviours that are intended to enable the work to 'propagate'.[13] Specifically, smart contracts allow the artwork to control funds generated from sales and donations, which it can use to commission new versions of itself. *terra0* is an artwork-as-proof-of-concept that presents itself as a self-owning, self-reproducing forest.[14] The underlying idea is that the forest, relying on smart contracts and a blockchain-enabled infrastructure, can monitor its own health through a range of sensors. Over time, the forest can then, in theory, make real-world decisions regarding its own preservation and growth.

Plantoid and *terra0* situate the manifold connections between artist, artwork, and art world as a new kind of entanglement in which the roles of creator, owner and curator lose much of their traditional distinctiveness and centrality. In these projects, the artworks themselves

12. See Martin Zeilinger, *Tactical Entanglements: AI Art, Creative Agency, and the Limits of Intellectual Property* (Lüneburg: meson press, 2021).

13. Primavera De Filippi, 'Plantoid' (n.d.), http://plantoid.org/.

assume agency and supplant these roles, and in doing so push beyond the idea of an artwork as commodity and static artefact. In effect, *Plantoid* and *terra0* represent complex agential assemblages characterised by entanglements between plants or plant-like entities, algorithmic protocols, human actants, legal mechanisms and semi-autonomous computational entities. In the world-facing behaviours of these assemblages, as well as in the interactions between their constituent parts, conventional views on subject-object boundaries, on ownership, and on anthropocentric notions of personhood can become radically destabilised. In their place, issues of (re-)production, propagation and participation in cultural and socio-economic exchanges are invoked. In other words, such works open up to scenarios that express an artwork's agency for determining and curating the shape and meaning of its own existence.

Blockchain Art and 'Ecosystems of Value'

Plantoid and *terra0* experiment with the imagining of agential assemblages that participate in what Laura Lotti has described as complex 'ecosystems of value'.[15] In such ecosystems, the artworks represent more than merely tokenised placeholders for aesthetic merit, objectified commodity or speculative asset. Thanks to the complex behaviours enforced through smart contracts, they become self-owning entities that no longer rely on human agents to determine characteristics such as their ownership status. At this point, questions about what an artwork is, how it is exhibited, and how it circulates begin to sound a lot like bigger concerns with governance, autonomy, self-determination and the nature of property itself.

How does self-ownership of an artwork, enforced by way of smart contracts enforcing what can and cannot be done with it, impact the work's 'curatability'? Two NFT-based art projects developed during the height of the NFT boom — Sarah Friend's *Lifeforms* (2021) [fig. 1]

14. Paul Seidler, Paul Kolling and Max Hampshire, 'terra0 — Can an Augmented Forest Own and Utilize Itself?', in R. Catlow, M. Garrett, N. Jones, & S. Skinner (ed.), *Artists Re:Thinking the Blockchain* (Lancaster: Torque Editions, 2017), 63–72, http://torquetorque.net/wp-content/uploads/ArtistsReThinkingTheBlockchain.pdf.

15. Laura Lotti 'Financialization as a medium: Speculative notes on post-blockchain art', in *MoneyLab Reader* Vol.2 (Amsterdam: Institute for Network Cultures, 2018), 95.

Figure 1: Sarah Friend, *Lifeform #3*, 2021. Courtesy of the artist.

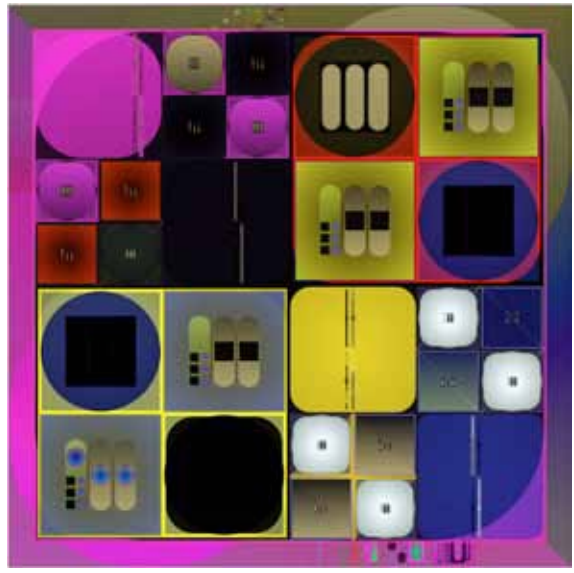

Figure 2: Harm van den Dorpel, *Mutant Garden Seeder*, 2021. Courtesy of the artist.

and Harm van den Dorpel's *Mutant Garden Seeder* (2021) [fig. 2] — explore this question, and provoke a rethinking of how interactions between artworks and audiences are conventionally curated. The first, *Lifeforms*, consists of a series of NFTs whose self-enforcing behaviours require owners to form impromptu gift economies and pass their tokens on to somebody else's wallet within a pre-determined period of time. The second, *Mutant Garden Seeder*, instrumentalises transactional records on the blockchain as the seed for generative changes in the appearance of individual works from the series. Both projects toy with a becoming-curatorial of digital-art objects that produces new, and sometimes unforeseeable, forms of engagement.

Sarah Friend's *Lifeforms* comprises an uncapped series of NFTs hosted on Polygon (a network connected to the Ethereum blockchain). The tokens can be minted on a custom website for a fixed price (10 MATIC, roughly £13 in late 2022). The artist describes each work as an 'NFT-based entity' that requires 'regular care in order to thrive'.[16] This requirement is encoded in the smart contract that controls the behaviour of each token, and which dictates that each NFT must be 'given away' within ninety days of its creation. If this does not happen, the work will 'die', which in this case means that the token representing the artwork will disappear from the owner's wallet and can no longer be transferred.[17]

This changes how *Lifeforms* is situated within the broader context of an art world that is still largely dominated by property-oriented notions of value and ownership. Whereas many NFT-enabled artworks continue to take the form of speculative assets, *Lifeforms* resists this identification and fundamentally reshapes the relationship between artwork and token holders. Because the NFTs that constitute the series must be passed on within ninety days, the project can only continue to exist if informal and sustainable gift economies emerge. Here, the 'value' of the tokenised artworks becomes detached from a traditional notion of private ownership. What takes its place is a non-financial duty of care shared between users who want to ensure the survival of the computational entities. Crucially, the artist can control neither the smart contract-encoded behaviour of the artworks

16. Friend, *Lifeforms*.

17. Ibid.

once they are minted, nor the behaviour of those who buy and share them. Importantly, the artist chose not to design a dedicated digital infrastructure through which token holders could coordinate care. This existential element of the experience of *Lifeforms* is therefore fully the responsibility of human participants who, in this scenario, have ceased to be owners, and have instead become custodians.

By enforcing the conditions for the lifecycle of each *Lifeform*, the smart contract underlying the project ultimately shapes not only the behaviour of the individual NFTs in the series, but also the behaviour of those who engage with them. The contracts incentivise social engagement, and the sphere within which the work circulates — a community in which the *Lifeforms* can thrive — has to emerge organically. I read this as an experiment that renders each *Lifeform* as a hybrid human-computational assemblage that possesses a performative strain based on which its own existence is curated in rudimentary but inexorable terms. The performance of curatorial agency is here expressed quite simply in the stipulations of the smart contract: the venue in which *Lifeform* is exhibited (i.e., the cryptocurrency wallet in which each token is held) must change at least every ninety days.

Harm van den Dorpel's *Mutant Garden Seeder* was released as a limited series of 512 unique tokenised digital artworks on the Ethereum blockchain, which the artist presented in collaboration with Folio, a platform specialising in NFT editions.[18] Each of the NFTs in the series is a dynamic, generative artwork that draws its distinctiveness from transactional data pulled from the blockchain. This includes, for example, the cryptographic hash identifying a *Mutant's* 'birth block', which is used as a seed number (described by the artist as a 'chromosome') in a genetic algorithm whose outputs are visualised as SVG vector graphics. Over time, the appearance of each NFT in the series mutates in response to shifting data values and emergent differences between the original seed block and subsequent blocks. *Mutant Garden Seeder* therefore builds on the very fact that the blockchain, as a substrate for the NFT art world, is itself dynamic and emergent, and is characterised by continuous transaction and verification processes. In this way, the project curates complex visualisations of the transactional nature of the financialised environment in which each work in the series exists. Again, this behaviour is encoded in smart contracts that do not rely on human intermediaries for generating the changing appearance of the works.

As such, *Mutant Garden Seeder* is an aesthetically charged visualisation and commentary on the transactional aspects of the Ethereum blockchain as a financial technology. Each work in the series responds to the continually shifting realities of the values expressed in the Ethereum ledger, which are given shape in the mutations that occur over time. As a consequence, the smart-contract-enabled generative elements of each work in the series create and re-create visual expressions of transactional behaviours recorded on the blockchain. The ability to do so is enabled on the level of code, which displaces both the agency of the artist to determine the shifting appearances of each 'mutant', and the agency of the traditional curator to control how it is displayed.

Art that Lives and Dies on the Blockchain

Early in the NFT hype cycle, Ruth Catlow connected the potential of blockchain art to radical theorists of economy, feminism and the commons, with a reminder that in order for life to thrive, 'economies must follow cultures, not the other way round'.[19] This sentiment applies to all art-making and the social contexts in which it is embedded, but it pertains especially to digital art that draws on financial technologies. Each of the art projects I discussed here is well aligned with Catlow's observation, and all of them explore the intersections between life, culture and the economic. As I've suggested, they do so by imbuing digital artworks with a curatorial agency that helps us to reimagine the nature of digital artwork, as well as the ways in which artworks can exist and be experienced in socio-cultural ecologies that push beyond the centrality of human agency.

Perhaps the most noteworthy common thread running through my examples is that each project elevates the digital artwork above an existence as mere commodity, speculative asset or aesthetic object. Each project proposes the blockchain-based, smart contract-enabled digital artwork as a considerably more complex agential assemblage — as a computational entity that is said to 'live', that is capable

18. Van den Dorpel, 'About Mutant Garden Seeder'.

19. Ruth Catlow, 'NFTs and the "Art" world: panic and possibility', 2021, https://www.theartnewspaper.com/2021/04/09/nfts-and-the-art-world-panic-and-possibility.

of 'reproducing', 'propagating' or 'mutating,' and that requires an attention resembling the kinds of care that we would usually reserve for living beings. These propositions should not be misinterpreted as expressions of a naïve animism of the blockchain, or as suggestions that semi-autonomous behaviours on the blockchain could amount to some sort of sentience. Instead, artists are here expressing genuine excitement concerning speculative terrains of nonhuman agency that are beginning to manifest in computational systems. The complex entanglements in which *Plantoid*, *terra0*, *Lifeforms and Mutant Garden Seeder* exist with human actants invoke more-than-human ecologies, where decentralised human-computational assemblages develop new ways of deciding how to do things, in which directions to proceed, and which value systems to support. The becoming-curatorial of digital artworks is but one expression of what becomes possible in such ecologies.

All of my examples also operate against the grain of the capitalist logic of financialisation that tends to drive the world of crypto art (and, arguably, much of the rest of the art world). The artists involved in creating the works under discussion here are known for their critical perspectives on decentralised finance, their interest in non-hierarchical organisation in and beyond the art world, and their attention to problems of data sovereignty, decentralised governance mechanisms and new forms of democratic decision-making. These notions, I would argue, are encoded in their works, and are enacted in the displacement of curatorial agency I have discussed throughout.

As I have suggested, the emergence of digital artworks that take advantage of smart contract functionality brings with it the potential for a becoming-curatorial of the digital artwork itself. But where can this go, what can this lead to? The projects under consideration here evidence a desire to engage critically with existing power structures of the art world. To speculate on new ways in which artworks can self-determine their way of being in the world certainly also means to speculate on ways to fundamentally reorganise the art world as such. The becoming-curatorial of smart-contract-enabled art projects also has the potential to turn artworks into research tools: the projects discussed represent fascinating social experiments that visualise not only the 'behaviours' of the artworks themselves, but also the behaviours

of audiences, curators and collectors affected by the rules encoded in the works. The blockchain-based nature of the projects means that a lot of data concerning these behaviours is freely available to anyone. In this sense, both *Lifeforms* and *Mutant Garden Seeder* continue to deliver interesting insights, some of which may somewhat frustrate their creators' expectations: Sarah Friend has reported that of the first fifty *Lifeforms* that were minted, forty-one 'died' because the token holders failed to give them away. Harm van den Dorpel noted that a custom web portal developed for the launch of the project was largely ignored by its audience. The portal was meant to let collectors participate in curating the appearance of newly 'hatched' *Mutants* by deciding on the specific blockchain seed hash to which each NFT would ultimately be locked. But instead of embracing this offering of curatorial agency, most buyers chose to completely bypass the custom interface and the durational element of deciding on the appearance of the work, and instead conducted their purchases instantly. The series sold out almost immediately upon its release, and most of the individual works in the series were not allowed a chance to mutate before becoming subsumed into the circuits of the art market.

Does the death of 82% of Sarah Friend's *Lifeforms* mean that the project failed as a critical intervention in the property-oriented domain of NFT art? Does the near-instant selling out of *Mutant Garden Seeder* mean that the project's focus on durational 'evolution' of digital artworks was an aesthetic conceit that its audiences did not appreciate? No. But it suggests, I would argue, that the becoming-curatorial of digital artworks has not (yet) overcome the value propositions of the traditional art world — perhaps because NFT-based art objects are, after all, instantiations of a financial technology. The crypto-art boom pulled digital art into the high-stakes art market, and cultivated whole new worlds of audiences as potential collectors and owners. But the art projects discussed here work differently: the desire to own kills Sarah Friend's *Lifeforms*; the desire to beat the market and invest early prevents van den Dorpel's *Mutants* from iterating through interesting visual forms before they are minted. Such effects hold critical insight: these projects are social experiments that interrogate existing ecosystems of value, and which speculate on the development of new ones. In this sense, it remains to be seen if the becoming-curatorial of smart contract-enabled digital works of art can bring about truly radical displacements and recalibrations of agency.

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III. Future Curating

Creative Al Lab: The Back–End Environments Of Art–Making

Eva Jäger

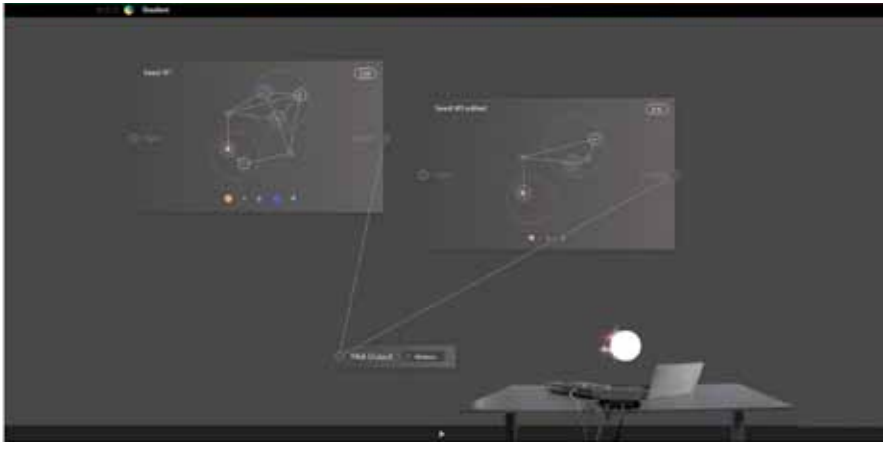

Figure 1: Still from *ML/Al lnterfaces Tutorial Series*, 2020. lmage courtesy of Trust, Berlin and Ricardo Saavedra.

The Creative Al Lab is a collaboration between the R&D Platform at Serpentine Galleries and King's College London's Department of Digital Humanities. The Lab follows the premise that currently we are at the early stages of understanding the aesthetics and semiotics of 'artificial intelligence' (Al). We also approach Al as a framework that holds together a number of disciplines, technologies and systems (creative, cultural and computational). Historically, the themes contained within Al discourse, such as interfaces, automation, data analysis, algorithmic bias, intelligence, alien logics, etc., have featured as cornerstones of

various hyped technologies including robotics and virtual reality and machine learning. Today, Al serves as the wrapper via which we engage with these fundamental concepts of digital culture.

From 2016–25, Serpentine has commissioned and overseen the production of a number of artworks where Al technologies are used as a technical medium as well as a conceptual reference or narrative cue. The Lab, which formed in 2019 and officially launched in July 2020, grew out of a need to explore the experimentation and production phases of these complex projects as creative and research outputs in their own right. The Lab's first initiative since launching has been the formation of a database of creative Al tools and resources. This is a growing collection of research commissioned and gathered by the Creative Al Lab, aggregating tools and resources for artists, designers, engineers, curators and researchers interested in incorporating machine learning (ML) and other forms of artificial intelligence (AI) into their practice. They cover a broad spectrum of possibilities presented by the current advances in ML, like enabling users to generate images from their own data, create interactive artworks, draft texts or recognise objects. Most of the tools require some coding skills, but others do not. Beginners are encouraged to turn to RunwayML. Tools might be core to the production of the work itself, or play a smaller assistive role. Resources help to imagine and critically conceptualise future AI systems, ways of working and deployment contexts.[1]

By focusing on the production or 'back-end' environments of this type of art-making, we have been able to investigate the truly novel ways in which artists are remaking interfaces, building datasets and generally reaching into the grey-box of Al technologies.[2] lmportantly, this emphasis on the back-end has led us to insist that the Lab has no mandate to commission or showcase front-end artworks. lnstead, the Creative Al Lab holds space for conversations, research and hands-on experimentation that addresses the technical frameworks of Al and

1. Creative Al Lab Database: https://creative-ai.org.

2. During a Creative AI panel discussion at Serpentine on the topic 'Aesthetics of New AI', Leif Weatherby (NYU Digital Theory H-Lab) noted of AI, 'It's not just a black box, it's at least grey. When you open that up, you start to see things that have either aesthetic value, critical value, or both.'

their impacts on art-making, and conversely, the possible impacts on AI research and development of art-making that deploys AI.[3]

There are a couple of reasons why we should insist on an exploratory creative R&D format within an art-institutional setting. Firstly, by constructing an organisation within the organisation we can unbind from front-end formats such as exhibitions or commissions. lnstead, we can follow in the steps of an underrepresented working method within humanities research and museums' output.[4] Secondly, we can provide a necessary supplement to the generic approach to AI that the art-institutional discourse has thus far offered in interpreting the front-end of artworks made using AI technologies.[5] To this extent, our mission is to develop a critical literacy that might help art institutions approach AI as a nuanced medium in art-making. Without this, we will continue to reproduce narratives where art is an antidote to technology rather than a valuable part of its development.

Cultural producers of all kinds should be involved in forming the cultural meaning of AI technologies. And since we cannot separate the cultural meaning of a technology from the technological object itself (for instance, the machine learning model),[6] it seems that we must go through the back-end.

3. Serpentine has a history of working in this practice-driven way across its programme, and importantly, not only as a feature of technologically orientated research. A key example of this is the community research undertaken as part of the Edgware Road Project and the Centre for Possible Studies.

4. Here we reference (within the humanities) the interdisciplinary work of thinker-tinkerers like Gilbert Simondon, who combined research as a media theorist with lab work where he experimented with computer components, taking machines apart and rebuilding them. Or (within the arts) we look to the studio and lab practices of artist-engineers like Roy Ascott and Rebecca Allen, to name a few. This method for working is of course not novel. We focus on it only to examine where this method is located — or more importantly, not located — in the museum.

5. This is something that Nora N. Khan has outlined in her participation with the Lab and in her essay, 'Towards a Poetics of Artificial Superintelligence: How Symbolic Language Can Help Us Grasp The Nature and Power of What is Coming', included in this collection, p.31.

6. Gilbert Simondon in his 1958 *Du Mode D'existence des Object Technique* writes, 'Culture has become a system of defense against technics... based on the assumption that technical objects contain no human reality.'

Making Meaning

What follows is an example of this approach that also forms the basis for our next investigation at the Lab.

At a recent talk, Mercedes Bunz, Principal lnvestigator of the Lab and Senior Lecturer in the Department of Digital Humanities, King's College London, reiterated that if the arts and humanities distance themselves from nitty-gritty technology through siloed critique they will become irrelevant.[7] lnstead, she and the Lab work closely with computer scientists as they begin to pivot toward self-critique. Bunz offered some insights into understanding Al technic from the arts-and-humanities perspective — through semiotic studies — that remain under-utilised in computer science. Most notable is the concept of meaning-making described by Stuart Hall, among others, as a process of both encoding and decoding.[8] lt is a process, Bunz argues, that has now been taken up by Al, through deep learning. Understanding contemporary Al as having the capacity to make meaning is crucial if we follow Hall's logic (as Bunz does in a recent paper on the subject) because then meaning can also be made by calculation — a task to which Al is regularly assigned.[9] This proposes a paradigm shift: the core work of culture, the making of meaning, can now also be *made* (processed, analysed, calculated) by Al — by the technology itself.

While this is only one specific example (where we admittedly also need to argue that semiotics is what art and culture bring to the table, so to speak), the point is that it confirms that the conceptual meaning of works made with Al technologies is inseparable from its technical meaning. And it can only really be understood by engaging with the technicalities (in the back-end) in a serious way.

7. Keynote lecture at the newly opened Centre for Culture and Technology at the University of Southern Denmark.

8. Stuart Hall, 'Encoding/ decoding', *Culture, Media, Language: Working Papers in Cultural Studies*, 1972–1979, ed. Stuart Hall, Dorothy Hobson, Andrew Lowe and Paul Willis (London: Hutchinson, 1980), 128–38.

9. S. Bunz, 'The calculation of meaning: on the misunderstanding of new artificial intelligence as culture', *Culture, Theory and Critique*, no.60: 3–4 (2019), 264–78, https://doi.org/10.1080/14735784.2019.1667255.

As we set out on this investigation and others, we remember to embrace the brittleness of our systems and their specific intelligences. Hopefully, this will bring with it divergent understandings of art-making, artworks and art ecosystems. Perhaps it can give way to an approach that replaces autonomous agents (human subjects) with collaborative coalitions (human and non-human subjects). Perhaps these collaborative coalitions will also produce new meaning.

The creative R&D made possible through the Creative AI Lab and its home in Serpentine's Arts Technologies research initiative has been a key resource for Serpentine as it produces its annual strategic briefing: *Future Art Ecosystems: Art × Public AI*.[10] The briefing was influenced by how artists work with AI. From there, it built out insights and strategies envisioning how the cultural field could advance AI innovation within the UK. Our approach aims to steer AI not simply as a new category of tech products, but as a public resource and infrastructure. As part of this research, we identified the need for cultural organisations to consider themselves stewards of valuable data sets (collections, archives, etc). In this role, cultural institutions will deliver valuable research and contribute to building the necessary infrastructure in a way that is efficient and useful to the public.

This proposition was implemented at Serpentine during the production of the exhibition *The Call* by Holly Herndon and Mat Dryhurst. The Arts Technologies team, the artists and a team of legal and policy experts from the fields of IP and GDPR worked to develop a pioneering framework for collective data governance: cultural institution as 'Trusted Data Intermediary'. This approach goes a long way in providing further agency for creators who put their content into AI training. Surfacing their value in data sets and providing methods of bargaining and administration is one proof of concept that this exhibition provided, an urgent next step for a sustainable AI development landscape. As a cultural institution, Serpentine was a fine testbed, providing the financing and production of a highly complex real-world experiment, a rarity throughout other fields. The project's findings (including legal advice and contracts) now provide orientation

10. *Future Art Ecosystems: Art × Public AI*: https://reader.futureartecosystems.org/briefing/fae4.

for policy-making and technology companies. To share these insights, the project initiated conversations and events attended by technology organisations such as Google, DeepMind, Signal, and OpenMined, as well as policymakers including the Information Commissioner's Office (ICO), the Ada Lovelace Institute, the Department for Digital, Culture, Media and Sport (DCMS), and the Department for Science, Innovation and Technology (DSIT), who also invited Serpentine to give evidence in their forthcoming consultation on data trusts.

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Khan, Nora N. 'Towards a Poetics of Artificial Superintelligence: How Symbolic Language Can Help Us Grasp The Nature and Power of What is Coming'. In this journal, p.31.

Simondon Gilbert. *Du Mode D'existence des Object Technique*. 1958.

Extract from Future Art Ecosystems 4: Art × Public AI

Victoria Ivanova,
Eva Jäger,
Alasdair Milne and
Gary Zhexi Zhang

FAE4_LineOfFlight_Ecosystems_01 CROSSLUCID, Executed in 2024,
Still from *Line of Flight: Introduction* (AI-driven Moving Image, 00:00:52)

Serpentine Arts Technologies
March 2024

This excerpt is taken from the publication *Future Art Ecosystems 4: Art × Public AI (FAE4)* published in March 2024.[1] FAE4 is the fourth volume in a series of strategic briefings from Serpentine Arts Technologies. Each volume provides concepts, references, language and arguments that can be integrated into operational agendas for the development of twenty-first-century cultural infrastructure: the systems that support the production, distribution and financialisation of art and advanced technologies as a whole and respond to a broader societal agenda.

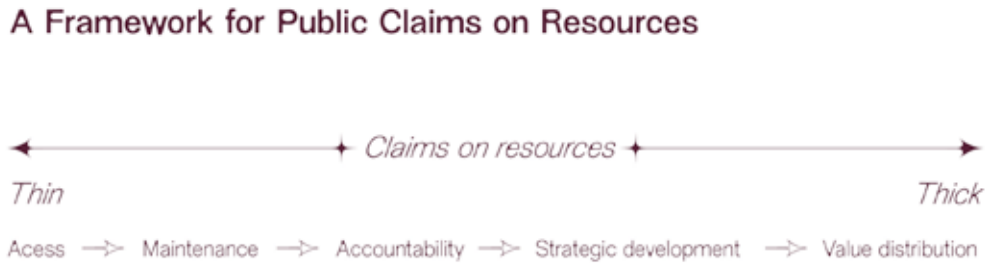
The *FAE4* report delves into the potential of public AI, emphasising its importance for artists and cultural institutions. It explores the intricate layers of the AI stack, from data and AI models to the necessary natural resources, outlining various strategies for cultural organisations and artists to engage with and intervene in AI systems. The report is structured around three chapters: *Organisation, Artist and Ecosystem*, each addressing different aspects of AI's impact on the cultural sector.

Chapters 1 and 2 lay out how developments in AI are reconfiguring organisational and artistic practices, while at the same time pointing to new spaces of opportunity to shape the interactions and expectations attached to the notion of public AI. What is currently unfolding may, in retrospect, appear as a 'pilot' phase, meaning that there is an urgency to set the foundations on which robust art and advanced technologies (A×AT) strategies can be developed, and to start acting on these strategies. Chapter 3, presented here, offers a set of recommendations for cultural, civic, technological and policy-making actors for orienting the A×AT ecosystem to advance public AI.

1. The full text can be read online and is available in print from Serpentine Galleries, https://futureartecosystems.org/briefings/.

1. Defining Public AI

AI technologies promise to affect nearly every aspect of our lives.[2] Knowing that this transformation will play out on a societal scale requires governance and ownership mechanisms that entitle a plurality of voices to steer AI not simply as a new category of tech product, but as a public resource and infrastructure.[3] In democratic societies, the latter entities are subject to varying degrees of 'publicness' through (1) accessibility for use, (2) maintenance as a matter of public responsibility, and (3) accountability to the public in their function. Additional aspects include (4) participation in strategic decisions about the development and application of resources, and (5) how the value that is derived from these resources is distributed, which is typically harder to render public.[4]



Within complex innovation systems both public and private investments flow into research and development. Instead of understanding 'public' and 'private' as binary conditions attached to specific types of intermediaries (i.e. state versus market actors), FAE proposes to regard the notion of publicness as a spectrum on which the terms of public agency are negotiated, ranging from 'thin' to 'thick'. 'Thick'

2. OpenAI, Developing safe & responsible AI, https://openai.com/safety/.

3. Shrey Jain et al., *Plural Publics* (2023), https://gettingplurality.org/2023/03/18/plural-publics/.

4. Many groups are working to define ideas of public AI; they include: *The Public AI Network, Public AI White Paper* (2024), https://docs.google.com/document/d/1b8xYlNBCtUHCQHSsNwklR8ivqmNgCK0qeQ-LwjSEHMk/edit?tab=t.0; Collective Intelligence Project, and The Alan Turing Institute, amongst others. FAE4 draws on ideas from across these frameworks. We also use the term 'public' following John Dewey's conception of the term in *The Public and Its Problems* (1927).

public governance might apply to state-run assets funded by taxes, while 'thin' publicness could be obtained when/where infrastructures are freely accessible to the public but are privately owned. Between these extremes, frameworks such as commoning could be deployed to pool resources offering greater access and maintenance buy-in.[5, 6] Through mission-driven public-private partnerships, such as those developed to build national supercomputing capabilities, state bodies can cooperate with private industry to deliver speciality products and services.[7, 8] Non-governmental interest organisations, academia and grassroots movements also operate within this ecosystem to address unmet needs, both at the level of general policy and on behalf of specifically affected communities.[9]

AI Tech Stack

Today's AI is constituted through an entanglement of resources and infrastructures, each layer possessing its own context and openings for incorporating publicness into its design. What follows is the mapping of entanglements through AI's technical stack, consisting of seven hierarchical layers organised in two tiers. The 'hardware' tier provides the physical material and machinery by means of natural resources, server networks and compute layers. These enable the transfer and processing of information in the 'software' tier from the data layer to the model, network protocols and application layers. By zooming in on the stack layers, the interdependence between industry, states, non-governmental organisations, academia and the many publics that

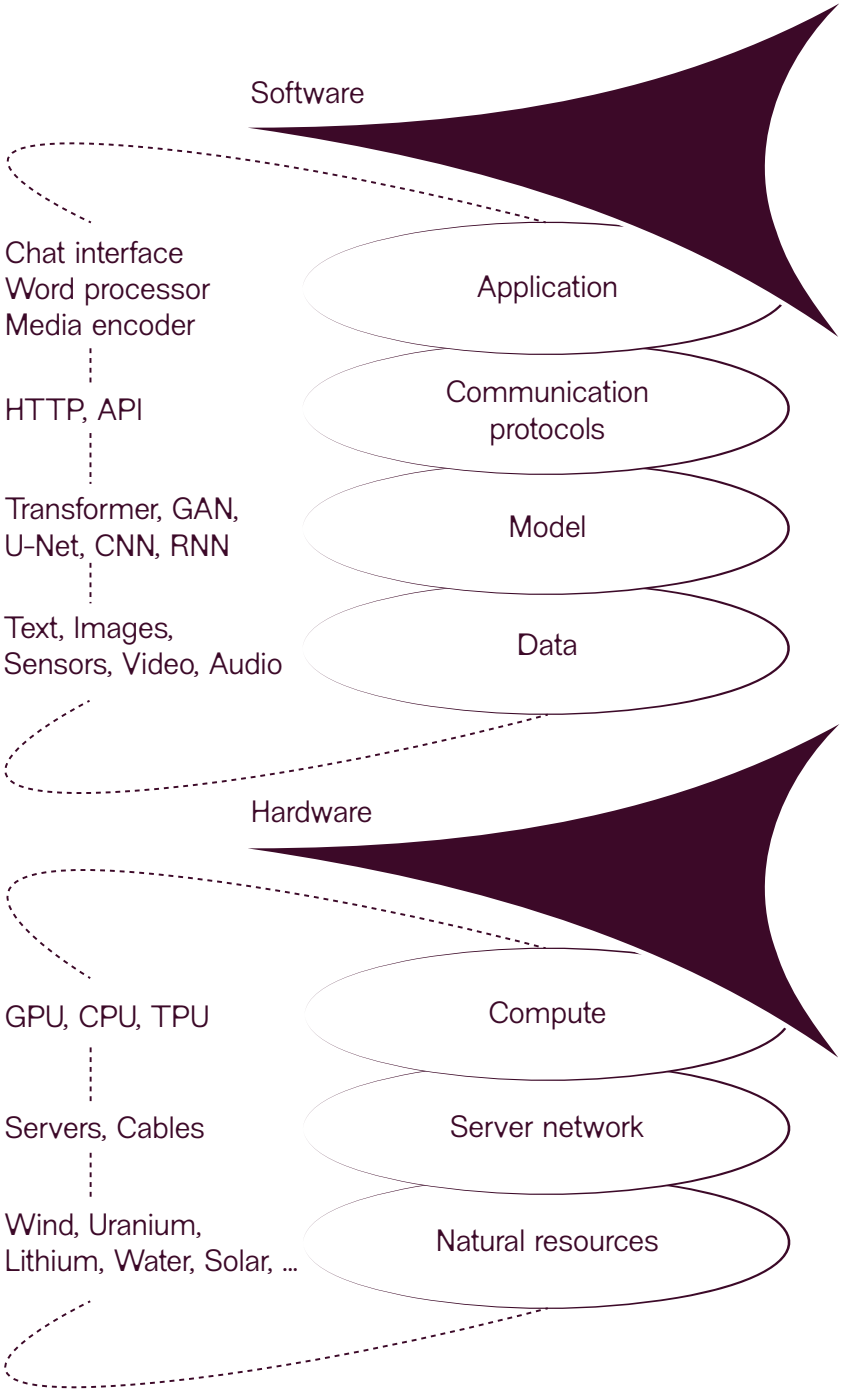
5. This includes much of academia, as well as non-profit organisations committed to stewarding the commons such as Internet Archive. https://archive.org and Arxiv, https://info.arxiv.org/about/index.html.

6. Elinor Ostrom, *Governing the commons* (New York: Cambridge University Press, 1990).

7. Mariana Mazzucato, *Public Purpose: Industrial Policy's Comeback and Government's Role in Shared Prosperity* (Boston MA: Boston Review, 2021).

8. UK AI Research Resource, dubbed Isambard-AI, will be one of Europe's most powerful supercomputers. The new facility will serve as a national resource for researchers and industry experts spearheading AI innovation and scientific discovery. An unprecedented £225m investment has been allotted to create UK's most powerful supercomputer in Bristol (2023), https://www.bristol.ac.uk/news/2023/november/supercomputer-announcement.html.

9. These include organisations such as The Alan Turing Institute, Aapti Institute and Omydiar Network.


Software
Chat interface
Word processor
Media encoder
Application
HTTP, API
Communication protocols
Transformer, GAN, U-Net, CNN, RNN
Model
Text, Images, Sensors, Video, Audio
Data
Hardware
GPU, CPU, TPU
Compute
Servers, Cables
Server network
Wind, Uranium, Lithium, Water, Solar, ...
Natural resources

are implicated in the creation and adoption of AI can be understood, highlighting the fact that 'public AI' is not just a speculative category, but a reality that requires ongoing development and support.[10]

→ Software Tier

Application Layer

Applications in the context of this AI stack are software products that utilise machine learning models as a core component of their capability; for example, content creation services such as Stable Diffusion, ChatGPT or Suno.ai. Other present-day applications include virtual assistants (e.g., Apple's Siri), recommendation systems (e.g., those used by Netflix), developer tools for writing code (e.g., GitHub's CoPilot), speech and language recognition tools (e.g., Google Translate), biometric identification technology (e.g., the fingerprint recognition system AppLock), computer sensing and simulation systems (e.g., those operated by driverless vehicles such as CARLA), search engines (e.g., Google Search and Bing) and others.

While the release of ChatGPT in November 2022 captured the public's imagination, the history of applications that use different underlying AI capabilities (or precursors to AI) spans decades[11] Companies are, by default, incentivised to develop commercial products for consumers; however, governments, non-profits and individuals also develop their own applications. For instance, in the UK, the National Health Service develops applications for doctors to more accurately detect diseases using patient data.[12] However, applications developed by the

10. An endeavour can be understood as 'public' when it is 'in service of society and not industry or government'. See Jürgen Habermas, *The Structural Transformation of the Public Sphere* (Cambridge: MIT Press, 1991).

11. OpenAI, Introducing ChatGPT. https://openai.com/index/chatgpt/; William van Melle, MYCIN: a knowledge-based consultation program for infectious disease diagnosis (1978), https://www.sciencedirect.com/science/article/abs/pii/S0020737378800492; Bruce T. Lowerre, *The HARPY Speech Recognition System* (1976), https://stacks.stanford.edu/file/druid:rq916rn6924/rq916rn6924.pdf; Feng-hsiung Hsu, *Behind Deep Blue: Building the Computer that Defeated the World Chess Champion* (Princeton: Princeton University Press, 2002).

12. Tammy Lovell, *NHS rolls out AI tool which detects heart disease in 20 seconds* (2022). https://www.healthcareitnews.com/news/emea/nhs-rolls-out-ai-tool-which-detects-heart-disease-20-seconds.

public sector are not always state-owned. Sometimes they are developed privately and licensed to the public sector. Regardless, privacy and consent are rights that are intrinsic to the individual irrespective of whether or not the tool is developed by the public sector, private sector, or is state-owned.[13]

Application development is underpinned by a robust ecosystem of open research and code sharing. The development of applications relies on platforms such as GitHub (for code), and HuggingFace (for machine learning models and datasets). Applications can be patented (e.g., Spotify). In the US and Europe, applications are subject to a voluntary code of practice, which extends to application providers in general.[14, 15] Applications are also subject to a further round of scrutiny within digital marketplaces such as Apple's App Store or Google Play.

Network Protocols Layer

Network protocols define the rules for how data is transmitted and received over a network, enabling AI applications to communicate efficiently with each other, with data sources, with AI models and with end-users.

Hypertext Transfer Protocol (HTTP) is the open data communication protocol underlying the World Wide Web. Its specifications standardise the exchange of information; they are publicly available and can be used by anyone.[16] As a protocol, it is not regulated by any single

13. In France, tax authorities used proprietary software developed by Google to identify undeclared tax revenue. See *Undeclared pools in France uncovered by AI technology*, https://www.bbc.co.uk/news/world-europe-62717599.

14. In 2022, the UK government set out a voluntary code of practice that includes better reporting of software vulnerabilities and more transparency for users regarding the privacy and security of apps available in all app stores. See *New rules for apps to boost consumer security and privacy*, https://www.gov.uk/government/news/new-rules-for-apps-to-boost-consumer-security-and-privacy#:~:text=The%20new%20measures%20include%20.15. In New York State, automated hiring apps are subject to bias testing. See NYC Consumer and Worker Protection, *Automated Employment Decision Tools: Frequently Asked Questions* (2023), https://www.nyc.gov/assets/dca/downloads/pdf/about/DCWP-AEDT-FAQ.pdf.

16. CERN, The Birth of the Web, https://home.web.cern.ch/science/computing/birth-web.

governmental entity. Instead, it is maintained and developed by international standards organisations, primarily the Internet Engineering Task Force (IETF) and the World Wide Web Consortium (W3C). These organisations work through consensus-driven processes involving various stakeholders, including developers, engineers, industry representatives and others, to ensure that the protocol remains effective, interoperable and up to date with evolving technological needs.[17]

An Application Programming Interface (API), on the other hand, is a set of tools that enables the exchange of data and functionality between platforms, and integrations between different systems and devices. In AI applications, APIs are often used to access the capabilities of AI models, without interacting with the model itself, for a fee (e.g., enterprise-grade Gemini and ChatGPT Enterprise).

Model Layer

A machine learning model is a computer programme. In contrast to conventional programming, it is not manually defined through a sequence of instructions. Instead, the process of defining the computer programme is automated by means of algorithms that find patterns in large quantities of exemplary data.[18] While there are many different machine learning methods, deep learning algorithms are the current predominant subset of methods. They typically use deep artificial neural network architectures with multiple layers that can recognise features and context in data.[19] The model configuration is defined by a set of numerical parameters known as the model's weights. In 2021, the concept of a 'foundation model' was coined to describe a large (i.e., powerful) model that can process or generate information from

17. Wikipedia, HTTP, https://en.wikipedia.org/wiki/HTTP.

18. Rishi Bommasani et al., *On the Opportunities and Risks of Foundation Models* (2021), https://arxiv.org/pdf/2108.07258.

19. Yann LeCun et al., *Deep Learning* (2015), https://www.nature.com/articles/nature14539.

20. Foundation models generally refer to transformer architecture trained on huge amounts of data and use transfer learning to perform general-purpose tasks that can then be further fine-tuned into skills such as text synthesis, image manipulation or audio generation. See Elliot Jones, *Explainer: What is a foundation model?* (2023), https://www.adalovelaceinstitute.org/resource/foundation-models-explainer/; Rishi Bommasani et al., *On the Opportunities and Risks of Foundation Models* (2021), https://arxiv.org/pdf/2108.07258.

multiple types of data inputs, such as text, images, audio and video.[20] Today, these foundation models are largely multimodal, meaning they can move across those types of input and output. Since training large models from scratch is expensive, requiring large amounts of data and compute resources, foundation models provide an opportunity for commercialisation. Examples of commercial foundation models include OpenAI's GPT-4 and Google's Gemini, while Meta's Llama 2 and the Mistral models are open source.[21]

Building efforts have consolidated around just a few foundation models within corporate, or privately controlled, contexts due to the massive investments that they require.[22] However, more recent projects have shown that smaller models are starting to compete with foundation ones.[23, 24] Nevertheless, only a handful of foundation models from US-based companies have the greatest number of users globally. There is debate as to whether foundation models should be required to be open source due to their impact as a 'foundational layer' of most AI applications — Meta's Llama 2, Stability AI's Stable Diffusion, and Google's BERT are examples of open-source foundation models emerging from proprietary companies — or whether the models should be subject to regulation by governments in jurisdictions where they are in use (or some combination of both).[25, 26]

Not all model-makers reveal the contents of their training data, whether open-source or closed, and it is believed that many of these datasets are protected by copyright. Consequently, these leading AI

21. See OpenAI's GPT-4, https://openai.com/index/gpt-4-research/; Google's Gemini, https://gemini.google.com; Meta's Llama 2, https://www.llama.com; and Mistral AI, https://mistral.ai.

22. Rishi Bommasani, et al., *On the Opportunities and Risks of Foundation Models* (2021), https://arxiv.org/pdf/2108.07258.

23. Harsha Nori, *Can Generalist Foundation Models Outcompete Special-Purpose Tuning? Case Study in Medicine* (2023), https://www.microsoft.com/en-us/research/publication/.can-generalist-foundation-models-outcompete-special-purpose-tuning-case-study-in-medicine/.

24. Yi Tay, *Training Great LLMs Entirely from Ground Up in* [...] *the Wilderness as a Startup* (2024), https://www.yitay.net/blog/training-great-llms-entirely-from-ground-zero-in-the-wilderness.

25. Billy Perrigo and Yann LeCun, *On How An Open Source Approach Could Shape AI* (2024), https://time.com/6691705/time100-impact-awards-yann-lecun/.

26. *Stable Diffusion is a model by UK-based AI company Stability AI, with open source code and weights*, https://stability.ai/news/stable-diffusion-public-release.

organisations are confronting legal challenges that have yet to result in new laws.[27, 28, 29] Meanwhile, the Responsible AI Licenses (RAIL) initiative is advocating for the development of licences for fine-tuning and downstream usage of models that curtail misuse.[30]

Data Layer

Models require high-quality data for training and fine-tuning.[31] While early efforts to create openly available, labelled datasets, for example ImageNet, improved the quality and capabilities of AI models, recent technical advances in foundation models have reduced the reliance on such resource-intensive efforts.[32, 33] Instead, the web is directly scraped by a large-scale web crawler, resulting in the Common Crawl dataset, which is a continually updating set of raw webpage data

27. See Tim Bradshaw and Joe Miller, *New York Times sues Microsoft and OpenAI in copyright case* (2023), https://www.ft.com/content/23c15ce1-16c5-4b2f-804e-2c0da64e1972.

28. For example, an investigation by *The Atlantic* in August of 2023 revealed that Meta partially trained its extensive language model using a dataset named Books3, which includes over 170,000 books that are either unauthorised copies or otherwise protected under copyright rules. Alex Reisner, *Revealed: The Authors Whose Pirated Books Are Powering Generative AI* (2023), https://www.theatlantic.com/technology/archive/2023/08/books3-ai-meta-llama-pirated-books/675063/.

29. Because their rise has been so meteoric, the attempts to regulate models are still in their infancy, with suggested measures under development in the EU, US, China and the African Union. In the UK, the Frontier AI Taskforce is a research team within the government to evaluate risks. In the House of Lords, a draft *Artificial Intelligence (Regulation) Bill* has been put forth. See Robert Hart, *White House Unveils 'Sweeping' AI Strategy as Biden Pushes for Transparency and Safety* (2023), https://www.forbes.com/sites/roberthart/2023/10/30/white-house-unveils-sweeping-ai-strategy-as-biden-pushes-for-transparency-and-safety/?sh=3144c3d5df04; and *Artificial Intelligence (Regulation) Bill* (2023), https://bills.parliament.uk/publications/53068/documents/4030.

30. *Responsible AI Licenses (RAIL) initiative*, https://www.licenses.ai.

31. High-quality data is accurate, complete, reliable, and relevant information for its intended use in operations, decision-making, analysis or processing. See Maria Priestley et al., *A Survey of Data Quality Requirements That Matter in ML Development Pipelines* (2023), https://dl.acm.org/doi/10.1145/3592616.

32. Jia Deng et al., *ImageNet: A Large-Scale Hierarchical Image Database* (2009), https://www.researchgate.net/publication/221361415_ImageNet_a_Large-Scale_Hierarchical_Image_Database.

33. Richard Sutton, *The Bitter Lesson* (2019), http://www.incompleteideas.net/IncIdeas/BitterLesson.html.

34. Common Crawl, *Our Mission*, https://commoncrawl.org/mission.

with extracted metadata and text.[34] Despite increasing criticism, it still serves as the most important resource for researchers, developers and anyone interested in analysing the vast amount of information available on the internet.[35]

High-profile lawsuits brought against companies including OpenAI, Microsoft, Stability AI and Midjourney allege that their models infringe on copyrighted material in the training of their models.[36] Even the use of openly accessible or Creative Commons-licensed material has engendered significant debate around concerns relating to value extraction. Web crawling can also lead to datasets unintentionally containing illegal content. For example, the community-driven open source dataset LAION-5B has been accused of containing child-abuse material.[37, 38] Other open-data repositories, for example, libraries on HuggingFace, offer developers easy access to specific datasets, while vendors such as Google Ads are given consent by users to own their data and then monetise it. Governments and the healthcare industry have high-quality datasets related to societies' overall level of wellness through medical imaging and health records, as well as census and municipal data.[39, 40]

35. Stefan Baack, and Mozilla *Insights, Training Data for the Price of a Sandwich: Common Crawl's Impact on Generative AI* (2024), https://www.mozillafoundation.org/en/research/library/generative-ai-training-data/common-crawl/.

36. USA cases: Tremblay v OpenAI (consolidated with Silverman v OpenAI and Chabon v OpenAI), 2023; Alter v OpenAI and Microsoft (consolidated with Authors Guild & ors v OpenAI), 2023; Basbanes & Ngagoyeanes v Microsoft and OpenAI, 2024; The New York Times v Microsoft and OpenAI, 2023; Chabon & ors v Meta Platforms, Inc., 2023; Kadrey v Meta Platforms, Inc., 2023; Andersen v Stability AI, 2023; Getty Images v Stability AI, 2023; Huckabee & ors v Meta, Bloomberg, Microsoft, and The EleutherAI Institute, 2023; J.Doe 1 and J.Doe 2 v GitHub, Microsoft and OpenAI, 2022; Concord Music Group & ors v Anthropic PBC, 2023; Thomson Reuters v Ross Intelligence, 2023. UK: Getty Images v Stability AI, 2023.

37. LAION, *Laion-5b: A New Era Of Open Large-Scale Multi-Modal Datasets* (2022), https://laion.ai/blog/laion-5b/.

38. Alex J. Champandard on X (formerly Twitter) (2023), https://x.com/alexjc/status/1737860015262929405.

39. In the UK, Health Data Research UK is a portal that enables access to health data to enable research and development. See Health Data Research UK, https://www.hdruk.ac.uk.

40. Other public services, e.g., public transport or postal services, also create data that could be used to improve the services they provide. Over the last several years, 'data dignity' campaigners and associated organisations have been working to prototype new public governance models for data protection including data trusts and

→ Hardware Tier

Compute Layer

Data-driven machine learning algorithms are reliant on high-performance computing. Graphics processing units (GPUs) are semiconductor chips originally designed for 3D graphics, but their competency in performing complex mathematical calculations at high speeds has made them hardware that is fundamental to AI systems in order for models to be trained quickly and at scale.[41] Nvidia, Advanced Micro Devices (AMD) and Intel are currently the largest companies producing GPU hardware. Additionally, organisations that offer applications that use computational power access GPUs via cloud providers such as Amazon Web Services, Microsoft Azure and Google Cloud Platform, which, in turn, buy chips in bulk from companies such as Nvidia.

Because of high demand and intense global competition, geopolitical tensions have emerged surrounding the semiconductor industry; nations are vying for dominance in manufacturing, design and supply-chain control. In the past three years, particularly in response to Taiwan's geopolitical status as the leading global chip producer, governments in the US, the EU and the UK have pushed to support national semiconductor manufacturing, research and development through new policy positions, legislation and by providing financial incentives. Generally, investment by outside actors in national or enterprise computing projects is now regarded as a matter of national security and global competition.[42] Despite attempts by the US government to slow R&D capacity through restrictions on key exports in China and the Middle East, China is fast catching up to state-of-the-art chip-manufacturing technologies. In addition to

cooperatives. See RadicalxChange, https://www.radicalxchange.org/#message; Aapti Institute, https://aapti.in; Open Data Institute, https://theodi.org/about-the-odi/; Data Empowerment Fund, https://data-empowerment.fund; and Data Trusts Initiative, https://datatrusts.uk.

41. Significant increases in computational power since 2016, thanks to advancements by Nvidia, AMD, Intel, and Qualcomm, have enabled the training of larger and more complex AI systems, https://www.bbc.co.uk/news/business-65675027.

42. Paresh Dave, *OpenAI Agreed to Buy $51 Million of AI Chips From a Startup Backed by CEO Sam Altman* (2023), https://www.wired.com/story/openai-buy-ai-chips-startup-sam-altman/.

governments, industry players have also become active. OpenAI, for example, is seeking to raise $7tn, significantly from investors in the Arabian Gulf, for its own chip-production capacity.[43]

As opposed to applications, network protocols and small-scale models, the computing costs of foundation models means that GPUs are less accessible for small-scale entities or open innovation, raising questions about enclosure. It is a resource that has consolidated around a few key companies that service both the market and government needs.

Server Networks Layer

Server networks, otherwise known as 'clouds', are clusters of computers that store data, run software such as AI models, and provide access to both data and models via APIs and communication protocols.[44] To operate on the internet, server networks rely on the vast system of underwater cables that act as highways for data traffic across the planet. Over recent years, major server networks like Amazon Web Services and Microsoft Azure have come to account for much of the web. The business model of server networks is a straightforward exchange of use/access for a fee. Companies that rely heavily on server architecture — such as Google — build their own.[45] The strategic placement of servers near where they will be needed most has instigated a land grab by companies and governments as they try to secure space to build new server racks and cooling systems. National security is increasingly a major concern for countries as governments allow foreign companies to operate servers in their jurisdiction. In Guizhou, China, for instance, Apple operates the Chinese iCloud, a server network that is not connected to the global Apple iCloud.

43. Anna Tong et al., *Exclusive: ChatGPT-owner OpenAI is exploring making its own AI chips* (2023), https://www.reuters.com/technology/chatgpt-owner-openai-is-exploring-making-its-own-ai-chips-sources-2023-10-06/.

44. While it is true that server networks also use computing units (e.g. CPUs) to communicate, dividing the server network and compute layers in this AI tech stack allows for clarity in terms of the unique infrastructural and governance issues of each respective layer.

45. Debbie Weinstein, *Our $1 billion investment in a new UK data centre* (2024), https://blog.google/around-the-globe/google-europe/united-kingdom/google-1-billion-investment-in-a-new-uk-data-centre/.

Natural Resources Layer

Control over natural resources including oil, gas and coal has shaped modern society, creating massive wealth and establishing new regulatory regimes, while simultaneously accelerating environmental breakdown and laying the foundation for the technological developments of the twentieth and twenty-first centuries. In centuries past, the search for and sequestration of natural resources provided the foundation of colonial projects. Today, control over rare earth metals, integral to both the global rollout of renewable energy and the mass expansion of AI, will define relationships between countries and companies who have access to rare metal wealth and those who do not.

The natural resources required for AI can be broadly grouped under the headings of materials and energy. Materials, e.g., silicon, gold, silver, palladium and lithium, are necessary for the fabrication of chips, servers, cables and batteries. Energy from renewable sources (wind, solar, hydro), fossil fuels (oil, gas, coal) and nuclear reactions (fission and fusion) power the data centres, server networks and computing operations, as well as their cooling systems.

From publicly owned oil companies such as Norway's Equinor, to fully privatised water companies in the UK like Thames Water, governance of natural resources across the Western world varies by location and resource. Much attention in recent years has been focused on establishing democratically, or at least more publicly accountable energy systems across Europe with an accompanying shift away from oil, gas and coal towards renewables.[46] This process has been accelerated by the massive profits generated by gas suppliers following the price spike resulting from the Russian attack on Ukraine, and by accelerating climate breakdown. Less attention has been focused on the supply chains and, often, weak governance models in markets for rare metals such as palladium and lithium, or even more traditional metal commodities, such as gold and silver. Frequently, these metals, key to a transition to renewable energy, are extracted from the territories of the former colonies of Europe as transnational corporations accrue

46. TUC, *Public ownership of clean power: lower bills, climate action, decent jobs* (2022), https://www.tuc.org.uk/sites/default/files/2022-09/TUC_public%20energy%20generation_Sept2022.pdf.

massive profits from this resource extraction at the expense of their workers and of local communities.[47]

2. Ecosystem

Since 2020, Future Art Ecosystems (FAE) has been advocating for dedicated infrastructural development of the AxAT ecosystem. The research and insights that have informed strategic briefings to date, the ongoing R&D projects by Serpentine Arts Technologies and its expanding network of collaborators, as well as the production of new artistic commissions, have led to the recognition of key areas where ecosystemic development and investment are required. Strengthening of these areas is a prerequisite for the AxAT ecosystem to leverage its agency in negotiating the publicness of AI. Below is a review of strategic priorities in relation to these areas of focus and to the AxAT ecosystem's engagement with the AI stack. This review is followed by a set of recommendations for cultural, civic, technological and policy-making actors for orienting the AxAT ecosystem to advance public AI.

Investing in the Foundations of the AxAT Ecosystem with a Public Mission

→ Advanced Production Capabilities

Advocating for independent, in-house, and public sector-led production models as a key driver for AxAT practices

For the cultural sector, ensuring that technical literacy is a strategic priority will allow organisations to develop advanced production capabilities that make sense for their missions. Investment in capacity

47. Jake Simms and Andy Whitmore, with contributions from Kim Pratt, *Unearthing injustice: A global approach to transition minerals* (2023), https://foe.scot/wp-content/uploads/2023/05/Unearthing-Injustice.pdf.

FAE4_LineOfFlight_Ecosystems_02 CROSSLUCID, Executed in 2024,
Still from *Line of Flight: Network* (AI-driven Moving Image, 00:01:16)

development and inter-organisational training programmes are two vehicles via which private and public funders can support the cultural sector in this process. Critically, however, funding should not be attached to the integration of specific systems; training curricula should be steered by independent or civic organisations.

Further, funders and cultural institutions that support artists working with advanced technologies need to attach key performance indicators (KPIs), and, following this, resources, to robust and accountable production pipelines as seriously as they are currently being attached to outputs (i.e. artworks, exhibitions and visibility). These production pipelines can be developed as general organisational capabilities for the wider public as opposed to being project-specific.[48]

→ Protocols for Organisational Interoperability

Devising new benchmarks and systems for deeper and longer-term collaborations between organisations across cultural, technological and civic ecosystems

The scale of challenges and opportunities presented by all advanced technologies, and AI specifically, means that impactful intervention necessitates a plurality of specialisations across cultural, civic, legal, technical and policy domains, in order to foster an environment where longer-term partnerships between and across contexts and sectors should be developed. Individual cultural organisations with the relevant capabilities should be encouraged to allocate capacity to engage in this specific type of partnership development, including setting up additional operational mechanisms (e.g., subsidiaries with missions that are legible to a distinct set of supporters). The cultural field is experienced and well-placed to act as a convening space; however, it requires a more dedicated approach to harnessing this capability.

Further, this type of activity can pave the way for the development of cross-sectoral protocols and policies for the adoption of AI systems

48. See Chapter 3 across all previous FAE publications: *Future Art Ecosystems 1: Art × Advanced Technologies* (2020), *Future Art Ecosystems 2: Art × Metaverse* (2022), and *Future Art Ecosystems 3: Art × Decentralised Tech* (2023), https://futureartecosystems.org/briefings/.

at an operational level. Within the cultural sector itself, the state should champion projects that allow the sector to study and understand itself as a whole in relation to wider societal dynamics. *Towards a National Collection*, supported by UKRI's Arts and Humanities Research grant, is an example of this phenomenon.[49] Research and innovation funding will be required for groups of cultural actors to organise around cross-cutting issues relating to new sectoral protocols for expanded data policies, the adoption of AI tools, IP standards and frameworks for engaging with private technology providers.[50, 51]

→ New Ownership and Distribution Models

Prototyping new models to achieve generative and equitable value distribution that supports producers and their communities

The current model of corporate, philanthropic and public funding for the cultural sector sets up a framework wherein cultural organisations are seen to be at the receiving end of a value exchange.

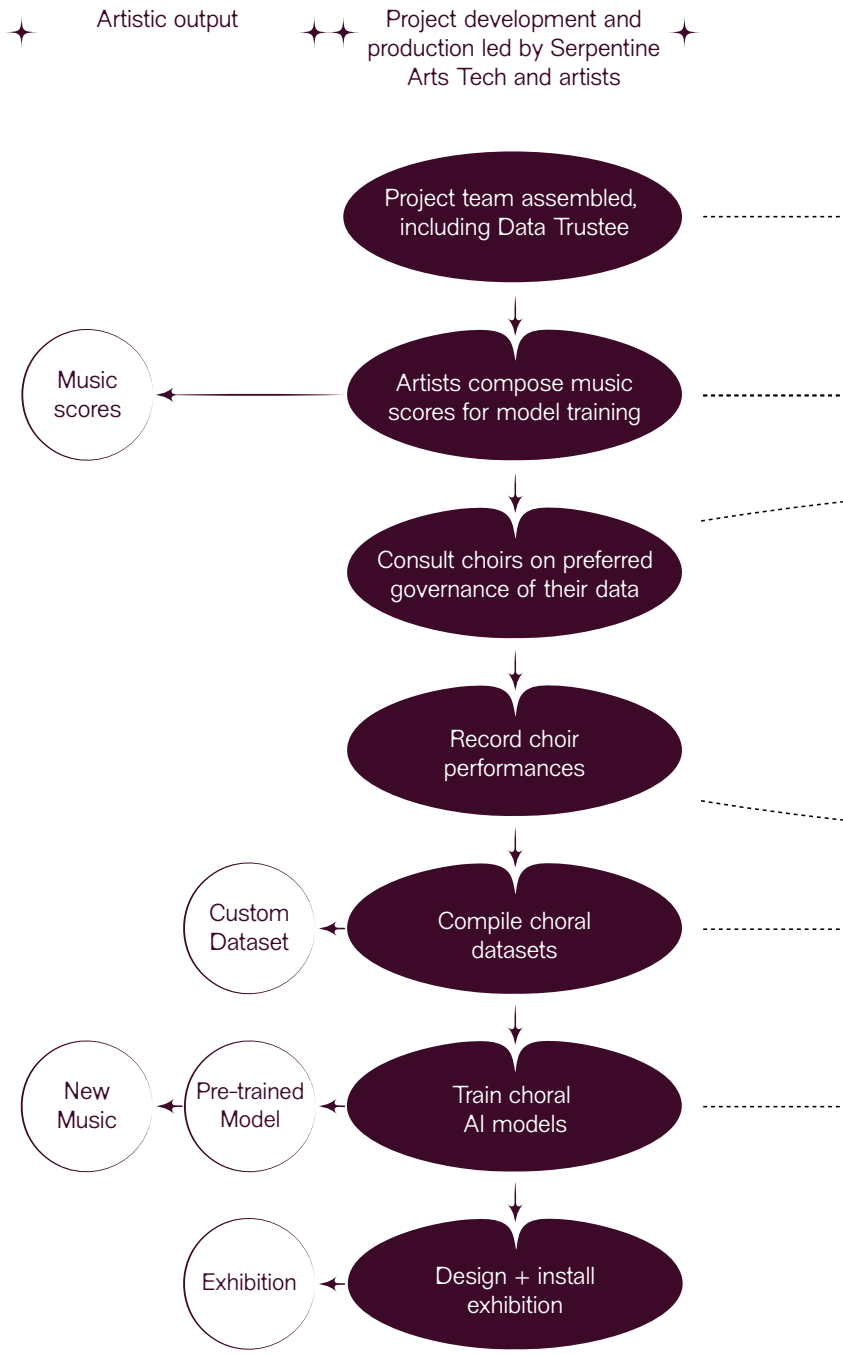
In order to shift this model, or to develop parallel ones, risks need to be taken. This means supporting AxAT (as well as non-AxAT) artists whose practices are experimenting with new formats of investment in and distribution of their work. This could also go beyond backing individual artists, providing a platform for audiences and other communities to assert their agency by contributing to and interacting with institutions in novel ways.[52] Organisations with the advanced production capabilities and the experience required to support AxAT artists are well-placed to develop and share these ownership and

49. *Towards a National Collection*, https://www.nationalcollection.org.uk.

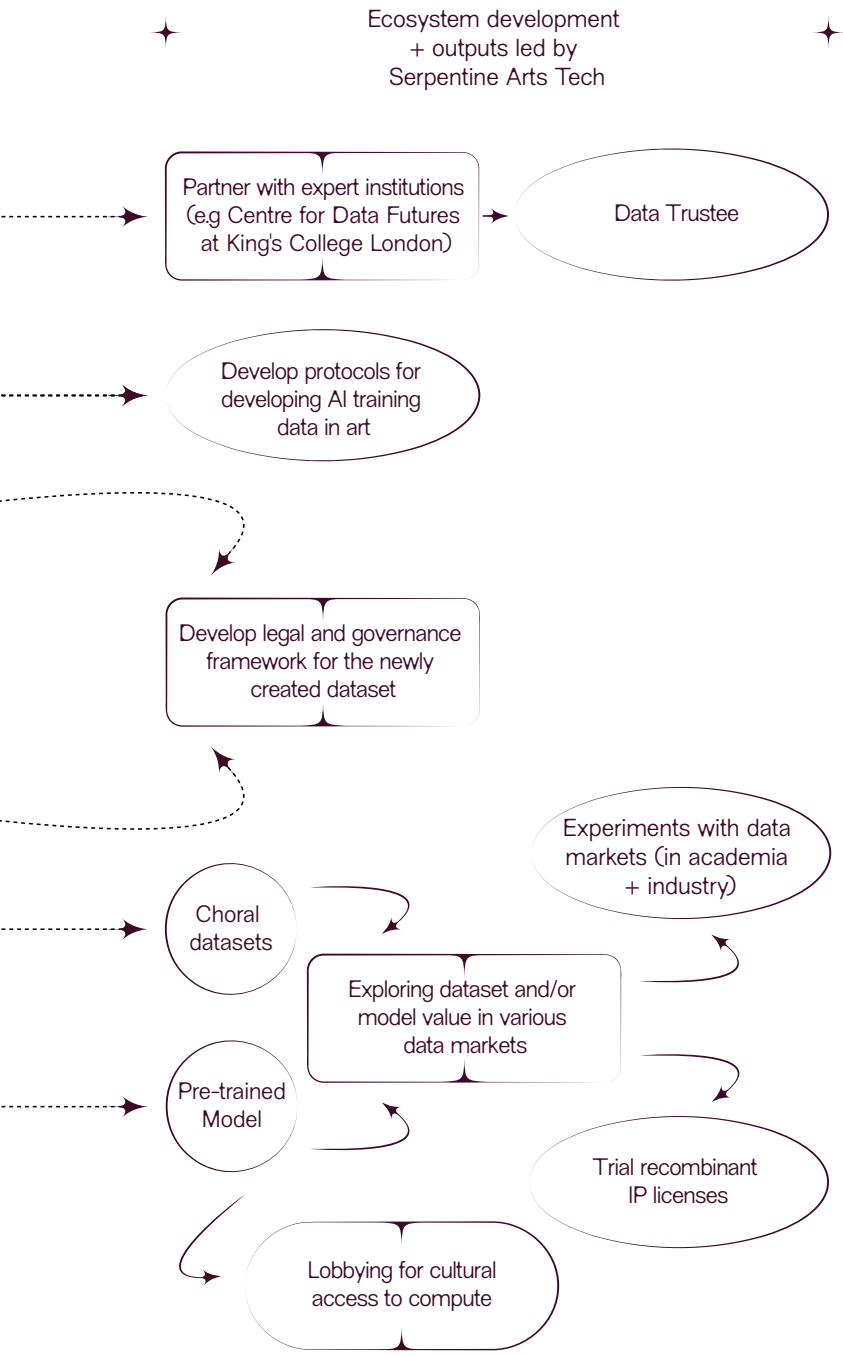
50. This could include developing a framework for facilitating public arts organisations (outside of major national institutions such as Tate and the V&A) with the relevant capabilities to lead on large-scale research and innovation projects in circumstances where they do not currently qualify to do so without a leading academic partner.

51. The Museums + AI Network, and the resulting *AI: A Museum Planning Toolkit* is an earlier example of this concerning the museum sector specifically, https://themuseumsai.network/toolkit/.

52. See *Partial Common Ownership, a stewardship system for art developed by Serpentine Arts Technologies and RadicalxChange*, https://www.radicalxchange.org/wiki/pco-art/.



A mapping of the organisational and mechanism design elements being tested out in relation to AI data and models as part of the Serpentine Arts Technologies commission with Holly Herndon and Mat Dryhurst 'The Call,' 2024–25.


Ecosystem development
+ outputs led by
Serpentine Arts Tech
Partner with expert institutions (e.g Centre for Data Futures at King's College London)
Data Trustee
Develop protocols for developing AI training data in art
Develop legal and governance framework for the newly created dataset
Experiments with data markets (in academia + industry)
Choral datasets
Exploring dataset and/or model value in various data markets
Pre-trained Model
Trial recombinant IP licenses
Lobbying for cultural access to compute

distribution prototypes across the AxAT ecosystem, but, more significantly, to share them across the wider cultural sector and beyond. Additionally, supplementary supportive measures need to be taken (e.g., wider cross-sectorial partnerships, the creation of new entities, wider funding) to allow for the cultural sector to shape new markets in this way.

→ New Systems of Measurement

Moving beyond footfall and media visibility as the dominant metrics of success, and devising new measurement systems for communicating the value of AxAT in society

Development of new AxAT categories of metrics and approaches is contingent on progress within the three areas discussed previously. For example, advancing production capabilities and ownership models that deliver thick public claims on resources such as data, modelling and compute, and forming mission-driven coalitions with partners, will, by default, require a different set of metrics to assess the project from those called for by audience and media engagement through footfall and clicks. Long-term or cross-sectoral impact metrics would better capture the impact of such projects.

Recommendations for a Proactive AxAT Participation in Public AI

Asserting agency and strategic intention within the evolving AI stack not only requires the infrastructural foundations detailed above, but also a vision for the role that AxAT (and some parts of the cultural sector) should play as an intermediating space between technological and societal transformations. One of the unique features of AxAT, in contrast to many other art ecosystems, is how operational experimentation lies at the heart of the AxAT production process, both for artists and organisations. The development of AxAT projects straddles technical, legal, operational and creative processes. They lead not only to the emergence of a new artwork (or other form of public output), but to various insights emerging from the entanglement between these processes and associated cross-sectorial communities. What would

it mean to commit to these prototyping affordances of the AxAT ecosystem for the advancement of public AI?

Sandboxing of New Organisational Practices and Forms

Functionally, what AxAT has to offer is the development of practices and potential new organisational forms for the data and model layers of the AI stack (and, to a lesser degree, the compute layer) as public resources. This is usually delivered in the context of projects that involve the typical cohort of AxAT stakeholders: artists, arts institutions, technologists, technology companies, public bodies, audiences, specialist communities (e.g., researchers, experts from other fields and universities) and funders. The three vectors listed below offer only a handful of potential sandboxing experiments that the authors of FAE have tied to the creative R&D focus of Serpentine Arts Technologies projects. There is ample remit within these vectors for a multiplicity of approaches and stakeholders.[53]

→ Public Data Market Mechanisms

Speedrunning and developing early operational frameworks for data stewardship, data bargaining, data valuation and stakeholder coordination of data

While the contested scraping of the open internet has been a norm in AI development until the present, new data markets, provenance standards, data brokers and newly formulated relations to data subjects, who collectively bargain for the value of their networked data, are likely to emerge. These marketplaces will probably be largely automated but will require new platforms, vendors, pricing and validation mechanisms, and stewardship protocols. This presents an opportunity

53. For example, Transfer Data Trust offers a specific approach to the role that trusts can play in AxAT, setting up a model that 'integrates the perpetual purpose artist trust with cooperative organisational structures', https://transfergallery.com/data-trust/#:~:text=TRANSFER%20Data%20Trust%20is%20a,in%20TRANSFER's%20decade%2Dlong%20journey.

to build a new landscape with thick public resource distribution. AxAT projects can become laboratories for testing all the components of a data market with a variety of stakeholders, determining ownership, governance, advocacy and pricing mechanisms of different datasets, and how they are informed by the data relations of the cultural context. Working with research initiatives in university, policy and industry settings can offer an opportunity to bridge these insights with policy and design work that will inform future data markets.

→ New IP Paradigms

Testing out networked IP, recombinant IP, and creative licensing as a means of evolving and/or departing from the inherited copyright-focused frameworks for protecting IP within the cultural context

We are in a historical moment when individual creators, legacy institutions and media (e.g., The Natural History Museum, *The New York Times*), entertainment corporations (e.g., Disney), and some platforms (e.g., Reddit), find themselves, however briefly, within a relatable struggle to assert their rights in an uncertain climate relating to IP ownership and the governance regime for training AI models. In a world where infinite media can be generated without specialist technical know-how, users will want to find ways of accessing and remixing media at a new depth and scale. They will generate new content inside existing worlds, or build their own with derived assets, or some combination of both. The move towards a highly personalised media landscape means that IP holders of the current media landscape (artists, institutions and conglomerates) may need to experiment with different reconfigurations of ownership. For example, one potential reconfiguration could be motivated by creating more flexible licensing frameworks to ensure that users can personalise and fork characters, lore and worlds, and reintegrate new recombinant media into their social online interactions. More generally, new online media dynamics will necessitate participation mechanisms that protect users from extractive AI training practices, whilst still allowing for circulation as a norm for online interactions.

The focus here is on the exploration of constructing the legal-technical layer for new media interactions through the development

of networked and/or recombinant IP (i.e., IP that is sensitive to recombinant media creation as a new normal). New IP categories and their technical implementation can build on data governance experiments in the art and civic contexts, and extend to the licensing of small-scale models where a narrow remit means they can be more precise, experimental and less resource-intensive. The proliferation of such trusted models will underpin new economies and services that public organisations are well placed to provide.[54] These new frameworks can take the networked nature of artistic production, creative inspiration and audience interaction dynamics into account to map out relational, collective and fluid ways of assigning different levels of contribution, attribution, ownership and rights. AxAT organisations, artists and projects could combine efforts with groups who can leverage these learnings to lobby and advocate at policy and developer community levels.[55]

→ Early cross-technological use-cases

Supporting the development of blockchain × AI digital economies for artists and new AxAT organisations

Virtual production and blockchain integration for the creative economy are two (potentially overlapping) spaces where the AxAT ecosystem has the opportunity to shape the integration of AI systems. While experiments in new IP paradigms and public data market mechanisms will be critical for setting some of the terms for a space that is being completely transformed by AI, how this intersects with virtual production and blockchain technologies will then redefine the roles and rights of 'content creators'.

Certain AI tools will soon be proficient at creating 3D virtual assets and self-programming virtual worlds. Coupled with open-source interoperability mechanisms such as the Universal Scene Description (USD)

54. Currently Hugging Face serves as a community hub for collating different licences that are being deployed by developers working with AI models, https://huggingface.co/docs/hub/en/repositories-licenses?search=true.

55. SAG-AFTRA is working on a new licence for voiceover actors to safely explore new job opportunities in the 'digital voice twin' landscape, https://www.sagaftra.org/sag-aftra-and-replica-studios-introduce-groundbreaking-ai-voice-agreement-ces.

file format, a major transformation of production pipelines for various media industries and artists is likely underway, with the potential to disrupt the huge film, TV, advertising and online marketing labour markets.[56, 57] Users, and thus artists, will soon be in a position, at least for a short period of time, where they can access exactly the same open source, and often interoperable, toolkits as those used by industry as products are tested and improved by the tool and platform developers. This will shift the models for how virtual worlds, animation, 3D, and any other modes of CGI production are structured, ultimately lowering the costs for production (though potentially only temporarily) with less requirement for niche technical specialisms.

As new operational and business models will start to emerge at the scale of media and entertainment industries, the art field's capacity to be positioned alongside industry players will be contingent on a robust AxAT ecosystem that can incubate new skills and production pipelines, and lobby for how new economic and distribution models will benefit a broad cross-section of creative sectors and society.[58]

A similar dynamic may unfold as the market for the integration of blockchain and AI technologies starts to emerge.[59] Blockchain's core affordance of providing a decentralised immutable ledger for various information flows such as decisions and transactions could address some of the systemic risks and challenges that AI poses for tracking

56. Universal Scene Description (USD), an open-source framework developed by Pixar for describing, composing and reading 3D scenes, is at the core of platforms such as NVIDIA's Omniverse, which is a developer platform that allows for persistent interoperability and therefore real-time distributed collaboration when developing CGI projects without requiring access to each other's tools.

57. Deloitte's *TMT Predictions 2024* (2024), https://www.deloitte.com/content/dam/Deloitte/at/Documents/technology-media-telecommunications/at-tmt-predictions-2024.pdf.

58. CoSTAR, the UK R&D network for Creative Technology, is a UKRI funded programme to support world-leading R&D into screen and performance technologies to build UK-based capabilities and economies across media and the creative industries, but it does not include the art field, https://www.ukri.org/councils/ahrc/remit-programmes-and-priorities/convergent-screen-technologies-and-performance-in-realtime-costar/.

59. *AI and Blockchain. The New Power Couple*. https://kpmg.com/us/en/articles/2023/ai-blockchain-new-power-couple.html.*Ecosystems 3: Art × Decentralised Tech*, https://futureart-ecosystems.org/briefing/fae3/.61. Jacob Horne, *How AI Is Finding Its Way Onchain* (2024). https://zora.co/writings/ai-plus.

of provenance, attribution and verifiability. The art context served as an early prototyping space for blockchain-based digital markets, as well as niche cultural experiments around governance, smart contracts, mechanism design and decentralised autonomous organisations (DAOs). The confluence of these factors makes AxAT a fertile context for trialling the ways in which blockchain's and AI's technological capabilities can mutually support each other.[60] For example, prioritising how the provenance of recombinant media worlds can be traced using blockchain technology could become a game-changer for artists and users more generally, allowing for more layered and nuanced compensation frameworks to emerge for recombinatory contributions to new media worlds (e.g., datasets, models and model artefacts).[61]

→ Lobbying for deeper AI systems access and compute quotas on behalf of the cultural sector

Utilising cultural reputation, technical literacy, insight and strategic understanding of the technology sector to negotiate on behalf of the cultural sector

Access to deeper levels of AI systems than those offered by increasingly consumer-facing AI products and services built on closed foundation models will be critical for artists to work with these systems as creative media, and for the cultural sector to lobby on behalf of creatives and the sector. Meanwhile, for artists and institutions who want to train their own models, access to compute or partnerships with compute providers will be essential. In order to ensure that compute privileges don't only reach those who are able to negotiate for them, a campaign for 'public cultural compute' should include leading AxAT organisations and actors, including setting up a public cultural compute bank.

Plural and concerted ecosystemic action today means that the AxAT ecosystem can articulate *de facto* precedents that either serve as experiments or help to shape forthcoming legislation and cultural norms around AI. Outside of the EU's AI Act few jurisdictions have taken

60. See *Future Art Ecosystems 3: Art × Decentralised Tech.* https://futureartecosystems.org/briefing/fae3/.

61. Jacob Horne, *How AI Is Finding Its Way Onchain* (2024), https://zora.co/writings/ai-plus.

a comprehensive approach to regulating AI. The UK has set up a number of AI-related bodies, but has yet to legislate.[62] As these bodies concretise policy, there is an opportunity for the cultural sector to make use of the AxAT ecosystem in order to test inter-organisational policies and standards, as well as to leverage the 'Brussels Effect,' where necessary, in order to embed measures that allow public AI to blossom.[63]

62. See Deloitte's overview, *The UK's Framework for Regulating AI. Agility is Prioritised but Future Legislation is Likely to Be Needed*, https://www2.deloitte.com/uk/en/blog/emea-centre-for-regulatory-strategy/2024/the-uks-framework-for-ai-regulation.html.

63. The term 'Brussels Effect' refers to the influence of EU regulatory legislation on big tech outside of the EU's discrete jurisdiction. See *The Brussels Effect and Artificial Intelligence*, https://www.governance.ai/research-paper/brussels-effect-ai.

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Beyond Matter. An Inquiry into the Modes of Exhibition Practices in the Virtual Condition

Lívia Nolasco-Rózsás

Beyond Matter. Cultural Heritage on the Verge of Virtual Reality (2019–23) [fig. 1] was an international, collaborative, practice-based research project. It engaged with a contemporary shift in the production and mediation of visual art within institutional frameworks that is largely attributable to the rapid development and ubiquitous presence and use of computation and information technology, specifically augmented and virtual reality but also artificial intelligence.

Figure 1: Logo of the project *Beyond Matter*, 2020. Design by AKU Collective.

The shift is seismic and it is leading to a condition that may be summarised as 'the virtual'. If the postmodern condition was a 'crisis

of narratives', as Jean-François Lyotard put it,[1] then the virtual condition reveals a crisis of dichotomies. Its analysis suggests that dichotomies are losing their validity: presence and absence, physical and computer-generated, real and simulated. The algorithmically generated increasingly dominates our reality, intertwines the physical with the virtual, and skews the linearity of time. This has extensive implications for the spatial aspects of the curation and mediation of visual arts, as well as their reception by a public whose affinity for technology is ever-increasing. The museum transmogrifies into a hybrid entity whose geographical location is extended by various digital platforms; instead of one, there is an affluence of exhibition spaces, an extended but also porous system of multiple dimensions.

The virtual condition is thus a tendency in cultural spheres toward the interdependence of physical and digital spaces, as well as the coexistence of multiple exhibition temporalities for art's mediation and reception. It is based on an ontological perspective of virtual realism that considers the virtual to be as real as the physical. It relates to and results from a dynamic genealogy of culture-related general conditions, such as Jean-François Lyotard's postmodern condition (1979), in which the metanarratives that were a quintessential feature of modernism had become generally untenable; the post-medium condition described two decades later by Rosalind Krauss; or Peter Weibel's post-media condition as new technologies and telecommunications infiltrating the arts. It overlaps with various other contemporary conditions, such as the digital condition identified by Felix Stalder, the planetary condition by Yuk Hui and the curatorial condition by Beatrice von Bismarck.[2]

The *Beyond Matter* project scrutinised the virtual condition in art production and mediation by means of practice-based research, resulting in a plurality of media that include virtual and augmented

1. Jean-François Lyotard, *La condition postmoderne: rapport sur le savoir* (Paris: Éditions de Minuit, 1979).

2. For relevant literature see Rosalind Krauss, *A Voyage on the North Sea: Art in the Age of the Post-Medium Condition* (London: Thames & Hudson, 1999); Peter Weibel, 'The Post-Media Condition', Arte ConTexto, no. 6 (2005): 11–15; Felix Stalder, *The Digital Condition* (Cambridge: Polity Press, 2018); Yuk Hui, *Art and Cosmotechnics* (Minneapolis: University of Minnesota Press, 2021); and Beatrice von Bismarck, *The Curatorial Condition* (Berlin: Sternberg Press, 2022).

realities, digital models and digital artworks, presented in a network of computer-based and physical exhibition spaces that generated hybrid experiences.

The creation of generative networked spaces to display art and produce knowledge is not a novelty: it has unfolded hand in hand with the development of computation's ability to visualise simulated or generated spaces that may or may not resemble our observable surroundings and the ways in which we perceive them.

Throughout the *Beyond Matter* project various activities took place that have resulted from the practice-based research on the virtual condition undertaken by the partner institutions. Through a common endeavour, the partners aimed to produce a 'pool of tools'[3] and related knowledge to help arts practitioners, curators and museum professionals understand the shift described above and then plan and use best practices. Putting an emphasis on the spatial aspects of art production, curation and mediation, the project included the digital revival of selected past landmark exhibitions, the curation of new art and archival exhibitions, conferences, artist residency programmes, an online platform and publications. These multiple actions were based on the virtual condition and also reflected on it.

Beyond Matter was led by ZKM | Center for Art and Media Karlsruhe, and the collaborators comprised of researchers and curators at: Aalto University, Espoo; Centre Georges Pompidou, Paris; Ludwig Múzeum — Kortárs Művészeti Múzeum (Ludwig Museum — Museum of Contemporary Art), Budapest; Tallinna Kunstihoone (Tallinn Art Hall); Tirana Art Lab — Center for Contemporary Art; and the associated partners EPFL Pavilions, Lausanne; HAWK — University of Applied Sciences and Arts, Hildesheim, GIM Gesellschaft für Innovative Marktforschung mbH, Heidelberg and Bio Design Lab at the HfG Karlsruhe. These are institutions of varied scales and profiles with a shared interest in the innovative use of digital technologies to reach non-local audiences, to expand their exhibition spaces digitally,

3. The expression 'pool of tools' was used by Peter Weibel in the context of the exhibition *Renaissance 3.0* (2023–24, ZKM | Karlsruhe).

and to create hybrid access to the content they wish to mediate. With this project they each tread upon new territory.

At the heart of *Beyond Matter* was an exploration of the potential harbored in computer-generated exhibition spaces. The key focus areas, examined through an array of approaches, were formed by notions of space and their meaning in the context of artistic and exhibition practice, as well as by perceptions of the reciprocal relationship between computer-generated virtual and physical spaces — and the immersive features in them — from the point of view of all actors in the constellation of an exhibition.[4] This exploration manifested variously throughout the projects, for example in the modelling of two historical exhibitions or through inviting artists to elaborate their take on the virtual from diverse angles.

In the context of art production and mediation, the word 'virtual' often appears together with 'reality'. Virtual reality is predominantly understood as a term for computer-aided interactive and immersive environments accessed via screened images and in many cases additional devices (such as head-mounted displays). Dissecting the term 'virtual reality', including its etymology, aids in understanding the condition brought about by the technological opportunity to create relatively sophisticated representations of anything we can perceive and calculate digitally. Indeed, deconstruction serves as a basis for constructing new terms, which in turn serves to contextualise art production and mediation. Donna Haraway came up with a seemingly deconstructive yet genuinely constructive method to evolve the abbreviation 'SF' into versatile pairings of words.[5] Generally standing for science fiction, SF was subjected to a word game as Haraway formulated other terms that it could stand for, all of which relate in meaning to science fiction or offer an alternative to it, such as 'speculative fabulation' and 'string figures'. Inspired by how all these new SF terms joined Haraway's arsenal of methodologies, we applied her formula to 'VR' and found that it could stand for a variety of

4. The term 'constellation' is used here in the sense that Beatrice von Bismarck used it in *The Curatorial Condition* (Berlin: Sternberg Press, 2022).

5. See Donna Haraway, *SF: Speculative Fabulation and String Figures/ SF: spekulative Fabulation und String-Figuren, So Far, 100 Notes — 100 Thoughts/ 100 Notizen — 100 Gedanken*, documenta (13) (Ostfildern: Hatje Cantz, 2011).

terms beyond virtual reality: viral radiation, valid readings, vaporous restoration, variable relations, visible revision, visionary ramblings and many more.

The final publication, which summarised the project under the title *Beyond Matter. Within Space. Curatorial and Art Mediation Techniques on the Verge of Virtual Reality*[6] took these enfoldments of VR as an initial set of points to frame the *Beyond Matter* endeavour. Each chapter took one enfoldment as its initial point and elaborated on the newly coined term through commissioned essays and descriptions of the outputs of the practice-based research conducted throughout the project, or, in the case of the last chapter, through interviews with the artists and scholars who participated in the *Beyond Matter* residency programme.

The first large-scale exhibition organised in the framework of *Beyond Matter: Spatial Affairs* took place in 2021, in the midst of the COVID-19 pandemic. The various waves of lockdowns made planning of public events, travel and workflows challenging. Throughout this time, art institutions largely relied on online formats. Spatial online art mediation formats had constituted the main focus of *Beyond Matter* before the pandemic-related lockdowns accelerated this process of digital expansion.

Along with the physical international group show *Spatial Affairs*, presented at Ludwig Museum — Museum of Contemporary Art in 2021 and the online environment that enhanced it under the title *Spatial Affairs. Worlding — A tér világlása*,[7] the Hybrid Museum Experience Symposium (HyMEx)[8] [fig. 2] laid the groundwork for long-term collaborative research regarding the problematic of the

6. *Beyond Matter, Within Space. Curatorial and Art Mediation Techniques on the Verge of Virtual Reality,* ed. Livia Nolasco-Rózsás, Marianne Schädler (Berlin: Hatje Cantz, 2023). The online version of the book is available open access: https://withinspace.beyondmatter.eu.

7. *Spatial Affairs* was curated by Giulia Bini and Lívia Nolasco-Rózsás. The catalogue of the exhibition includes texts by Sven Lütticken, Ádám Lovász, Ceci Moss and the curators. *Spatial Affairs*, ed. Giulia Bini, Lívia Nolasco-Rózsás, Jan Elantkowski, Fruzsina Feigl, Borbála Kálmán (Berlin: Hatje Cantz, 2021).

8. The Hymex Symposium was convened by Borbála Kálmán and Lívia Nolasco-Rózsás. The proceedings of the symposium are available online: http://hymex2021.ludwigmuseum.hu/.

Figure 2: Screenshot of the online exhibition *Spatial Affairs. Worlding — A tér világlása* (2021), https://spatialaffairs.beyondmatter.eu/en. Design and programming by The Rodina. Curated by Giulia Bini and Lívia Nolasco-Rózsás.

Figure 3: Screenshot from the *Tirana Floating Archive* (2022), https://tiranafloatingarchive.org/. Curated by Adela Demetja, design by Denislav Golemanov.

dichotomy between the virtual and actual exhibition space. Pre- and post-computational approaches from the interwar avant-garde through Conceptualism to very recent works of art were selected for Spatial Affairs, and they point at the mutual dependence between the algorithmically created and the palpably real. At its conceptual core, the exhibition investigates the binary relationship between the actual and the virtual, the real and the possible, as it evaporates into a multidimensionality in which the only betrayed party is dualism, leading to exploded axes of complex and multiplied notions of space.

Beside *Spatial Affairs*, the *Tirana Floating Archive* [fig. 3] was conceived as a virtual space that mediated curated artistic knowledge and aesthetic components that are unbound from where their physical carrier is actually situated, or where their exhibition takes place. These spaces offer answers to queries about the significance of the space of the exhibition after the post-digital turn, and how art institutions can react to this paradigmatic shift.

Another project on the verge of physical and digital was the travelling exhibition *Matter. Non-Matter. Anti-Matter*,[9] with a specific focus on its extended iteration at ZKM | Karlsruhe. Each presentation of this exhibition, varying in size and context, had the same element at its core: *The Immaterial Display*, a hardware installation developed to present digital exhibition spaces — also described in the chapter. The two digital exhibition models shown on the display engaged with *Iconoclash* and *Les Immatériaux*. Based on those two paradigmatic exhibitions, the exhibition and its accompanying programme explored the possibilities of virtual exhibition histories.

Taking up the case studies of *Les Immatériaux* (Centre Pompidou, 1985) [fig. 4] and *Iconoclash. Beyond the Image Wars in Science, Religion, and Art* (ZKM | Karlsruhe, 2002) [fig. 5], Centre Pompidou and ZKM | Karlsruhe committed themselves to examining the possibilities of exhibition revival through experiential methods of digital and

9. The exhibition travelled to Tallin Art Hall (2021), Tirana Art Lab (2022), Oodi Library Helsinki, Design Museum Helsinki, Aalto University. Its extended version, including a large selection of artworks based on both past exhibitions, was presented at ZKM | Karlsruhe (2022–23). Another selection with the focus on *Les Immatériaux* was on display at the Centre Pompidou, Paris (2023–24).

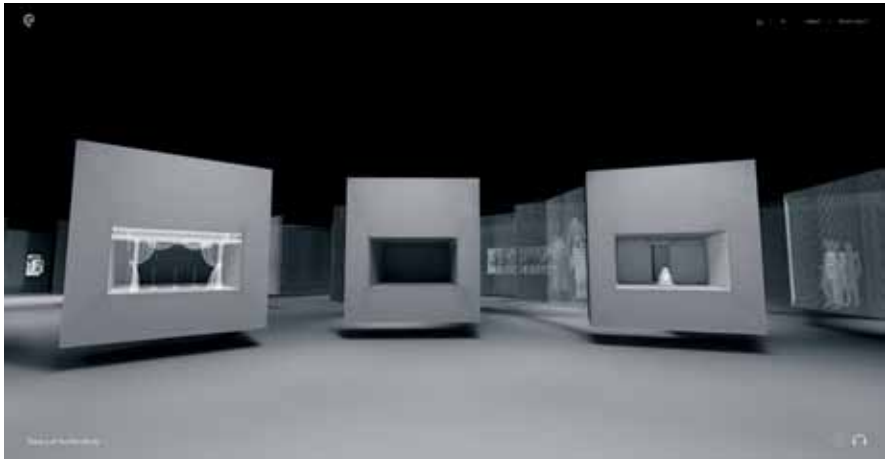

Figure 4: Screenshot *Les Immatériaux: A Virtual Exhibition* (2022) https://lesimmateriaux.beyondmatter.eu/. Concept by the New Media Department of the Musée national d'art moderne-centre de création industrielle, design concept by Aalto University, project management by Matthias Heckel, software development by Netzbewegung GmbH, archival research by Andreas Broeckmann and Marie Vicet.

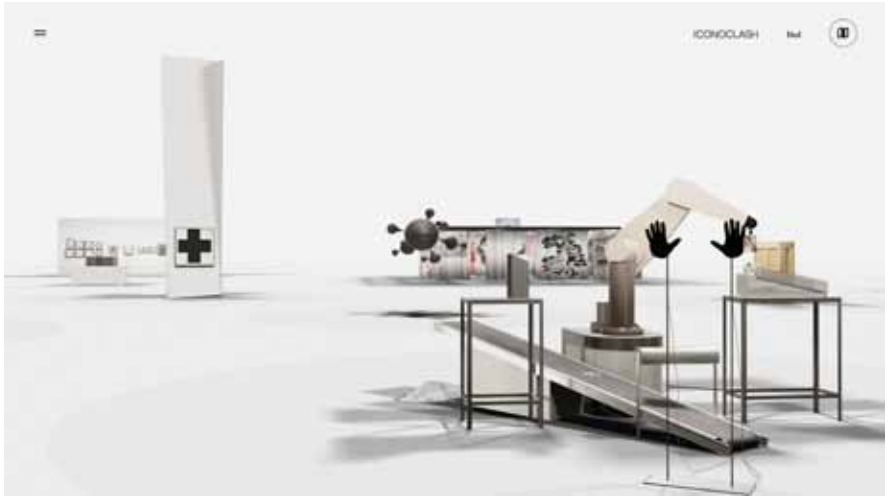

Figure 5: Screenshot from *Iconoclash as a Digital Experience* (2022), https://iconoclash.beyondmatter.eu/. Concept by Lívia Nolasco-Rózsás, UI/ UX and motion design by Matthias Heckel, software development by Netzbewegung GmbH, archival research by Felix Koberstein. © ZKM | Zentrum für Kunst und Medien Karlsruhe

Figure 6: Exhibition view of *Matter. Non-Matter. Anti-Matter. Past Exhibitions as Digital Experiences* (2022–23) at ZKM | Center for Art and Media Karlsruhe. Photo: Esteban Gutierrez Gimenez. © ZKM | Zentrum für Kunst und Medien Karlsruhe

spatial modelling. Both past exhibitions constituted complex thought experiments deployed through and manifested in space. Both also experimented with innovative ways of juxtaposing scientific, technological and artistic practices. In their respective ways, *Les Immatériaux* and *Iconoclash* proposed the exhibition as both a medium and an interface with a different level of reflection and creativity.

The models were created with a non-physical and non-reconstructive approach, denoted as 'Vaporous Restoration' aiming at the emulation, modelling, or proxy-creation of the two selected past spatial assemblies of artworks. These virtual exhibition models[10] are based on extensive archival research, interviews with experts and the curators, and an iterative design process among a large interdisciplinary group. The chosen exhibitions were well-known, complex, self-reflexive instantiations of the medium that outlined escape routes from modernity while elaborating on notions of representation and materiality.

10. Both can be visited online: https://iconoclash.beyondmatter.eu and https://lesimmateriaux.beyondmatter.eu.

The digital models inevitably prompt the question of whether the aura of an artwork, or even of the entire exhibition, can be migrated into the digital realm.

Inspired by a quote of Walter Benjamin,[11] one of the main objectives of *Matter. Non-Matter. Anti-Matter* [fig. 6] was to revisit, restore and re-present these past exhibitions in our spaces using digital technology. The exhibition presented digital models of the two past exhibitions on *The Immaterial Display*, a hardware apparatus newly developed for explorations of virtual exhibitions. The models' online launch took place in conjunction with the exhibition opening on 2 December 2022. A selection of artworks and artefacts attested to art's conceptual dematerialisation and digital rematerialisation. Some artworks were specially commissioned for the exhibition, while others largely came from the collections of Centre Pompidou and ZKM | Karlsruhe, many of which were exhibited in *Les Immatériaux* or *Iconoclash* or both.[12]

The tension between presence and absence and the digital dissolution of the dichotomy between the two was phrased as 'Variable Relations' throughout the project. This connotes the multiplicity of connections between visitors, artworks, artefacts, scenographies, curatorial concepts, artists, scholars, museum professionals, objects and subjects. These new relations across virtual and physical spaces give rise to an epistemological shift that manifests in the *Beyond Matter VIEW Platform*,[13] or in the virtual exhibition platform of Tallinn Art Hall.[14]

The evaluation methods applied within the project are also discussed here. Performance-oriented research and audience and community

11. 'The true method of making things present is to represent them in our space (not to represent ourselves in their space).' Walter Benjamin, *The Arcades Project*, trans. Howard Eiland and Kevin Mc Laughlin (Cambridge, MA: The Bellknapp Press, 1999), 206. First published as 'Das Passagen-Werk', in *Gesammelte Schriften*, Vol.5.1, ed. Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt/Main: Suhrkamp, 1982).

12. Creation of the exhibition models was a collaborative effort of many researchers. They couldn't have been realized without the MA Fellowship Program of the Aalto University, coordinated by Cvijeta Miljak.

13. https://beyondmatter.eu/projects.

14. https://kunstihoone.virtualexhibition.eu.

studies[15] were conducted, and followed *The Immaterial Display* on its journey through Europe, while an evaluation automaton was developed and used to evaluate the digital content and interfaces in a hybrid exhibition qualitatively and quantitatively.

Beside practice-based research, *Beyond Matter* enabled artistic research and creation. A residency programme[16] saw fourteen artists join one of three participating institutions. Due to pandemic travel restrictions, not all resident artists and researchers could be present at the host institution and some had to develop and/or exhibit their residency project online. *The Beyond Matter VIEW Platform* contains the entirely online environments and the online parts of larger projects by some of the artists. Despite these logistical challenges, all the results of the residencies could be exhibited or performed in one or another framework provided by the *Beyond Matter* project — in the *Matter. Non-Matter. Anti-Matter* exhibition in Tirana, at ZKM, or as part of the group show *Immerse!* at Tallinn Art Hall.[17]

Beyond Matter entangled and intertwined formats, actions, processes and results; it had a complex project architecture. Each partner contributed a layer of research and was involved in different activities. Beyond Matter has also engendered new content — through exhibitions, symposia, discussions and publications — but it also facilitated professional exchange between art institutions, mainly within European countries, contributed to cultural professionals' skillsets around digital mediation formats, and fostered a transnational mobility of artworks and arts professionals. The project also contributed to the digital commons through digitised archival materials and the development of open-source software that is available online and usable by any other cultural organisation wishing to provide online access to the cultural heritage in its guardianship.

15. Lily Díaz-Kommonen and Cvijeta Miljak, affiliated with Aalto University conceived and conducted the evaluation.

16. The residency programme took place in three institutions: Tallinn Art Hall (curated by Corina Apostol), Tirana Art Lab (curated by Adela Demetja), ZKM | Karlsruhe (coordinated by Felix Koberstein).

17. The exhibition *Immerse!* (2023) was curated by Corina Apostol and Lívia Nolasco-Rózsás. Its catalogue was published with texts by Matthew Fuller, Helen Kaplinsky, Lukáš Likavčan, Zsolt Miklósvölgyi, Márió Z. Nemes and the curators. *Immerse!*, ed. Corina L. Apostol, Lívia Nolasco-Rózsás, Berlin: Hatje Cantz, 2023.

Figure 7: Screenshot from the *Generic Exhibition Platform* (2023), https://genericexhibitionplatform.beyondmatter.eu/. Concept by Lívia Nolasco-Rózsás, UI/ UX and motion design by Matthias Heckel, software development by Netzbewegung GmbH. © ZKM | Zentrum für Kunst und Medien Karlsruhe.

A further outcome of the Beyond Matter project is the *Generic Exhibition Platform* [fig. 7]. Primarily developed for the digital emulation of *Iconoclash*, it is an AI-based software tool that facilitates the generation of digital exhibition spaces. An exemplary online environment demonstrates the features of the software, which seeks to encourage museums, art organisations and cultural professionals to benefit from the open-source tool for the creation of digital exhibitions of their own. In the interest of the participatory and democratic sharing of resources, the software is freely available on the GitHub account of ZKM | Karlsruhe.

For the creation of a new digital exhibition, digital objects (in the form of digital 3D assets), must be uploaded into the respective Content Management System of the generic exhibition platform, alongside information on the assets (author, title, description, etc.), and keywords. Without the digital objects, the exhibition space is an uninterrupted plane. The space is defined by the objects and the user and the ever-evolving relation between these two agents.

The algorithm developed for the generic exhibition platform determines the position of the digital 3D objects within the digital exhibition space. The profile of an exhibit is described by the values

of predefined tags. By observing an exhibit over a certain period of time and spending time in its activity zone, the user profile of the visitor is defined. The similarity between all exhibits and the visitor is calculated continuously. The visitor attracts exhibits that share coinciding levels of similarity with their user profile.

As the examples show, the project laid down possible directions for practice-based research and creation in non-academic environments such as art centres, museums, art halls or art labs in the hope that not only the outcomes but also the methodologies elaborated over the last four years will prevail, that art institutions will carry on with digital world-making and create online platforms that function as assemblies, that hybrid experiences in art mediation will soon be widely accepted, and AI-based construction of digital platforms for sharing knowledge will become ubiquitous.[18]

18. This text is largely based on the introduction to the project in the publication *Beyond Matter. Within Space*.

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Training the Archive. A Research Project on Automated Structuring of Museum Collection Data to Support Curatorial Practice

Dominik Bönisch

Project Design

If you work in an art museum and have access to the collection in preparation for exhibitions, you have the demanding task of deciding which artworks will be on display and which will remain hidden in the depths of the depot. It is likely that there will be a natural limit to the number of pieces you, as a curator, can remember and consider. Perhaps there is a well-structured database in-house that you can skip through from A to Z, but maybe this information is not yet available. What happens to the shadow existence of the overlooked artworks?

Training the Archive (2020–23) emerged from this question and aims to investigate the possibilities and risks of so-called 'artificial intelligence' or AI, or more precisely the use of machine learning in automated structuring of museum collection data to support curatorial practice. The research project is dedicated to the question of how machine learning

algorithms[1] can be used to create new contexts in digitised archives and to explore the technology regarding a possible application in museum practice. It is a joint project[2] of the Ludwig Forum for International Art Aachen and the HMKV Hartware MedienKunstVerein, Dortmund, in cooperation with the Visual Computing Institute of the RWTH Aachen University. The aim of the project is the research-based development of a software — the so-called *Curator's Machine*[3] [fig. 1] — which enables curators to gain new access to image collections by collaborating with the machine. The software will automatically retrieve both visual similarities and semantic relations between objects in digital collections. This will help to structure and prepare large amounts of information in digital museum archives to find and select artworks or artists from the museum collection on specific search prompts.

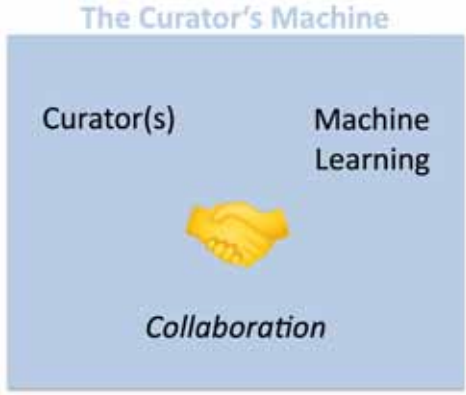

Figure 1: Illustration of the concept for the *Curator's Machine*. Credit: Dominik Bönisch, 2021.

1. An algorithm is a mathematical equation or a set of rules for solving a task. In artificial intelligence, the algorithm determines for the machine how to find solutions to a problem step by step. This is deemed machine learning. Thereby, the technical systems use many different types of layered algorithms that are reliant on a large amount of training data.

2. The project is funded by the Digital Culture Programme of the Kulturstiftung des Bundes (German Federal Cultural Foundation). Funded by the Beauftragte der Bundesregierung für Kultur und Medien (Federal Government Commissioner for Culture and the Media).

3. The term refers to Tillmann Ohm's work *The Artist's Machine*, a computer-generated publication that was automatically written and laid out by the ARCU (Artificial Curator) algorithm, after the artist posed a research question as input.Tillmann Ohm, *The Artist's Machine* (Thesis Commons, 2018), https://doi.org/10.31237/osf.io/tj6yf.

Prototyping the Curator's Machine

In order to incorporate the curators' historical, stylistic and object-related contextual knowledge, a process of human-machine interaction is significant. Based on Lev Manovich's questions about new challenges to cultural analytics,[4] the *Training the Archive* project investigates whether the process of curating can be broken down into its individual steps to transfer them into statistical procedures. For this reason, the 'curatorial gaze' — understood as a complex gesture of bringing together and selecting artworks — will itself be the basis for the machine learning methods used. The result should be a software application that enables an explorative search in a museum collection, whereby the recommended artworks in turn are influenced and trained by expert-made groupings, thus putting the objects into (novel) context. In doing so, the envisaged *Curator's Machine* is understood as a generator of ideas that puts the human at its centre and is intended to support processes of rediscovering and revisiting of digital objects in the art museum collection.[5]

4. Lev Manovich, *Cultural Analytics* (Cambridge, MA: MIT Press, 2020, 14).

5. Dominik Bönisch, 'Suggestions for a Curator's Machine: A Collaborative Approach to the Use of Artificial Intelligence in Art Museums', in *Art, Museums and Digital Cultures: Rethinking Change*, ed. Helena Barranha and Joana Simões Henriques, 136–48 (Lisbon: Instituto de História da Arte, Universidade NOVA de Lisboa & maat, 2021). https://doi.org/10.34619/hwfg-s9yy.

↓
Prototype 1

Clustering objects in the museum collection [fig. 2] with the use of pre-trained 'off-the-shelf' artificial neural network models. Investigating whether automated visual groupings can be changed by training the algorithm with man-made annotations about hidden patterns of connection between artworks.[6]

Figure 2: Scatterplot of a cluster, which combines images with different animal species. Credit: Dominik Bönisch, 2020. All imagery is open-source data from the online collection of the Statens Museum for Kunst (SMK), Copenhagen via open.smk.dk.

6. Dominik Bönisch, 'The Curator's Machine: Clustering of Museum Collection Data through Annotation of Hidden Connection Patterns Between Artworks', *International Journal for Digital Art History*, Vol.5 (May 2021): 5.20–35, https://doi.org/10.11588/dah.2020.5.75953.

↓
Prototype 2

Development of a recommender system that provides suggestions from the collection depending on a sequence of image selections by an expert. This annotated sequence of artworks that would belong together in an exhibition represents a trajectory through the embedding space that the recommender system is supposed to replicate to continue the 'path' and make meaningful suggestions to the curator by presenting nearest neighbour samples [fig. 3]. Eventually, omitting pre-trained artificial neural networks in favour of a self-built auto-encoder due to identified biases towards art-historical image corpora.[7]

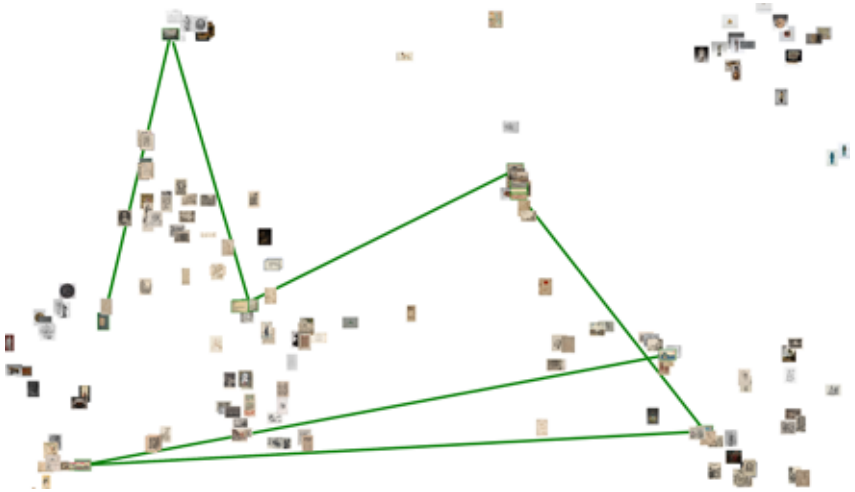

Figure 3: Example of a trajectory through the embedding space. Credit: Visual Computing Institute (VCI), RWTH Aachen University, 2020. All imagery is open-source data from the online collection of the Metropolitan Museum of Art (MET), New York via metmuseum.org/art/the-collection.

7. Francis Hunger, '"Why so Many Windows?": How the ImageNet Image Database Influences Automated Image Recognition of Historical Images', *International Journal for Digital Art History*, Vol.6 (September 2023): 3.70–85, https://doi.org/10.11588/dah.2021.6.82135.

↓
Prototype 3

Use of vision-language models for simultaneous embedding of semantic and image information to be able to draw on extended textual concepts and descriptions for the recommendations. This became possible by implementing the so-called CLIP (Contrastive Language–Image Pre-training) algorithm, trained on images with its captions to establish connections between image and text information.[8]

↓
Prototype 4

An easy-to-use multimodal retrieval system that suggests relevant artworks from the museum collection based on search prompts only [fig. 4]. The artworks of interest can be interactively arranged and grouped together. The recommender system learns from the manually set clusters as well as the defined relation patterns on the canvas and adapts the image-search results in real time. The design challenge was to keep the query time short and to develop an appealing and simple interface [fig. 5].

8. Radford, Alec, Jong Wook Kim, Chris Hallacy, Aditya Ramesh, Gabriel Goh, Sandhini Agarwal, Girish Sastry, Amanda Askell, Pamela Mishkin, Jack Clark, Gretchen Krueger and Ilya Sutskever, 'Learning Transferable Visual Models from Natural Language Supervision', *ArXiv Preprint* (February 2021). https://arxiv.org/abs/2103.00020.

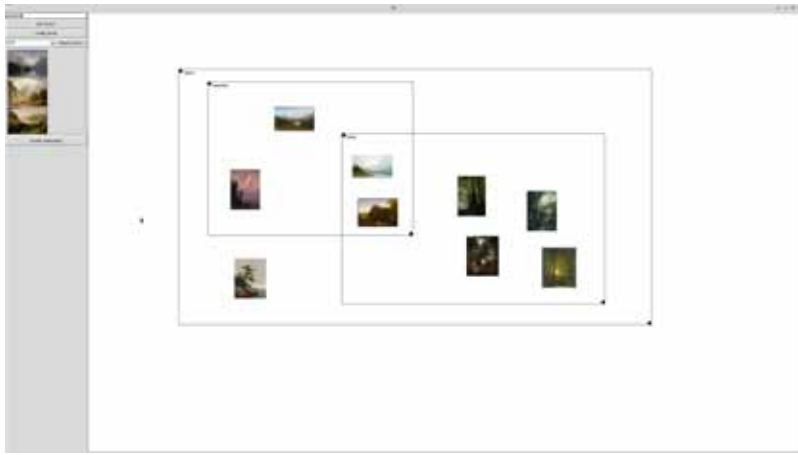

Figure 4: Early attempt at a complex user interface on which image selections can be grouped and sorted, from which the recommender system learns, adapts and refines the succeeding image searches. Credit: VCI, RWTH Aachen University, 2022. All imagery is open-source data from the MET.

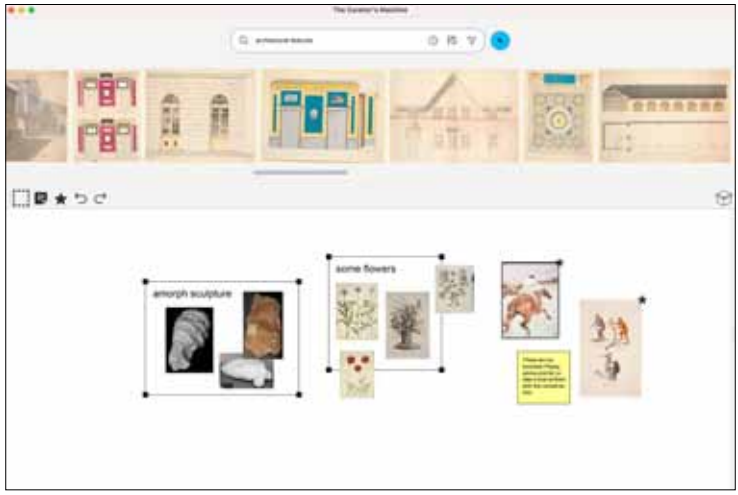

Figure 5: Final Interface. Credit: VCI, RWTH Aachen University, 2023. All imagery is open-source data from the SMK.

↓
Prototype X

The resulting software application is to be tested and fed back with curators from the *Training the Archive* network. The final use case will be the application of *The Curator's Machine* to the digitised collection of the Ludwig Forum Aachen. At the end of the project, the source code[9] for developers will be available as an open repository, thus ensuring that it can be applied in many museums and to other digital archives. The scientific processing of the findings takes place via the publication format of working papers,[10] as well as via video interviews,[11] with experts from the field, the compilation of information on a dedicated blog,[12] and the organisation of a conference,[13] accompanied by a publication.[14]

9. See on GitHub: https://github.com/VCI-RWTH/TrainingTheArchive.

10. See https://trainingthearchive.ludwigforum.de/en/working-papers-2/.

11. See the playlist: https://trainingthearchive.ludwigforum.de/en/interviews-en/.

12. For more information see: https://trainingthearchive.ludwigforum.de/en/.

13. Find the lectures here: https://trainingthearchive.ludwigforum.de/en/documentation/.

14. Inke Arns, Eva Birkenstock, Dominik Bonisch and Francis Hunger (ed.), *Training the Archive* (Cologne/ Aachen: Verlag der Buchhandlung Walther und Franz König/ Ludwig Forum für Internationale Kunst Aachen, 2024).

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Bönisch, Dominik. 'The Curator's Machine: Clustering of Museum Collection Data through Annotation of Hidden Connection Patterns Between Artworks'. *International Journal for Digital Art History* Vol.5 (May 2021): 5.20–35. GitHub: https://github.com/VCI-RWTH/ TrainingTheArchive. https://doi. org/10.11588 dah.2020.5.75953.

Hunger, Francis. '"Why so Many Windows?": How the ImageNet Image Database Influences Automated Image Recognition of Historical Images'. *International Journal for Digital Art History*, Vol.6 (September. 2023): 3.70–85. https:// doi.org/10.11588/dah.2021.6.82135.

Manovich, Lev. *Cultural Analytics*. Cambridge, MA: MIT Press, 2020, 14.

Radford, Alec, Jong Wook Kim, Chris Hallacy, Aditya Ramesh, Gabriel Goh, Sandhini Agarwal, Girish Sastry, Amanda Askell, Pamela Mishkin, Jack Clark, Gretchen Krueger and Ilya Sutskever. 'Learning Transferable Visual Models from Natural Language Supervision'. *ArXiv Preprint* (February 2021). https://arxiv.org/abs/2103.00020.

Ohm, Tillmann. *The Artist's Machine. Thesis Commons*, 2018. https://doi. org/10.31237/osf.io/tj6yf.

Curation and its Statistical Automation by Means of Artificial Intelligencee

Francis Hunger

'I believe that museum curators should consider new ways of classifying and sorting information made possible by algorithms, as it is already part of their daily work and activities now that many museum collections have been digitalized and can be viewed and edited via collection management systems and software.'[1]

'Indeed, curating has become a practice available to any user of mobile and networked technologies, while also any object, including a salad, is ready to be curated.'[2]

1. Merel van der Vaart and Lorna Cruickshanks, 'Understanding Audience Participation Through Positionality — Agency, Authority and Urgency', *Stedelijk Studies*, no.8, 2019, https://stedelijkstudies.com/journal/understanding-audience-participation-through-positionality-agency-authority-and-urgency/.

2. Magda Tyżlik-Carver, 'Posthuman Curating and Its Bio-political Executions — The Case of Curating Content', in *Executing Practices*, ed. Helen Pritchard, Eric Snodgrass and Magda Tyżlik-Carver (London: Open Humanities Press, 2018), 171–90.

Introduction

What remains of curation if the 'next biennial', as Joasia Krysa suggests, is 'curated by a machine'?[3] Will the profession of curator continue to exist if we succeed in formalising and automating 'creativity'? How does curatorial action change if, as van der Vaart and Cruickshanks propound,[4] it automates questions of classification and sorting, i.e. curatorial knowledge creation, to a greater extent than before? What concept of curating art remains if we describe, as Tyżlik-Carver does,[5] an expansion of the curatorial and concomitant reconfigurations of human subjectivities on digital platforms?

This paper[6] serves to define the position of The Curator's Machine in the field of the curatorial. The Curator's Machine is a software prototype designed to take on curatorial tasks using pattern recognition and computer vision. The Ludwig Forum Aachen and the Hartware MedienKunstVerein Dortmund are cooperating on developing this prototype as part of the project Training the Archive.[7]

3. UBERMORGEN, Leonardo Impett, Joasia Krysa and B^3(NSCAM). 'The Next Biennial Should Be Curated by a Machine'. Artwork, 2021. https://whitney.org/artport-commissions/the-next-biennial.

4. Van der Vaart and Cruickshanks, 'Understanding Audience Participation Through Positionality'.

5. Tyżlik-Carver, 'Posthuman Curating and Its Biopolitical Executions'.

6. This text was first published as Working Paper 3, *Training the Archive — Working Paper Series*, Aachen/Dortmund, November 2021, DOI: 10.5281/zenodo.5705769. It was originally authored within a research project by the Ludwig Forum for International Art, Aachen and Hartware MedienKunstVerein, Dortmund, funded by the Digital Culture programme of the German Federal Cultural Foundation and the Federal Government Commissioner for Culture and Media.

7. For more information, see the previous working papers: Dominik Bönisch, 'The Curator's Machine. Clustering von Musealen Sammlungsdaten Durch Annotieren Verdeckter Beziehungsmuster Zwischen Kunstwerken', *Training the Archive — Working Paper, Aachen/Dortmund*, May 2021, doi:10.5281/ZENODO.4604880, and Francis Hunger, '"Why so Many Windows?" — Wie Die Bilddatensammlung ImageNet Die Automatisierte Bilderkennung Historischer Bilder Beeinflusst', *Training the Archive — Working Paper, Aachen/Dortmund*, June 2021, doi:10.5281/ZENODO.4742621.

The aim of this text is to elaborate on current developments in the field of the curatorial that are entering our daily lives through the expanded statistical and automated capabilities of data processing by means of artificial 'intelligence'. For this purpose, a number of artistic, technical and curatorial projects are discussed as case studies: first a meta-artwork about curation and biennials from UBERMORGEN, Leonardo Impett and Joasia Krysa *The Next Biennial Should Be Curated by a Machine*, second Tillmann Ohm's project *Algorithmic Art Curation* (ARCU), which translates data into spatial relationships, and third the curation of art for an online platform using eBay as an example. Similarities and differences will be filtered out from these case studies to fine tune the concept of post-AI curation.

We must initially set down several preconditions to firmly define concepts such as: firstly, curation and curator; secondly, curatorial research, curatorial set and data sets; thirdly, automation of knowledge creation in curatorial software infrastructures, and fourthly, post-human curating and post-AI curating.

These reflections are all to be read in the context of Training the Archive, since I have created this present paper as a component of this project. The project's goal is the artificial intelligence software prototype The Curator's Machine, which visualises similarities and differences in art collections and thus becomes a curatorial tool. 'The confirmation that machines could generalise the specific knowledge of curators of the collection of a museum invites us to consider a productive thought experiment. It is technically possible to store the annotations on the hidden connection patterns between individual artworks in an ANN (Artificial Neural Network) as a separate model, so that it can be continuously retrained with new expert knowledge, without losing the specific findings from the annotation work of the individual experts.'[8]

8. While Bönisch (ibid.) speaks of 'Artificial Neuronal Networks', the present text instead employs 'weighted network' to dispense with the biological concept of 'neurons' and to de-anthropomorphise the methods of artificial 'intelligence'. At the same time, I write 'intelligence' in quotes to indicate that it is not intelligence in the human sense but rather in the sense of detection that is being negotiated here. In some cases, I therefore also speak of 'automated statistics' or 'automated pattern recognition'. These linguistic corrections are preliminary suggestions, which I am is continuously developing.

The participating project partners foster different curatorial cultures. The Ludwig Forum Aachen has its own collection and works with it, while the Hartware MedienKunst-Verein Dortmund works without a collection and pursues questions on the social significance of art, particularly of media art.[9] The artistic director of the HMKV, Inke Arns, insists above all on contemporaneity as a central characteristic of media art, whereby the focus is not on technology but on its technological effects on society.[10] Does this result in project-relevant views of 'curation'?

One point is clear from the outset: artificial intelligence is not a fundamental impulse that could 'revolutionise' or upend the field of curation, but it is a technical tool that may open up new forms of selection based on similarities, especially when applied to large amounts of data — big data. But selection, as we will see, is only a small component of the curatorial. This paper therefore serves to probe and explore curatorial practices applied to digitised data collections.

9. See Dieter Daniels, Rudolf Frieling et. al, 'Media Art Net | Concept', *Media Art Net*. 2005, http://www.medienkunstnetz.de/concept/. To keep the focus on questions of curation, the present paper avoids a more in-depth discussion of collecting, the creation of knowledge in the collected (see Michel Foucault, *Archäologie des Wissens*, Frankfurt am Main: Suhrkamp, 1969) and the patriarchal and colonial reshaping of collection (see James Clifford, 'On Collecting Art and Culture', in *The Predicament of Culture — Twentieth-Century Ethnography, Literature, and Art* (Cambridge, MA: Harvard University Press, 1988), 215–51); Walter Mignolo, *The Darker Side of the Renaissance — Literacy, Territoriality, and Colonization* (Ann Arbor, MI: University of Michigan Press, 2003); Constance Classen and David Howes, 'The Museum as Sensescape — Western Sensibilities and Indigenous Artifacts', in *Sensible Objects — Colonialism, Museums and Material Culture*, ed. Edwards, Gosden and Philips (London: Bloomsbury Academic, 2006), 199–222; Ariella Azoulay, *Potential History — Unlearning Imperialism* (London/Brooklyn, NY: Verso, 2019) Ch. 3). On the one hand, we would have to differentiate the collection from the archive. On the other hand, special genealogies of museum and custodial collecting would have to be elaborated, touching on classification, management and preservation (See e.g., Markus Krajewski, *Paper Machines — About Cards & Catalogs, 1548–1929*. History and Foundations of Information Science (Cambridge, MA: MIT Press, 2011).

10. Inke Arns, 'Und Es Gibt Sie Doch — Über Die Zeitgenossenschaft Der Medialen Künste', in *HMKV, Hartware Medienkunstverein, 1996–2008*, ed. Hartware MedienKunstVerein, Susanne Ackers, Inke Arns, Hans D. Christ and Iris Dressler (Bönen: Kettler, 2008), 6.

From Curating to Post-AI Curating

Curating and Curator

Curating describes the working relationship between the curator and aesthetic objects and constellations in relation to artists, institutions, collectors, media, exhibition visitors, sponsors and exhibition logistics. The aim of curatorial action is to create situations that result in a specific public sphere for a limited period of time. This current concept of curating has emerged in several phases.

Beginning in the eighteenth century at the latest, curation was an inwardly directed, targeted engagement of institutions with their collection, aimed at completing, preserving and valorising that collection. This also included exhibition activity, which was closely linked to the institution. The Latin root *curare* refers to the aspect of 'looking after' and 'caring for', but also 'administering' and 'commanding'.

Since the 1960s, institutional critique[11] and conceptual art processes[12] have shifted perceptions of curation. Over time, questions of mediation, participation and the creation of contexts and new knowledge supplemented tasks such as collecting, preserving, arranging and exhibiting. Not until the end of the 1990s did 'the curatorial' begin to receive attention as a knowledge-producing field in its own right.[13] Today, the term 'curatorial' refers to the meta-level of curating, located in the academic context and dedicated to theorising the curatorial field.

11. See Andrea Fraser and Yilmaz Dziewior, *Andrea Fraser — Works, 1984 to 2003* (Cologne/ New York, NY: Dumont, 2003).

12. See Seth Siegelaub, 'The Artist's Reserved Rights Transfer and Sale Agreement', *1971*, https://primary-information.org/files/english.pdf.

13. Joasia Krysa, 'Curating Immateriality — The Work of the Curator in the Age of Networked Systems', in *Curating Immateriality*, Data Browser 03 (New York, NY: autonomedia, 2006), 14; Jörn Schafaff, 'On the (Curatorial) Set', in *Cultures of the Curatorial*, ed. Beatrice Bismarck, Jörn Schafaff and Thomas Weski (Berlin: Sternberg Press, 2012, 136; Nora Sternfeld, 'What Can the Curatorial Learn from the Educational?', in *Cultures of the Curatorial*, ed. Beatrice Bismarck, Jörn Schafaff and Thomas Weski (Berlin: Sternberg Press, 2012), 333–44; Tyżlik-Carver, 'Posthuman Curating and its Biopolitical

In addition to these research tasks, the curatorial profession consists of a variety of coordinating practices, such as exhibition logistics, communication, funding and public relations, which are supported by corresponding infrastructural media.[14]

Changes in curating went hand in hand with a differentiation of the related professional field of curator. Alongside institution-bound, permanently employed curators, protagonists appeared who operated as freelance and nomadic 'independent' curators. The latter often worked without a fixed collection. They brought the curated objects together for a limited period of time and then returned them to their diverse places of origin.

Despite the many changes in the role of the curator, we can observe one constant — curators are positioned as experts. The majority of currently active curators are academically trained, partly interdisciplinarily in the newly emerging curating degree courses at universities[15] or, in the case of museums, disciplinarily in relation to the respective museum collection as an art historian or archaeologist, for instance.[16] From this, we can conclude that curating is always linked to expert knowledge. In curatorial activity, a distinction must be drawn between research in the academic sense and practice in the sense of coordinating practice [fig. 1]. The software prototype being developed in the scope of Training the Archive and discussed in a series of working papers serves as a research tool and is thus classified as part of the experimental research component of curatorial activity.

Executions', 171.

14. See Erhard Schüttpelz, 'Infrastrukturelle Medien Und Öffentliche Medien', *Media in Action* (Pre-Publication), no.0, 2016: 1–21.

15. Examples of curatorial degree programmes include: *École du Magasin Curatorial Studies* — Le Magasin (Grenoble), *Independent Study Program/Curatorial Program* — Whitney Museum of American Art (New York), *De Appel Curatorial Programme* — De Appel (Amsterdam), *MFA Curating* — Royal College of Art and Goldsmiths (London), *Kulturen des Kuratorischen* — HGB Leipzig, *PhD in Practice in Curating* — ZHdK (Zurich), *Curatorial Practice Program* — California College of the Arts (San Francisco, USA), *Center for Curatorial Studies and Art in Contemporary Culture* — Bard College (Annandale-on-Hudson, New York), *Curatorial Studies — Theorie — Geschichte — Kritik*, Kunstgeschichtliches Institut der Goethe-Universität (Frankfurt/Main), *Curatorial Studies* — KASK & Conservatorium (Ghent), and the *International Master's Programme in Curating Art* — Stockholm University (Stockholm).

16. Van der Vaart and Cruickshanks, 'Understanding Audience Participation Through Positionality'.

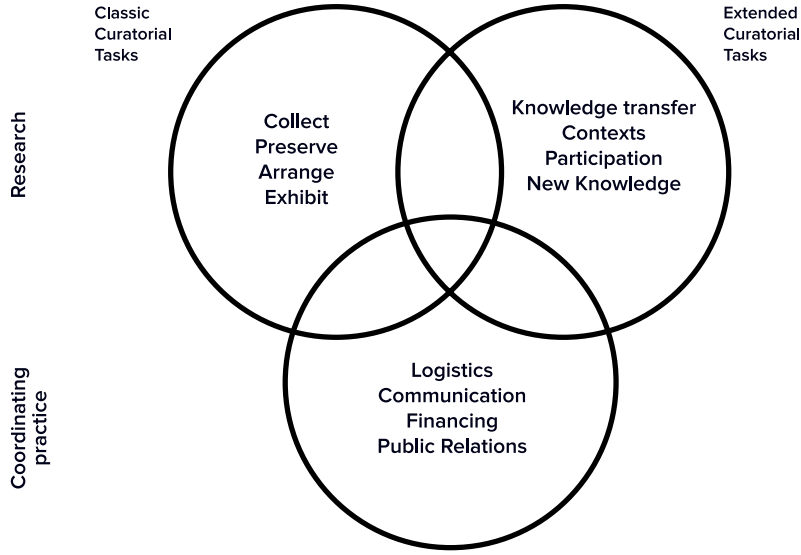

Figure 1: The curatorial field: experimental research and coordinating practice. The classic curatorial tasks of collecting, preserving, arranging and exhibiting have expanded since the 1960s to include questions of knowledge transfer, contexts, participation and knowledge creation. Coordinating tasks such as logistics, communication, funding and public relations are part of curatorial professional practice (author).

Curatorial Research and the Curatorial Set as a Data Set

In the text *Curating and Research — An uneasy alliance* Simon Sheikh focuses on curatorial research and establishes that two different meanings are embedded in the word 'research': firstly, research as the exploration of an area of knowledge in the journalistic sense, and secondly, research that follows a scientific approach.

> If journalism understands itself as an endeavor that uncovers the truth by looking at the facts, and thus constructing a story, or what we can call a discourse, from what it finds, then science works, principally and traditionally, in the opposite direction — that is, from the discourse to the objects. Science implies a specific way of looking, through apparatuses of knowledge, as exemplified

> by the microscope and the laboratory, which also goes for ethnographic and sociological models of field research.[17]

According to Sheikh, while journalistic methods present the results of their research as facts, experimental research treats its results as unsubstantiated concepts to be verified, which could confirm or falsify an initial thesis. In the case of falsification, questioning the research method itself and adapting it if necessary is part of scientific culture. This results in the exhibition as a changeable laboratory situation in contrast to the archive as a place of research: 'the historical similarities between the laboratory and the white cube of the gallery as spaces for isolated viewing and experimenting with objects are self-evident'.[18]

The concept of the curatorial set accompanies the laboratory character of curatorial experimental research. In the course of curatorial experimental research today, we create not only exhibitions, but also something that, according to the theorist Beatrice von Bismarck, can be described with the concept of the curatorial set, such as performances, installations, art in public space and similar settings that have the character of a laboratory. The curatorial set, a space or field that temporarily fixes exhibition objects in place, is akin to the data set. Data sets are characterised by their rigid and repetitive structure, so that in a data set the data retain an expectable location and become addressable. The way data is spatially organised in a data set or database can create meaning,[19] just as the way objects are ordered in a collection case, in tables or in a curatorial set can create meaning.

17. Simon Sheikh, 'Curating and Research — An Uneasy Alliance', in *Curatorial Challenges — Interdisciplinary Perspectives on Contemporary Curating*, ed. Malene Vest Hansen, Anne Folke Henningsen and Anne Gregersen, *Routledge Research in Art Museums and Exhibitions*, Vol.4 (New York, NY: Routledge/Taylor & Francis Group, 2019), 97–107.

18. Ibid., 110.

19. Sybille Krämer, 'Notationen Schemata Und Diagramme – "Räumlichkeit" als Darstellungsprinzip', in *Notationen Und Choreographisches Denken*, ed. Gabriele Brandstetter, Franck Hofmann and Kirsten Maar (Freiburg/ Berlin/ Vienna: Rombach Verlag, 2010), 29–45; Sybille Krämer, 'Zwischen Anschauung Und Denken — Zur Epistemologischen Bedeutung Des Graphismus', in *Was Sich Nicht Sagen Lässt. Das Nicht-Begriffliche in Wissenschaft, Kunst Und Religion*, ed. Joachim Bromand (Berlin: Akademie Verlag, 2010), 173–92.

The curatorial set and the data set are temporarily fixed until they are changed through practices of rearrangement. Both curatorial set and data set gain meaning through the positioning of the objects and through the relationships between the objects. Referring to a 1969 essay by the artist Dan Graham, Von Bismarck speaks of subjects and materials as 'in-formation', that is as arrangements of relationships that are in formations.[20] Information as formation is a concept that media theorist Markus Krajewski similarly emphasised in the text *In Formation — Aufstieg und Fall der Tabelle als Paradigma der Datenverarbeitung* (In Formation — Rise and Fall of the Table as a Paradigm of Data Processing).[21] This concept of information affects other media — databases usually structure objects in two-dimensional, relational data sets based on mathematical procedures for extracting information.[22]

The classifying procedures of artificial intelligence span via weighted networks a multi-dimensional space in which graphs and vectors spatially represent knowledge and knowledge relations: 'The operational power of machine learning locates data practice in an expanding epistemic space. The space derives, I will suggest, from a specific operational diagram that maps data into a vector space. It vectorises data according to axes, coordinates, and scales. Machine learning, in turn, inhabits a vectorised space, and its operations vectorise data.'[23]

An information model establishes the relationship between reality and machine computation in the computer. The information model determines which data are included in the reality of computing and which are excluded from it. To illustrate, the table header is an in-

20. Beatrice Bismarck, 'Relations in Motion. The Curatorial Condition in Visual Arts — and its Possibilities for Neighboring Disciplines'. *Frakcija Performing Arts Journal*, no.55, 2010: 54.

21. Markus Krajewski, 'In Formation — Aufstieg Und Fall Der Tabelle Als Paradigma Der Datenverarbeitung', in *Nach Feierabend: Zürcher Jahrbuch Für Wissensgeschichte — Datenbanken* (Berlin: Diaphanes, 2007), 37–55.

22. Marcus Burkhardt, *Digitale Datenbanken — Eine Medientheorie Im Zeitalter von Big Data* (Bielefeld: Transcript, 2015); Francis Hunger, 'Die Form Der Datenbank — Genealogien, Operationalitäten Und Praxeologien Relationaler Datenbanken in Ost Und West', diss. (Weimar: Bauhaus Universität Weimar, 2022).

23. Adrian Mackenzie, *Machine Learners — Archaeology of a Data Practice* (Cambridge, MA: The MIT Press, 2017), 51.

formation model par excellence, since the column labels determine which data are collected from reality and transferred to the data space of the table and which are not.

Do these similar spatial methods result in a transferability of curatorial settings into the formatting and formalisation of databases or the pattern recognition of artificial 'intelligence'? If so, this would pave the way for replacing curators with software.

Curatorial Software: Automating Knowledge Creation

If one views the exhibition space as a laboratory, the question arises as to how these laboratories and, above all, curatorial workplaces are equipped. I will not discuss this in its entirety here — the spatial situation of white cube or urban space and so on have been examined elsewhere.[24] Nor should there be any talk of bookshelves, desks and similar office furniture, binders full of documents and receipts or the inevitable coffee machine.[25] Instead, the discussion here is focused on the software tools of curatorial work that are assembled in the office.

Following the subdivision mentioned above, the coordinative practice includes calendars and transaction tables for logistics and process control, mathematical tables for financial calculation, address databases for artists and press work, and communication software such as e-mail, messenger and social media. Artificial intelligence-based text tools such as the proofreading software Grammarly or translation tools like DeepL or Google Translate are also increasingly used.

Tools for research and investigation include knowledge tables in Microsoft Excel, word-processing programmes such as Word and Open Office, search engines including Google, or VuFind in libraries, object and material databases such as LIDO and MuseumPlus, software for

24. See Brian O'Doherty, I*nside the White Cube — The Ideology of the Gallery Space* (Santa Monica, CA: Lapis Press, 1986); Rosalyn Deutsche, *Evictions — Art and Spatial Politics* (Cambridge, MA: Graham Foundation for Advanced Studies in the Fine Arts, MIT Press, 1996).

25. See Gloria Meynen, 'Büro', diss. (Berlin: Humboldt-Universität zu Berlin, 2004), http://edoc.hu-berlin.de/dissertationen/meynen-gloria-2004-12-20/PDF/meynen.pdf; Krajewski, Paper Machines.

3D visualisation of exhibition spaces like SketchUp or Blender, and more recently big data or pattern recognition (artificial 'intelligence') procedures. This results in figurations of the most diverse software, some of which merge into one another and are used as modules,[26] even if they were not originally designed to be modular.

In this context, software figurations refer to the layers of different software that build on each other, such as the Windows operating system, which carries the Excel programme, or the Linux operating system with the Python programming language, which allows the Keras programming library to be used for machine learning tasks. This software embodies and enables the execution of cultural techniques of knowledge creation that are typical for curation. They are part of the invisible infrastructure of curating.[27]

The motivation for using software is to operationalise and automate knowledge creation. Automation is not meant here in the sense of full automation, but always as partial automation of those areas that can be sufficiently abstracted and formalised so that they can be encoded in software.

Automation

An example is the Excel table, which can be sorted both by date and alphabetically. In this context, sorting by software is understood as an automated operation on data because it does not have to be done 'by hand'. Instead, an algorithm such as bubble-sort automatically changes the order of the entries. The operation 'Sort' allows two different knowledge-creation modes in one and the same table space: a temporal sort and a topological sort. If software such as Excel with its algorithmic sorting functions were not available, this process would have to be carried out laboriously by brain and hand as in the past.

26. See Lev Manovich, *Software Takes Command — Extending the Language of New Media, International Texts in Critical Media Aesthetics* (London, New York, NY: Bloomsbury, 2013), especially 113–23.

27. Geoffrey C. Bowker, Karen Baker, Florence Miller and David Ribes, 'Toward Information Infrastructure Studies — Ways of Knowing in a Networked Environment', in *International Handbook of Internet Research*, ed. Jeremy Hunsinger, Lisbeth Klastrup and Matthew Allen (Dordrecht: Springer Netherlands, 2010), 97–117.

Figure 2: Software figurations of curating between research/ information gathering and coordinating practice.

In this respect, we should not regard the use of artificial intelligence, i.e., complex, automated, statistical operations, as a break with previous knowledge-creating operations, but rather as a continuation of them. Curatorial practice thereby moves through a series of fields of knowledge and a series of medial automating practices within the framework of software applications, as the diagram above illustrates [fig. 2]. These medial practices are among the invisible infrastructures of curating.

Embeddedness

The Curator's Machine becomes part of the research infrastructure and is embedded in other knowledge-building processes and cultural techniques. Thus, a number of scripts are used to prepare the data, but also spreadsheets or database applications. The pattern-recognition software itself is based on a complex software ecology that includes languages such as Python and R as well as versioning, in Git for instance, or setting up virtual environments, Jupyter notebooks and the libraries needed for machine learning such as Keras or Pytorch, all the way to cloud offerings like Google CoLab.

Big Data

The Curator's Machine's visual pattern recognition is suitable for big data approaches, i.e., researching large amounts of data. The prerequisite for big data is a digitised institutional collection. The

big data approach of The Curator's Machine reaches its limits with smaller exhibition venues, art associations, galleries and off-spaces, which rarely have extensive collections of their own. After all, big data requires large amounts of data. Small institutions thus depend on external data sets to enrich their own data sets. However, adopting external data sets also entails adopting external collection logics, and it is important to consider to what extent they are in line with one's own principles.

Replication of Framing, Exclusions and Biases

The methods of The Curator's Machine are linked to the digital humanities, which aim to make digital methods productive for the social sciences.[28] However, the authors of The Curator's Machine are aware of the danger of merely digitally replicating the canon by drawing on existing collections. A knowledge tool like The Curator's Machine is, for instance, unable to remedy the exclusions or biases inherent in collections. Thus, existing framings of own and third-party collections are also imported into the big data data sets adopted in the context of pattern recognition. One can use this in the context of curatorial experimental research to make corresponding exclusions visible and point out epistemic gaps. In this context, I do not view gaps as something absent or missing, but as something inviting us to fill them with knowledge.[29]

28. For a critique of epistemological procedures in the digital humanities, see, among others: Alan Liu, 'Where Is Cultural Criticism in the Digital Humanities?', in *Debates in the Digital Humanities* (Minneapolis, MN: University of Minnesota Press, 2012), https://dhdebates.manifoldapp.org/read/untitled-88c11800-9446-469b-a3be-3fdb36bfbd1e/section/896742e7-5218-42c5-89b0-0c3c75682a2f#ch29; Daniel Allington, Sarah Brouillette and David Golumbia, 'Neoliberal Tools (and Archives): A Political History of Digital Humanities', *Los Angeles Review of Books*, May 1 2016, https://lareviewofbooks.org/article/neoliberal-tools-archives-political-history-digital-humanities/. If one follows the argument in Fabian Offert and Peter Bell, 'Generative Digital Humanities', in *CHR 2020: Workshop on Computational Humanities Research*, 2723 (Amsterdam: CEUR Workshop Proceedings, 2020): 202–12, the digital humanities are not only characterised by the application of digital methods to social-science fields, but also by reverse interventions from the social sciences into the media-technical discourse of digital tools.

29. The working paper by Hunger, 'Why so Many Windows?' investigates the framings, biases and exclusions already embedded in the pre-trained networks of pattern recognition using ImageNet as a case study.

However, whether or not the knowledge gained about exclusions leads to consequences in the collections depends not on the software, but on the institutional framework and the actors in the institutions.

Post-Human Curating and Post-AI Curating

What theoretical concept can describe the shifts in curating that are becoming inevitable with the emergence of artificial intelligence or pattern recognition? I will discuss this below using the concepts of post-human curating and post-AI curating.

Post-Human Curating

Digitally automated methods of knowledge creation, which also include pattern-recognition procedures, have become commonplace. These may include recommendations on YouTube that lead from one video to the next 'similar' video and create similarities through machine 'learning',[30] or the facial-recognition functions built into smartphones that focus on faces, identify people when taking photos and arrange the photo album accordingly, or automatically change photos by means of pre-trained weighted networks and turn photography into 'computational photography.'[31] These methods are based on the statistical evaluation of large amounts of data and the automated attribution of similarity. Objects that are similar to each other are grouped together and generate a 'similarity knowledge.'

Similarity is a fundamental property of automated, statistical pattern recognition, as media theorist Wendy Chun explains using the term 'homophily'. Homophily describes the tendency of people to approach others who are similar to themselves in behaviour and habitus. Data doubles can be used to map homophily online, and, as Chun de-

30. See John Paul Titlow, 'To Take On HBO And Netflix, YouTube Had To Rewire Itself', *Fast Company*, 15 May 2015, https://www.fastcompany.com/3044995/to-take-on-hbo-and-netflix-youtube-had-to-rewire-itself; Guillaume Chaslot, 'How YouTube's AI Boosts AlternativeFacts', *Medium*, 3 April 2017, https://medium.com/@guillaumechaslot/how-youtubes-a-i-boosts-alternative-facts-3cc276f47cf7; Wendy Hui Kyong Chun, 'Queerying Homophily', in *Pattern Discrimination*, ed. Hito Steyerl, Wendy Hui Kyong Chun, Florian Cramer and Clemens Apprich (Lüneburg: Meson Press, 2018), 59–98.

31. Hito Steyerl,'Proxy Politics — Signal and Noise', *e-Flux Journal*, no.60, December 2014.

scribes, this results in numerous consequences. 'Homophily reveals and creates boundaries within theoretically flat and diffuse networks; it distinguishes and discriminates between allegedly equal nodes: it is a tool for discovering bias and inequality and for perpetuating it in the name of "comfort," predictability, and common sense'.[32] In this text, I will use the term 'similarity', which is broader and more oriented towards artificial intelligence methods than the concept of homophily, which refers to humans. The mapping of supervised learning, which uses mathematical methods of classification and regression, can be described as the production of similarities. Similarity is a fundamental argument of artificial 'intelligence'.

For this shift, media theorist Magdalena Tyżlik-Carver has proposed the term post-human curating.[33] Tyżlik-Carver noted that content curation is performed equally by human and non-human agents (e.g. software figurations, data, databases, APIs, artificial intelligence). 'These are mundane practices where free digital labour is executed as linking, liking, reposting, aggregating, editing, filtering, semantic analysis, tagging and annotating, all of which are performed by people (individuals and communities, curators and users), software and social and technological platforms.'[34] Tyżlik-Carver's concept of post-human curating extends beyond the pure art context when she also describes these curatorial practices in, for instance, the social media context. According to Tyżlik-Carver, the self/subject is represented by data, which on the one hand makes it addressable and exploitable. On the other hand, the data curators themselves determine, by means of their curatorial practice, which data come into circulation, and in this way, they generate an 'affective data body'.[35]

32. Chun, 'Queerying Homophily', 62.

33. Also compare the experimental forms of collective, networked curating in the 1990s as discussed in Joasia Krysa, 'The Politics of Curating in/as (an) Open System(s)', diss. (Plymouth: University of Plymouth, 2008), https://pearl.plymouth.ac.uk/handle/10026.1/326, especially pp.72–76, and Olga Goriunova, *Art Platforms and Cultural Production on the Internet* (New York, NY: Routledge, 2013).

34. Tyżlik-Carver, 'Posthuman Curating and Its Biopolitical Executions', 171f.

35. Ibid., 185. The idea of the data body refers to the data double, a concept introduced in Kevin D. Haggerty and Richard V. Ericson, 'The Surveillant Assemblage', *British Journal of Sociology* 51 no.4: 605–22, 2000, doi:10.1080/00071310020015280 to describe the mirroring of subjectivity and corporeality in databases.

Her argumentation is interested in the intertwining of human and non-human actors (e.g., recommendation algorithms on YouTube or Amazon), and such considerations are also relevant for the present text. In order to further refine the conceptualisation, I will introduce the idea of post-AI curating as a subset of the concept of post-human curating, and discuss it in relation to the project Training the Archive and The Curator's Machine.

Post-AI Curating

To supplement Tyżlik-Carver's concept, I propose post-AI curating in this context as an automating, knowledge-creating process of curating (art), which, in addition to coordinating processes (email, calendars, financial plans, etc) and knowledge-creating media such as databases, also includes techniques of pattern recognition, so-called artificial intelligence. It is located within the investigative component of curating and here above all in the field of research in the sense of archival research, although its use in laboratory-like exhibition situations — and thus according to Sheikh's distinction in the field of curatorial experimental research — is also possible.[36]

Regarding post-AI curating, we should distinguish between the knowledge-creating processes of formalising curatorial decisions in databases and in artificial intelligence applications. While databases allow the filtering, ordering and combining of data sets by means of queries/ searches, pattern recognition can reconstruct data sets by means of algorithmic, generative procedures through spatial reorganisation (of the data vectors). Databases use reference to establish a traceable connection between the original object and the data extracted from it. For example, the attribute 'colour' exists in a given data set and for each data object this attribute is described with a discrete value ('red', 'yellow', 'green') that refers to the original object. It follows that queries to databases can only be made if the questioner knows which attributes are specified in the database in the first place. Thus, there is also a clear relationship between inclusions

36. Post-internet art describes art that no longer understands the internet as something new, but as a given (Gene McHugh, *Post Internet — Notes on the Internet and Art* (Brescia: Link Editions, 2011); Marisa Olson, 'Postinternet — Art after the Internet', *Foam Magazine*, 2011). In a similar sense, one could speak of 'post-AI' curating.

and exclusions. All attributes defined for the database are part of the information model and everything that is not defined as an attribute of an object is excluded. Knowledge of the information model is already assumed in the queries, for instance: 'Show me all objects from the data set that have the colour red' (SELECT object FROM collection WHERE colour='red').

In contrast to this referential knowledge creation, the epistemic process of pattern recognition/artificial intelligence is primarily based on the principle of homophily or the statistical similarity of the data objects to each other. Due to the complex mathematical and algorithmic processes that are active in the weighted networks of artificial intelligence that span thousands of nodes, the internal workings of artificial intelligence become a black box. Input and output can be observed, but the inner references are only perceptible to a limited extent. Human intervention mediates the weights within weighted networks in an iterative process of backpropagation (i.e., the feedback between output and the individual network nodes). However, it is not possible to predict the status of individual nodes. In contrast to the two-dimensional data objects of the database (represented as a table), the data objects in pattern recognition can be multidimensional. This enables a more complex aggregation of data that can map patterns that cannot be mapped in databases.

In contrast to the database, which is characterised by references, the principle of similarity rules in the field of artificial intelligence. Data objects that are similar to each other are positioned in spatial proximity to each other and this spatial positioning is the pattern that makes a statement about the data set. The main statements of statistical pattern recognition are statements about similarity/ dissimilarity of the data objects in relation to each other.

Therefore, on the one hand, the framings of the data set become extremely important, because a changed data set produces different similarity ratios, and on the other hand, the methods of weighting in the weighted networks become important, because they also affect the similarities. The Curator's Machine takes advantage of this by allowing curators to change the weights based on visual examples, creating individually weighted networks that are intended to assess individual decisions statistically.

Figure 3: Grid plot — passage from one image to another image based on the similarities of the adjacent images (Bönisch 2021).

However, there is an inherent problem. Since, as shown, weighted networks lack references between data objects and their underlying real-world objects, they can inadvertently generate false similarities. For example, a person assessing several objects for similarity may intend the similarity of two objects to be based on the colour blue. However, the weighted network does not comprehend this criterion as a selector for similarity. It only receives the fact that two selected objects are similar to each other. It doesn't create a concept of why and how something was deemed similar by humans. Since similarity is inscribed in weighted networks using mathematical-algorithmic procedures, namely by optimising the mathematical function, shortcuts may occur. In the case of texture bias,[37] the weighted network perceives the criterion of similarity to be texture and not the similarity of colour that the humans actually intended.[38]

In addition to the aspect of similarity, post-AI curating as a field of knowledge creation is also marked by a series of topoi that are decisive for automated statistics of pattern recognition (aka artificial intelligence) even beyond curating:

37. Robert Geirhos, Patricia Rubisch, Claudio Michaelis, Matthias Bethge, Felix A. Wichmann and Wieland Brendel, 'ImageNet-Trained CNNs Are Biased towards Texture — Increasing Shape Bias Improves Accuracy and Robustness', *ArXiv:1811.12231*, January 2019, http://arxiv.org/abs/1811.12231; Robert Geirhos, Jörn-Henrik Jacobsen, Claudio Michaelis, Richard Zemel, Wieland Brendel, Matthias Bethge and Felix A. Wichmann, 'Shortcut Learning in Deep Neural Networks', *ArXiv:2004.07780 [Cs, q-Bio]*, May 2020. http://arxiv.org/abs/2004.07780.

38. For more information on texture bias, see Hunger, 'Why so Many Windows?'.

- 'Intelligence' occurs as a statistical grouping of similarities that remain within a specific domain of knowledge.[39] The inherent relationality of the processes of artificial intelligence promotes homogenisation, as relationships are calculated from the proximity of objects to each other.

- Cultural artefacts are encoded into data doubles and in the process trans-coded and formatted.[40] Detection and classification is carried out through discretisation and is subject to a whole series of abstractions.[41]

- The generation of new, similar artefacts from existing data corpora is possible and further complicates the question of the 'authenticity' of data bodies.[42]

- Normative, data bias and algorithm bias constantly need to be renegotiated.[43]

- Automated knowledge-creation tools draw on data based on expended human labour.[44]

39. See Chun, 'Queerying Homophily'.

40. Haggerty and Ericson, 'The Surveillant Assemblage'; Lev Manovich, *The Language of New Media* (Cambridge, MA: MIT Press, 2001), 43–48.

41. See Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things Out — Classification and Its Consequences* (Cambridge, MA: MIT Press, 1999); Hito Steyerl, Wendy Hui Kyong Chun, Florian Cramer and Clemens Apprich, *Pattern Discrimination* (Lüneburg: Meson Press, 2018); Virginia Eubanks, *Automating Inequality — How High-Rech Tools Profile, Police, and Punish the Poor* (London: Macmillan, 2019).

42. See Offert and Bell, 'Generative Digital Humanities'.

43. See Safiya Umoja Noble, *Algorithms of Oppression — How Search Engines Reinforce Racism* (New York, NY: New York University Press, 2018); Catherine D'Ignazio and Lauren F. Klein, *Data Feminism* (Cambridge, MA: The MIT Press, 2020); Fabian Offert and Peter Bell, 'Perceptual Bias and Technical Metapictures — Critical Machine Vision as a Humanities Challenge', *AI & SOCIETY*, October 2020, doi:10.1007/s00146-020-01058-z.

44. See Nick Couldry and Ulises Ali Mejias, *The Costs of Connection — How Data is Colonizing Human Life and Appropriating it for Capitalism, Culture and Economic Life* (Stanford, CA: Stanford University Press, 2019); Francis Hunger, 'Data Workers of All Countries, End It!', in *Hamburg Maschine — Digitalität, Kunst Und Urbane Öffentlichkeiten*, ed. Isabella Kohlhuber and Oliver Leistert (Hamburg: Adocs, 2021).

- Human-posthuman entanglements take place in complex infrastructures. Artificial intelligence is *embedded* in socio-technical figurations.[45]

The point here is not to claim that the referential logic of databases is superior or inferior to the non-referential similarity of pattern recognition. There are different and justified application cases for both. Instead, this distinction clarifies what may constitute the difference between post-human curating and post-AI curating — the transition from reference to similarity.

Case Studies

The following case studies illuminate facets of the curatorial in relation to artificial intelligence according to the topoi of post-AI curating listed above.[46] They discuss the potentials of generative processes of artificial intelligence for curatorial action using the example of an algorithmically generated biennial, an exhibition curated primarily by algorithms, and the online platform eBay as an exhibition setting and curatorial tool. The focus is always on human-post-human curatorial interplay.

The art and research project *The Next Biennial Should Be Curated by a Machine* shows what happens when weighted networks and generative methods based on an existing corpus of data are used. At the same time, it is a sceptical comment on the strategies of curatorial experimental research, which brings knowledge into specific arrangements and establishes it as a public discourse. By taking automation

45. See Katherine Hayles, 'Computing the Human', *Theory, Culture & Society* 22 (1), 2005: 131–51, doi:10.1177/0263276405048438; Bowker and Star, *Sorting Things Out*.

46. However, I omitted a number of projects due to lack of space. These include, for instance, the exhibition project *Data/Set/Match* at the Photographers Gallery 2019–20 as part of the larger research project *Unthinking Photography* (https://unthinking.photography/themes/data-set-match). The artistic project *Computed Curation* by designer Philipp Schmitt is a book that shows a sequence of images selected with the help of a weighted network. Peter Bell and Fabian Offert's project *https://imgs.ai* develops an open-source software with a web interface for the comparative finding of images in data sets. The central function is the inclusion or exclusion of sample images that serve as a basis for refining the search set.

to the horizon of knowledge creation, confined by the knowledge domain of a (curatorial) data set, the artists show its limits.

What can post-AI curation look like? Tillmann Ohm's project *Automated Curator* (ARCU) investigates the extent to which curatorial decisions can be automated using artificial intelligence. Can machines replace curatorial decisions in post-AI curating? ARCU problematises the fact that automated knowledge formation tends to establish similarity as an unconscious normative. Although 'similarity' creates coherence, there is also a certain lack of tension, as we shall see.

The exhibition project *#Exstrange* represents the concept of post-human curating. In this project, curating extends from the exhibition space to the online world, which artificial 'intelligence' recommender systems co-configure. *#Exstrange* turns the trading platform eBay into a laboratory of curatorial experimental research. This case study shows how the status of artworks is transformed into data bodies in a data-driven exhibition platform.

The Next Biennial Be Curated by a Machine: B^3(NSCAM)

The *B^3(NSCAM)* project by UBERMORGEN, Leonardo Impett and Joasia Krysa (2021) [fig. 4] is the first inquiry in a series of experiments on curating and artificial intelligence.[47] Based on data from previous major art exhibitions at the Whitney Museum for American Art and the Liverpool Biennale, the net art and machine learning project *B^3(NSCAM)* created a set of sixty-four potential biennials. This project illustrates the transition from feature detection and classification using pattern recognition to generative methods. It

47. B^3(NSCAM) is the first instance of a project series curated by Joasia Krysa, commissioned for The Whitney Museum of American Art and Liverpool Biennial 2021, with a second experiment titled AI-TNB, a collaboration between Joasia Krysa, Leonardo Impett, Eva Cetinić (Experiment machine learning concept and implementation), MetaObjects (Ashley Lee Wong and Andrew Crowe) and Sui (Web development and design), commissioned for UK TaNC — Towards a National Collections and Liverpool Biennial. The third experiment entitled Newly Formed City, is a collaboration between artist Yehwan Song and researchers at Digital Visual Studies, Max Planck / University of Zurich, and Joasia Krysa, commissioned for Helsinki Art Museum and Helsinki Biennial 2023. Project website: https://www.kurator.org/ai/

Figure 4: UBERMORGEN/ Krysa/ Impett: *The Next Biennial Should Be Curated by a Machine* (screenshot). https://artport.whitney.org/commissions/the-next-biennial/index.html#.

shows that the existing data corpus itself is already fiction because it represents a conscious or unconscious extraction from reality. This data corpus was subjected to automated feature detection and classification using algorithms, weighted networks and pattern recognition. UBERMORGEN, Impett and Krysa take the fiction of the underlying data corpus to the extreme by generating a new biennial from it.

The data pool consisted of exhibition descriptions and Excel lists of artwork data. From this, an assemblage of scripts, algorithmic processes and data sets called B^3(NSCAM) generated potential biennials including fictitious artists generated from the data. A linguistic model based on the generation of word-level prediction was used for the text descriptions. This procedure calculates the subsequent word from a previous word based on statistical probability, and generates an entire text this way, word by word. According to Christiane Paul, who was involved in the process as a curator on the part of the Whit-

48. On curatorial language, see *International Art English: On the rise–and the space–of the art-world press release* (Rule und Levine 2012).

49. Sarah Cascone, 'Who Needs a Curator When You Have A.I.? A Group of Artists Trained a Machine to Curate 64 Possible Whitney Biennials', *Artnet News*, 6 May 2021, https://news.artnet.com/art-world/ai-whitney-biennial-curator-1959025.

ney Museum, the curatorial texts thus generated sounded extremely academic. To remedy this, they decided to add articles from *Rolling Stone* magazine as a further data source in an attempt to subvert the curatorial jargon[48] of the original data sets.[49] In a further step, the generated texts were combined with pop-cultural references, such as music by Black Pink, Toones & I, Lady Gaga and other chart and trap sounds, as well as with sound bites from TikTok videos. Shifting visual patterns that refer to vernacular do-it-yourself aesthetics of the 1990s, as well as Op art served as the pictorial background.

Clicking in *The Next Biennial Should Be Curated by a Machine* website on a gear wheel icon (which typically symbolises 'default settings' on computer interfaces) opens a modal window with the respective biennial. After the introductory text generated by the B^3(NSCAM) algorithm, a list of artists appears, consisting of fictitious names and generated biographies. Here is an excerpt from the biography of the 'artist' Macy-Grace Laning:

> Macy-Grace Laning (b. 1998, Citrus Park, United States) lives and works in New York, USA. Today, Laning studies the architecture of institutions such as prisons, mental hospitals, juvenile detention facilities, residential jungles, as well as fictional alien worlds. Her projects highlight the symbolic value of space as an arena for human interaction and action, and her fascination with the colonizers and their fetish for extra-terrestrial technology.[50]

Using similar curatorial jargon, curatorial statements, reviews and press releases were generated for each of the sixty-four biennials.

All in all, the artificial intelligence component, i.e., all the automatically generated elements programmed by Leonardo Impett on the basis of the pre-trained weighted network for text processing GPT-2, makes a rather depressing and repetitive impression. The artistic positions and curatorial statements generated in this game become interchangeable modules that can be combined with each other at will.

50. UBERMORGEN, 'The Next Biennial Should Be Curated by a Machine'.

51. Hans Bernhard, 'Re: Next Biennial (Training the Archive Text)', email, 6 August 2021.

UBERMORGEN comment that it will be 'the fluid biennial, the multiverse of all possible biennials displayed as an excerpt. The project is actually more a representation of the failure of current curation models than a radical reinvention or interpretation of curation.'[51] Their work further opposes a development in curating that increasingly turns artists into 'suppliers of semi-finished products'[52] that are reassembled at will by curators in exhibitions and biennials.

Since the present text has thus far been characterised by a rather unbroken relationship to curating, I shall quote a longer excerpt from UBERMORGEN's lecture event at the Digital Curator Symposium Brno as a more sceptical voice:

> If machines and institutions are synthetic curators, and existing human curators replace traditional artists, as a consequence, technical systems and institutions automatically become dominant. If all these systems feed on the 'curated' systems or sources, for example Google rankings, Wikipedia entries, and Artfacts lists, informational incest becomes the new gold (Ether) standard. Abusing contemporary fields of societal negotiations such as inclusion, diversity and bias and rendering these transformative issues into institutional PR narratives. Polishing and streamlining language to intersect while gaslighting audiences trained in populism and consumerism, incapable of processing uncomfortable realities, facing painful contradictions; and scared to cause inconvenience for corporate sponsors.[53]

The project's tastefully selected pieces of music and animated image backgrounds work against the statement clutter generated by artificial 'intelligence' (with partial human intervention). This humanly curated selection ultimately makes the project a meta-artwork that can be encountered according to human standards in the sense of enjoying art.

52. Ibid.
53. UBERMORGEN, 'The Next Biennial Should Be Curated by a Machine'.

Arrangment Based on Similarity: Artificial Curator

Artificial Curator (ARCU), a project by artist Tillmann Ohm (2020), takes semantic similarities in metadata as the starting point for pattern recognition. It shows how 'similarity', as a guiding principle in post-AI curating, can lead to the homogenisation of results and their banalisation.

Metadata are data like title, dimensions, material, etc that people have assigned to the digital image data object, as well as those (location, date, type of device, etc) assigned by machines in the course of digitisation. A weighted network helped to calculate contextual associations between the metadata. For this purpose, Ohm chose the pre-trained ConceptNet Numberbatch, which maps word embeddings as semantic vectors.[54] Vectors are mathematical constructs that make it possible to express 'distance' and 'direction' by specifying at least two points. By linking meanings to vectors, it is in principle possible to make the relationship between words mathematically processable.

The ARCU project [fig. 5] resulted in the installation of 'curated' artworks in an exhibition space, as well as a website-user interface that presented the relationships of the works of art to one another. For *Artificial Curator*, the Art Fund of the Free State of Saxony provided the Dresden State Art Collections including the meta-data of 365 artworks that entered the collection between 2011 and 2019 as part of the subsidised acquisitions of contemporary art from the Federal State of Saxony. Michael Arzt, curator of the Leipzig art space Halle 14 where *ARCU & Ohm* 2020 was exhibited, set 'Society' as the thematic focus.

Starting from this keyword, semantic relationships between the artworks were organised in clusters. No additional adjustment to the

54. Numberbatch is built using an ensemble that combines data from ConceptNet, word2vec, GloVe and Open Subtitles 2016, using a variation on retrofitting. It is described in the paper *ConceptNet 5.5: An Open Multilingual Graph of General Knowledge*, presented at AAAI 2017. Unlike WordNet, it was designed to be multilingual from the start. From version 17.04, which was released in 2017, the developers corrected bias and stereotypes they detected in the word contexts (see https://blog.conceptnet.io/posts/2017/conceptnet-numberbatch-17-04-better-less-stereotyped-word-vectors/).

Figure 5: View of the exhibition ARCU, Halle 14, Leipzig 2020 with Nadja Buttendorf Robotron — A tech opera, 2018; Dominik Meyer *Das Deutsche Tier grüßt seinen Wald*, 2009 and Martin Reich debris, since 2013 (Walther Le Kon/ Halle 14).

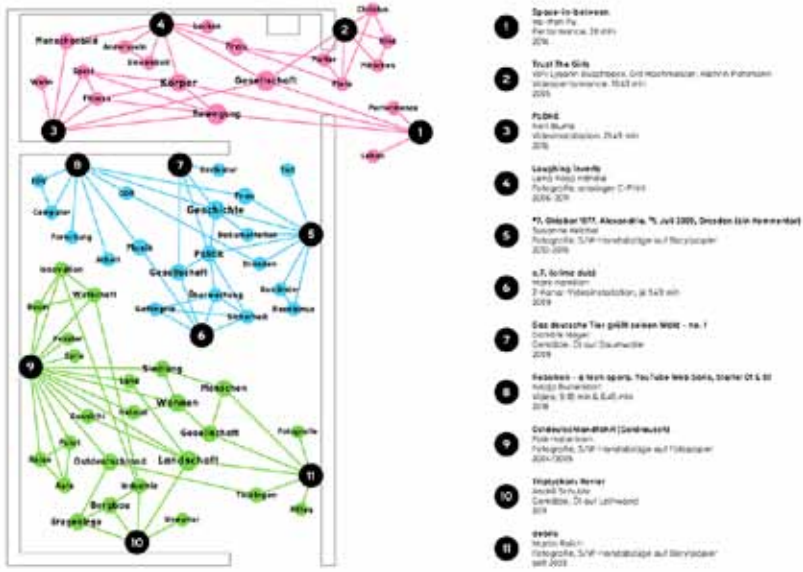

Figure 6: Scheme of spatial distribution and content mapping in the ARCU & Ohm project (Ohm 2020).

pre-trained ConceptNet Numberbatch weighted network was made. The selection was condensed down to twenty works of art based on the shortest pathways to the keyword 'society'. The Dresden State Art Collections ultimately made eleven of these works available for the exhibition.

After completing the selection process, the question was how to present the works in the space. For this purpose, Tillmann Ohm used ConceptNet Numberbatch to create new clusters from the works' meta-data and transferred them into spatial relationships on the floor plan of the exhibition hall. Thus, this translation of semantic into spatial relationships, usually performed through human curatorial practices, took place in a human-machine figuration.

Curation by means of artificial intelligence in ARCU is limited to the computational tracking of the vectorial relationships of data objects in latent space [fig. 6]. This is delimited by a specific domain of knowledge, in this case the 300 works of the Dresden State Art Collections or their metadata, which serve as material to which statistical operations were applied. Artificial curatorial 'intelligence' is embedded in a whole range of software artefacts such as databases, table-structured file formats for data exchange, graphics and image processing, and generative depiction techniques of network visualisation for the web browser.

One problem, according to Ohm, is that ARCU relies heavily on similarities in the data. The danger, explains Ohm, is that the selection will lack underlying tension because the selection criteria are based on similarities and the short distances of the data objects in the latent space. Objects that are similar to each other run the risk of levelling out and harmonising precisely those differences that make an exhibition exciting in the first place. This problem can possibly be mitigated if the underlying big data data set is as extensive as YouTube's databases, for example. At least the recommendations there based on the homophily principle are not boring, even if they are lacking in tension.

55. See Isabelle Graw, 'I Love Kippenberger. Andrea Fraser, Kunst Muss Hängen, Galerie Christian Nagel, Köln', *Texte Zur Kunst*, Vol.11, no.42, 2001: 156–60.

The majority of the works that ARCU chose from the Dresden State Art Collections are two-dimensional: photographs, drawings and paintings. In line with Andrea Fraser's reference to Martin Kippenberger 'Kunst muss hängen' (Art must hang),[55] the majority of the works were designed to be hung on walls, and only two, both video works displayed on monitors, were suitable for sculptural installation in the room. On the one hand, this 'bias' refers back to the 'bias' that already exists in the underlying collection itself, but it also marks the difference from human curators. The latter would have had the opportunity to look outside the scope of the Dresden State Art Collections for works on 'society' that do not hang in order to organise the space in a more balanced way.

#Exstrange: Curating for a Platform — eBay and Artworks as Data Objects

#Exstrange (short for 'Exchange with Stranger') by Rebekah Modrak and Marialaura Ghidini et al. (2017) is an exhibition that replaces a gallery space with eBay as a platform. In this case study, the artworks become data objects that are initially designed to be data-processable. What appears here as an art project points to a fundamental predicament of digital humanities projects: the type of data logic, the so-called information model, formats the possible results. In *#Exstrange*, the logic of the database (of eBay) is at issue, which is indicated, among other things, by the fact that the contributions must fit into a predefined category logic.

In contrast to the aforementioned projects, which were interventions in existing collections, *#Exstrange* [fig. 7] was conceived as a curatorial experiment and thus as curatorial experimental research, in which the main curators Rebekah Modrak and Marialaura Ghidini invited several artists and other co-curators. It joins a series of similar experiments on the eBay platform, such as John D. Freyer's *All my Life for Sale* (2000), Kembrew McLeod's *Selling My Soul* (2000), Mendi and Keith Obadike's *Blackness for Sale* (2001) and Ubermorgen's *The Sound of eBay* (2009). The aim was to interact with the platform's predefined algorithmic configuration and explore its possibilities and limitations. The platform provided the structure of the exhibition, since the artworks were to be classified into sales categories such as

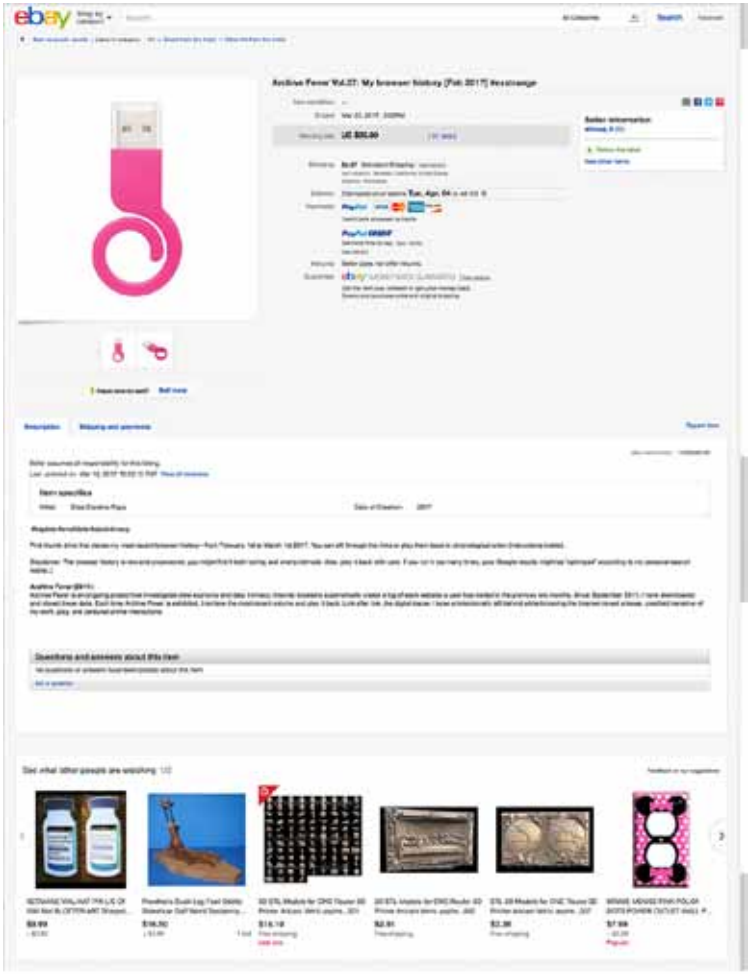

Figure 7: Elisa Giardina Papa's *Archive Fever Vol.37 — My Browser History* [Feb 2017] is an example from the #Exstrange exhibition on eBay (screenshot from http://exstrange.com/auctions/archive-fever-vol-37-my-browser-history-feb-2017/).

'electronic devices', 'services' or 'collector items'. Curators and artists perceived this structure and the description opportunities via titles, labels, prices and images as an explicit part of the artistic works.[56]

56. Gaia Tedone, 'Co-Curating with Cassini — From the Abyss of Commodification to the Exploration of Space Curation', in *#exstrange — A Curatorial Intervention on Ebay*, ed. Marialaura Ghidini and Rebekah Modrak (Michigan, MI: Michigan Publishing, 2017), http://exstrange.com/.

One of the co-curators, Gaia Tedone, observed how curatorial procedures had become embedded in the eBay platform: 'There is even an Office of the Chief Curator, which selects the most interesting, story-worthy and spectacular items on eBay.'[57] Tedone emphasised eBay's search function called Cassini, in particular, and how it demands 'best practices', i.e. high-quality photographic images, appealing titles and detailed descriptions from sellers/artists. She, therefore, referred to the search function as the 'Commodities Chief Curator'.[58]

In addition to the categorical functions of the database, eBay's platform ecology is characterised by search functions and recommendation components based on AI procedures.[59] Due to the requirements of the eBay platform, commercial aspects clearly dominate the organisation of knowledge, which is structured along the lines of automatability and searchability by product categories. The project demonstrates how the logics of reference and the artificial 'intelligence' logics of similarity intertwine in a higher-level user interface.

Conclusion

The case studies have shown consequences tied to artificial intelligence procedures: similarity, selection, embeddedness, big data, spatiality and information model, solutionism and digital humanities.

Embeddedness

As shown, curators use an entire range of automating software tools in the curatorial process, including search engines, spreadsheets, word processing, calendars and storage solutions. These software-data figurations automate existing cultural procedures and knowledge fields of administration, logistics, knowledge organisation and process control. The curatorial artificial intelligence of The Curator's Machine should be understood as part of these software-data figurations. Ruhleder and Star have identified *embeddedness* as an essential quality of infrastructure.[60] It follows that the prototype of The Curator's Machine

57. Ibid.
58. Ibid.
59. Katariya Sanjeev, 'EBay's Platform Is Powered by AI and Fueled by Customer Input', *Ebay Tech.*, 13 March 2019, https://tech.ebayinc.com/engineering/ebays-platform-is-powered-by-ai-and-fueled-by-customer-input/.

should take embeddedness more strongly into account than before, by expanding the possibilities for importing and exporting data, for instance.

Big Data Infrastructures

Methods of curatorial pattern recognition reference corpora of artistic works and large amounts of data. They are mostly limited to use in large institutions with their own collections due to the big-data approach. The methods are in part computationally intensive and complex and require their own infrastructures and personnel. These must be developed anew in a resource-intensive way for each pattern recognition project — a strategic factor that makes the further spread of artificial intelligence applications in small and medium-sized institutions difficult. By comparison, spreadsheets, email programmes or databases are easy-to-implement digitisation measures. This leads to the need for a civil artificial intelligence infrastructure, which does not yet exist, and which should be requested from state and non-state actors — a kind of non-commercial CoLab.

Spatiality and Information Model

The translation of vectors from weighted networks into spatial relationships has thus far only been rudimentarily investigated (i.e. without automated transfer into 3D spatial models) and can be worked on further experimentally. The fact that both curatorial sets and data sets are spatially organised suggests overlaps between these two knowledge-creating cultural procedures. However, this would require more research into the possibility of modelling exhibition spaces.

Solutionism and Digital Humanities

Engineering-solutionist perspectives on data objects oversimplify complex curatorial strategies, reducing them to technical solutions. Rather than discussing increasing the amount of data as a solution, for instance, we should consider abstaining from or foregoing pattern-

60. Susan Leigh Star and Karen Ruhleder, 'Steps Toward an Ecology of Infrastructure — Design and Access for Large Information Spaces', *Information Systems Research* 7 (1), 1996: 113, doi:10.1287/isre.7.1.111.

recognition procedures in favour of other experimental research methods. This is something the technological sciences could learn from the human sciences: 'We both — and everybody that has been involved in such [curatorial] practices — have been in a situation where we've had a concept that has been unmanageable and unrealizable', according to curator Irit Rogoff.[61]

Selection

Exploration and selection in existing, large data sets, which The Curators Machine promises to automate, makes up only a specific component of curatorial experimental research and coordinative practice. Training the Archive and the projects listed here, which are dedicated to the corpora of archives, have thus far been oriented towards selection; that is towards a — compared to the participatory-, discourse- and education-oriented approaches of curating — rather traditional notion of curating. Artificial intelligence procedures oriented towards similarities limit the knowledge potential to a specific domain of knowledge. They run the risk of producing homogenous results, lacking in tension. We need to evaluate whether this problem can be counteracted a) in the algorithmic process and b) in the user interface and c) by integrating it into participatory, discourse- and education-oriented curation processes.

Similarity

Pattern recognition is a promising method for assigning similarity to data objects. Backpropagation can control this assigning indirectly, but the reference to the original objects is lost in complex weighted networks. The internal workings of the weighted networks become a black box. Since mathematical optimisation sets the weights within the networks, the training processes tend to calculate short cuts, such as texture bias, which undermine human-intended ontologies and classifications. Using similarity procedures pushes the in-depth analysis of individual works into the background, because the objects or artworks are positioned solely according to an internal relationship, in other words, all of what is already in the data set. The knowledge

61. Irit Rogoff and Beatrice von Bismarck, 'Curating/ Curatorial', in *Cultures of the Curatorial*, ed. Beatrice von Bismarck, Jörn Schafaff and Thomas Weski (Berlin: Sternberg Press, 2012), 24.

generated in this way is necessarily relational and runs the risk of depoliticising the object of study.

To summarise: the concept of post-AI curating comprises curating in the field of art as a knowledge-creating process, supported by pattern recognition and weighted networks. The Curator's Machine as well as the projects *Artificial Curator* and *The Next Biennial Should Be Curated by a Machine* are rooted in the logics of curating in and with institutional collections. In contrast, *#Exstrange* shows the creation of curatorial sets as a curatorial experimental research outlined above. Can The Curator's Machine become more than the mere technological reawakening of social norms embedded in the collections?

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Rethinking Curating in an Age of Artificial Intelligence: The Next Biennial Should be Curated by a Machine[1]

Joasia Krysa and Leonardo Impett

1. This is an updated version of the text first published in Liverpool Biennial online journal *Stages*, Vol.9, 2021, and subsequently published in *HumaniTies and Artificial Intelligence*, ed. Freddy Paul Grunert (European Union: Noema Media and Publishing, 2022); and in *Expo-Facto: Into the Algorithm of Exhibition*, ed. Henk Slager, Mick Wilson (Utrecht: Metropolis M Books, 2022).

Rapid developments in automation and machine learning are reshaping our relationship with computers, but also our understanding of creative practices, from writing to curating. In this short essay, we outline the principles behind the collaborative project entitled *The Next Biennial Should be Curated by a Machine* (2021),[2] a series of machine learning[3] experiments developed to explore the relationship between curating and Artificial Intelligence (AI) and to speculate on the possibility of developing an experimental system[4] capable of curating, based on human-machine learning.

Referring to the *e-flux* project 'The Next Documenta Should Be Curated by an Artist' (2003) — which questioned the structures of the art world and the privileged position of curators within it — our project extends this questioning to AI.[5] It asks how AI might offer new alien perspectives on conventional curatorial practices and curatorial knowledge.[6] What would the next biennial, or any large-scale exhibition or a collection, look like if AI intervened in the curatorial process to make sense of artworks, or a vast amount of art-world data, in a way that exceeds the capacity of the individual human curator alone?

Curating an exhibition, and especially a biennial, is a complex process that goes far beyond the selection of artworks, commissioning new works, writing curatorial statements, or arranging works in exhibition spaces.[7] It is also about putting works and practices in conversation

2. *The Next Biennial Should be Curated by A Machine* is an umbrella concept that gathers various experiments exploring the application of machine learning techniques to curating, first developed as a collaboration between curator Joasia Krysa, digital humanist Leonardo Impett and artists Ubermorgen. See original project e-flux announcement upon which this text draws: https://www.e-flux.com/announcements/291923/the-next-biennial-should-be-curated-by-a-machine/.

3. Machine learning is defined as the study of computer algorithms that improve automatically through experience, as a sub-part of artificial intelligence. See 'Glossary' published in *Stages*, Vol.9, 2021, Liverpool Biennial, https://www.biennial.com/journal/issue-9/glossary.

4. For a definition of experimental system see: https://en.wikipedia.org/wiki/Experimental_system.

5. e-flux, 'The Next Documenta Should be Curated by an Artist', 2013. https://www.eflux.com/announcements/42825/the-next-documenta-should-be-curated-by-an-artist/.

6. Joasia Krysa, 'Can Machines Curate?', keynote lecture at the 5th National Symposium of the Brazilian Association of Cyberculture Researchers ABCiber 2011, published in *Digital Art: fractures, proliferative preservation and affective dimension*, edited by Yara Guasque, 38–89, Coleção Fast Forward/ UFG/ Media Lab, 2014.

with each other, creating constellations, drawing connections between works, and between works and the context, creating new interpretations and understandings, and ultimately creating narratives and telling stories that reflect particular worldviews. There can be many ways of drawing connections and telling stories, and there might be many stories in one biennial. Biennials are not single entities, and neither are they made by one curator, but by larger assemblages of humans and nonhumans.[8]

The Next Biennial Should be Curated by a Machine (TNBSCBM) is an experiment in making a biennial by multiple 'curators/authors' — human and machine (AI) — exploring inner machine logic: how machines select, label and organise works. It explores how machines make connections between works, between texts, between works and texts, and how they might create new works and texts from the source material drawn from various biennials, or how they make new connections that might lead to new narratives, new biennials as yet unimagined — or unimaginable — by human curators alone.

Under this overarching concept, three parallel experiments have been realised thus far, applying various machine learning techniques (a subset of AI) to work on ('curate') datasets derived from specific biennial exhibitions or collections. These experiments are subtitled B^3(NSCAM) and AI-TNB, both realised in the context of Liverpool Biennial 2021, and Newly Formed, realised in the context of Helsinki Biennial 2023. All experiments in the series are gathered on an overall project website providing extended contextual information at http://www.kurator.org/ai/. [fig. 1]

7. For a discussion about biennials see, for instance: Elena Filipovic, Marieke van Hal, Solveig Øvstebø, *The Biennial Reader* (Bergen: Bergen Kunsthalland Ostfildern: Hatje Cantz Verlag, 2010); Antoni Gardner and Charles Green, *Biennials, Triennials, and Documenta: The Exhibitions That Created Contemporary Art* (London: Wiley Blackwell, 2016); Shwetal A Patel, Sunil Manghani and Robert E. D'Souza, 'How to Biennale! (The Manual)', extract published in *On Curating*, no.39, 2018, https://www.on-curating.org/issue-39-reader/introduction.html#.YUzTNi1Q3OQ; 'The Biennial Condition', *Stages* journal Vol.6, 2016, ed. Joasia Krysa, Liverpool Biennial 2016.

8. For an earlier discussion see Joasia Krysa, 'Curating Immateriality. The Work of the Curator in the Age of Network Systems' (*Data Browser* Vol.3, ed. Joasia Krysa, 2006) and 'Curatorial Authorship' in *The Encyclopedia of New Media Art* (London: Bloomsbury, 2024).

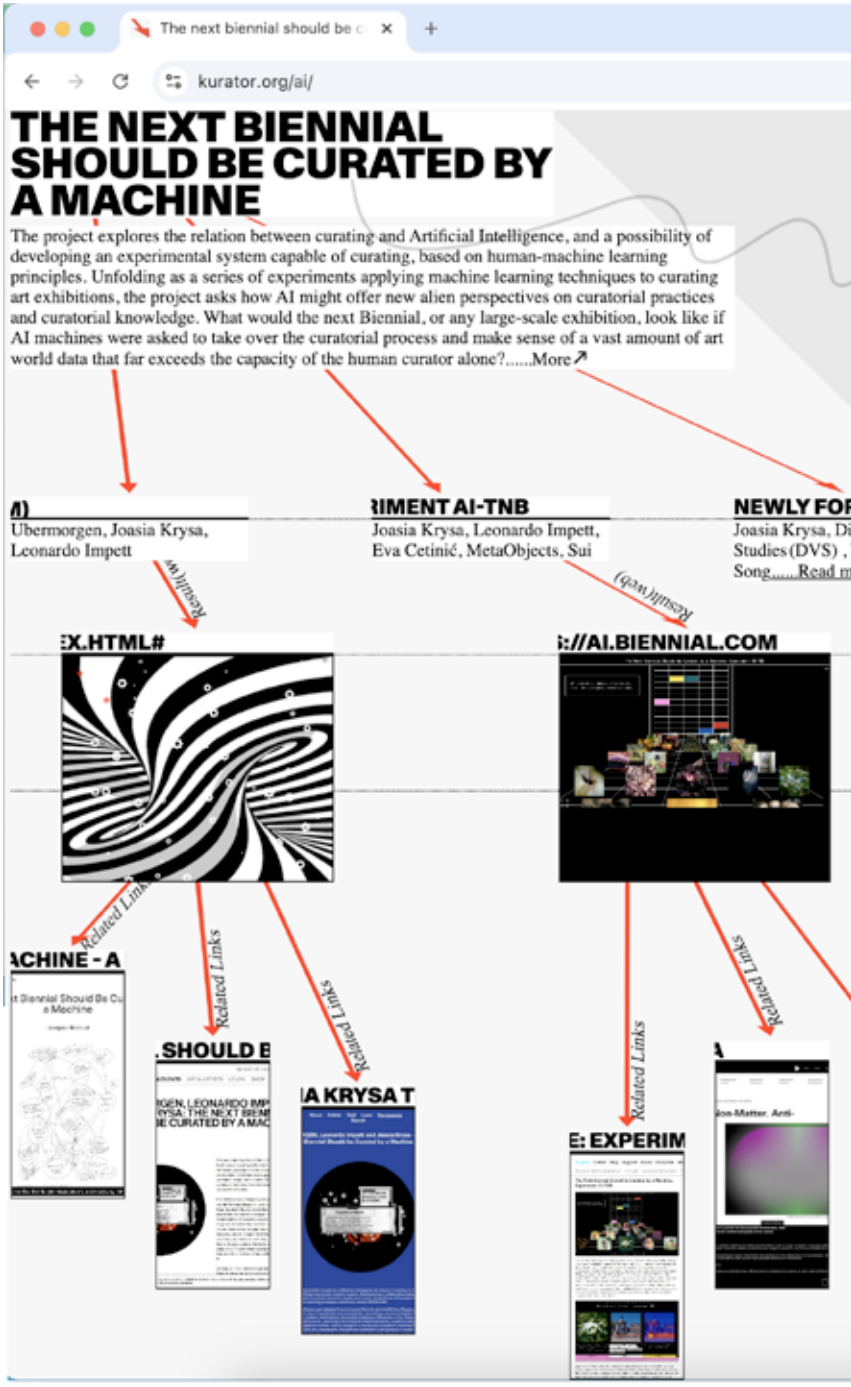
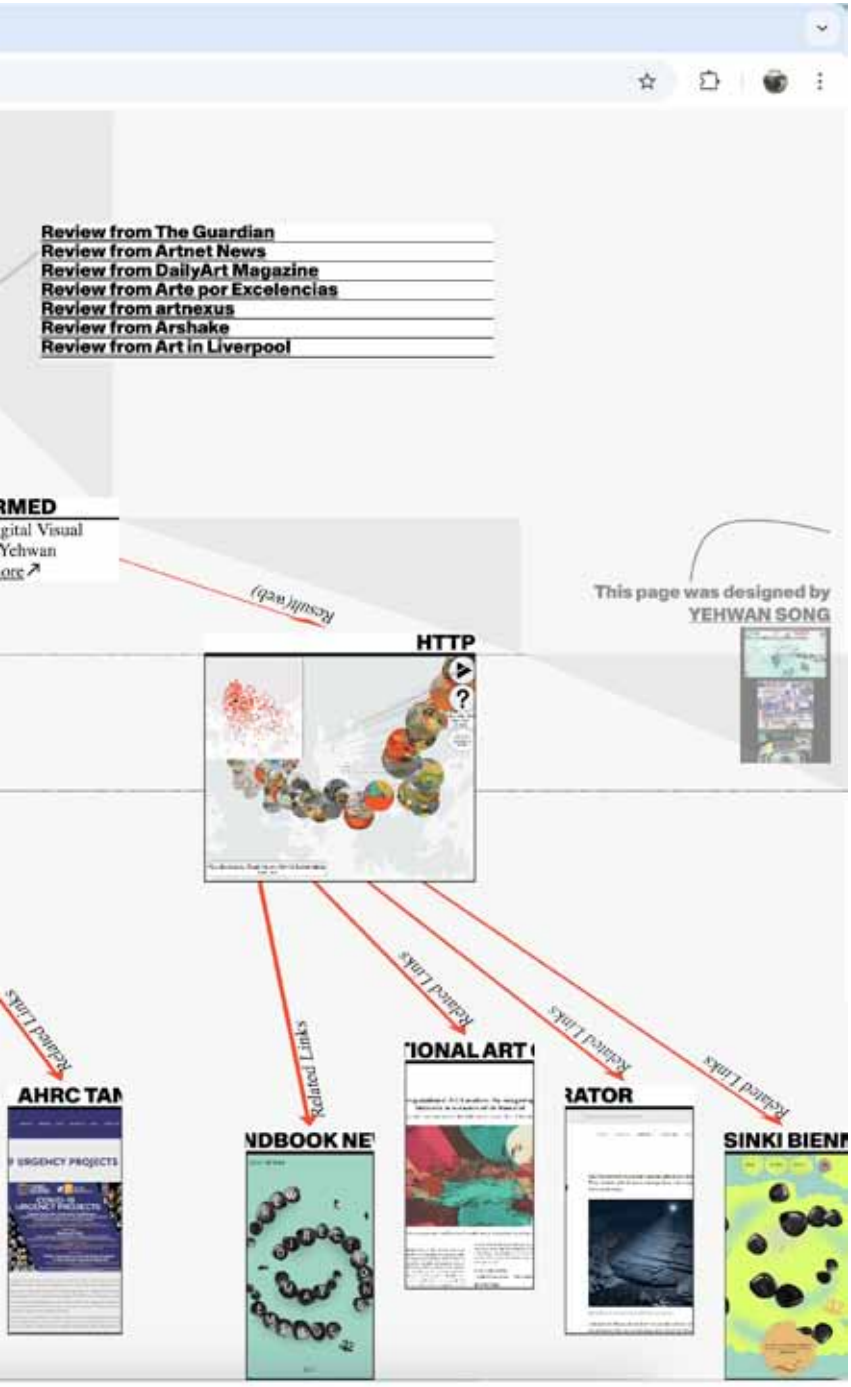


Figure 1: Project website. *The Next Biennial Should Be Curated by a Machine* (2021), Joasia Krysa and Leonardo Impett, et al. Website design by Yehwan Song. Replica of original project website: www.kurator.org/ai/.


Review from The Guardian
Review from Artnet News
Review from DailyArt Magazine
Review from Arte por Excelencias
Review from artnexus
Review from Arshake
Review from Art in Liverpool
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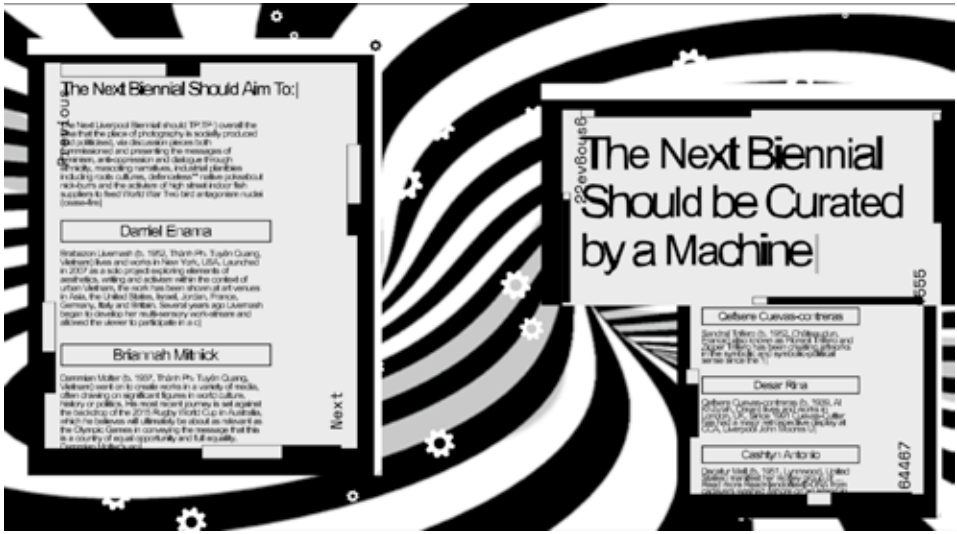
Experiment B^3(NSCAM) is a collaboration with artists Ubermorgen, commissioned by The Whitney Museum of American Art for its online platform *artport* and Liverpool Biennial.[9] The experiment takes archival text material and datasets from both commissioning institutions and processes them through a group of machine learning algorithms that we have collectively named B^3(NSCAM) deriving from the main title of the overall project. [fig. 2, 3] Processing datasets — including curatorial texts and artists' biographies — linguistically and semiotically, the AI system 'learns' their style and content, cutting and mixing them together. The new texts generated in this way are then presented to the online audience, with a degree of interactivity and 'branching', while the AI iteratively rewrites small parts of its own text at random.

The Whitney website describes the project in detail:

> The B^3(NSCAM) software uses datasets from Liverpool Biennial and the Whitney Museum, among other sources. It processes them linguistically and semiotically, calculating a future probability for words to appear, to generate endless combinations of possible instances of Biennials in flux. These imagined occurrences manifest as texts — seemingly conventional artist biographies, curatorial statements, press releases, and art magazine reviews — which engage in a continuous process of rewriting themselves. Always remaining fluid and ungraspable, the texts are presented in windows on a range of animated visual backgrounds that allude to the sixty-four parallel universes of possible Biennials constructed by the AI. Clicking on the interface's spinning wheels will launch a new Biennial universe on an animated graphic constructed from sources such as NASA and sci-fi imagery. Each universe is accompanied by a soundtrack from the TikTok playlist, alluding to the mix of creative expression and preconfigured elements

9. Experiment B^3(NSCAM) was developed by Joasia Krysa (series curator), Leonardo Impett (series technical concept) and artists Ubermorgen, and launched in March 2021 on The Whitney Museum of American Art's online portal *artport* at: https://whitney.org/exhibitions/the-next-biennial and Liverpool Biennial 2021 edition at: https://www.liverpoolbiennial2021.com/programme/ubermorgen-leonardo-impett-and-joasia-krysa-the-next-biennial-should-be-curated-by-a-machine/. For more information and to view the project visit: https://whitney.org/exhibitions/the-next-biennial.



Figures 2, 3: *The Next Biennial Should Be Curated by a Machine* (2021), Experiment B^3(NSCAM) by UBERMORGEN, Leonardo Impett and Joasia Krysa. Commissioned by Liverpool Biennial and the Whitney Museum of American Art for its *artport* website and Liverpool Biennial. Replica of original project website at the Whitney Museum of American Art's artport: https://whitney.org/exhibitions/the-next-biennial.

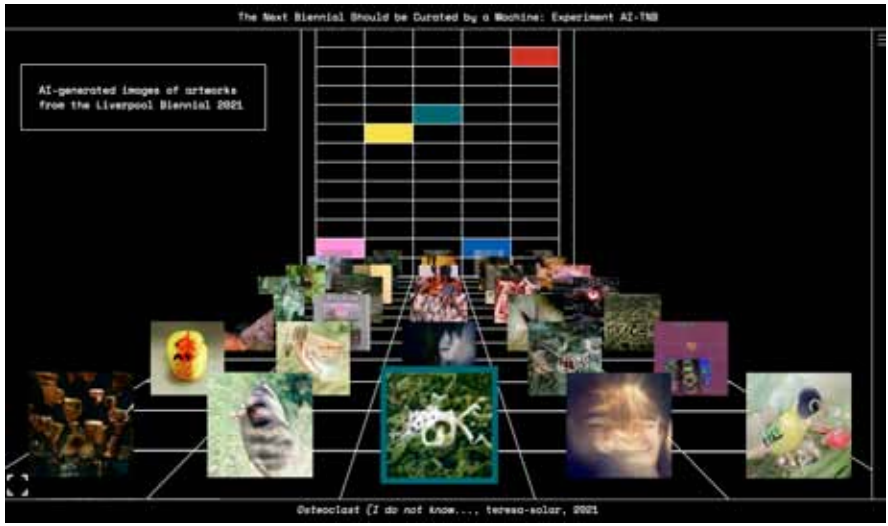
> in digital tools. The respective universes are created by subtle changes in the software's parameters, for example giving more weight to one data set — such as the Whitney or Liverpool Biennial — over another, or simply generating variations of biographies for artists with the same first or last name. Together these textual and graphic universes of Biennials narrate and visualise the impossible, absurd endeavour of an AI to curate on the basis of what it has learned from sources compiled by people and human understandings of art.

A parallel experiment, AI-TNB (in this subtitle AI stands for Audience Interaction — Artificial Intelligence) is commissioned for the UK AHRC — Arts and Humanities Research Council programme *Towards a National Collection*, to explore machine curation and visitor interaction with a focus on *human-machine co-authorship*.[10] The experiment takes specifically the Liverpool Biennial 2021 edition, curated by Manuela Moscoso and presented across multiple venues in Liverpool between March and August 2021, and interprets it as a parallel machine-visitor curated online version.[11] (Fig. 4, 5, 6, 7, 8, 9)

In this experiment, recent machine learning techniques are applied to data derived from the Biennial — including the photos of artworks, their titles and their descriptions — to create new readings of, and connections between, the works. At the heart of the experiment is OpenAI's new deep learning model CLIP, released in early 2021, which is able to judge the similarity between an image and a short text. On the project's landing page, visitors encounter fifty eerie images — some of which look like photographs, others like drawings or collages. These are images generated by AI in response to the titles of the source artworks of the Liverpool Biennial 2021, using a technique developed by Ryan Murdock (@advadnoun) employing CLIP to guide a GAN (Generative Adversarial Network) into creating an image that 'looks like' a particular text. *Fraught for those who bear bare witness*, by Ebony G. Patterson, for instance, results in an image of a bear's face

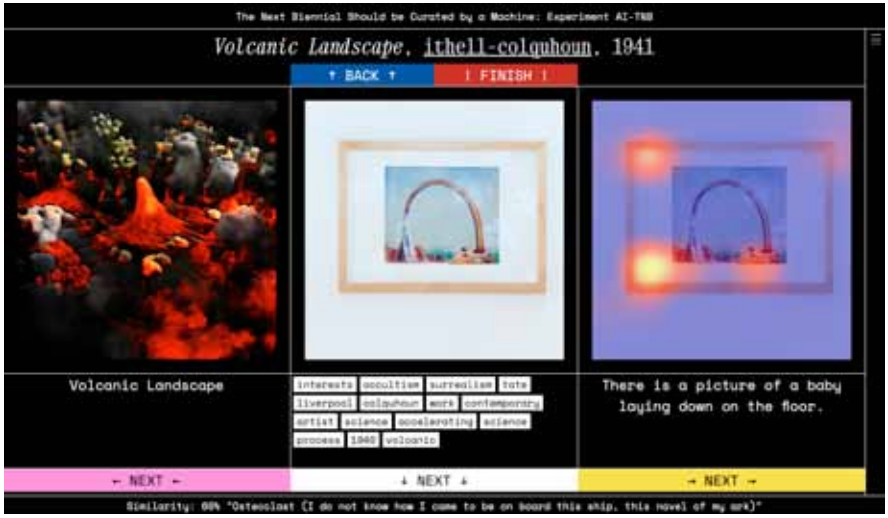
10. Leonardo Impett, I. Herman, P.K. Wollner and A.F. Blackwell, 'Musician Fantasies of Dialectical Interaction: Mixed-Initiative Interaction and the Open Work', in *International Conference on Human-Computer Interaction* (Cham: Springer, 2018), 184–95.

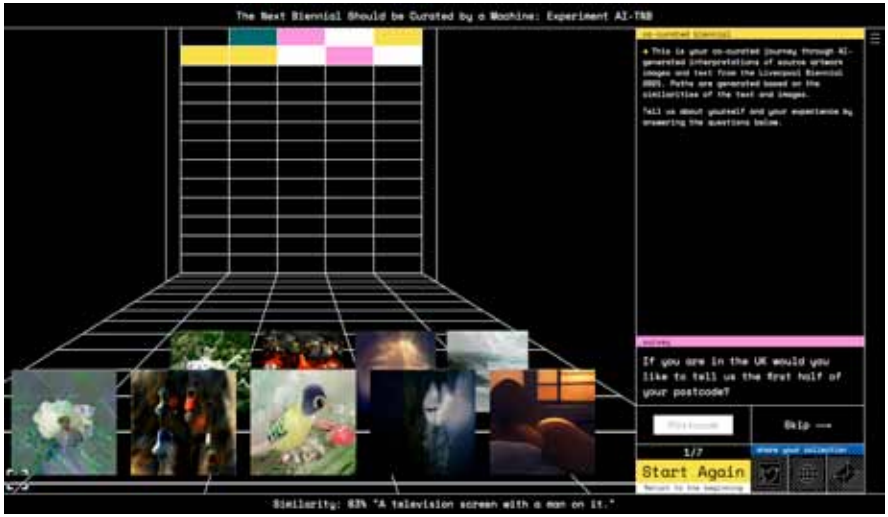
11. The 11th edition of Liverpool Biennial (2021), *The Stomach and the Port*, was curated by Manuela Moscoso and presented across multiple venues in Liverpool, March – August 2021, https://www.biennial.com/2021.

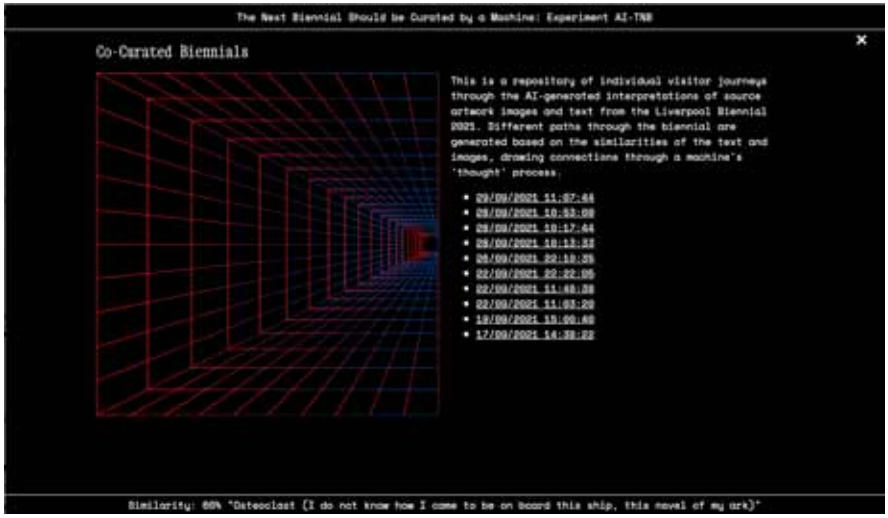


Figures 4–9: *The Next Biennial Should Be Curated by a Machine, Experiment AI-TNB (2021)* by Eva Cetinić, Leonardo Impett, Joasia Krysa, MetaObjects (Ashley Lee Wong and Andrew Crowe), and Sui. Replica of the original project website: https://ai.biennial.com.


The Next Biennial Should be Curated by a Machine: Experiment AI-TNB
Osteoclast (I do not know how I came to be on board this ship, this novel of my ark)
> Finding the most similar AI-generated image "Osteoclast (I do not know how I came to be on board this ship, this novel of my ark)":
> Similarity:
80% "I I I (something fat, something cosmic, something endless)"
80% "Masterless Voices"
80% "Pathology in Three Parts"
80% "Volcanic Landscape"
> Taking you to "Volcanic Landscape"


The Next Biennial Should be Curated by a Machine: Experiment AI-TNB
Volcanic Landscape, ithell-colquhoun, 1941
↑ BACK ↑
! FINISH !
Volcanic Landscape
interests occultism surrealism tate liverpool colquhoun work contemporary artist science accelerating science process 1940 volcanic
There is a picture of a baby laying down on the floor.
← NEXT ←
↓ NEXT ↓
→ NEXT →
Similarity: 80% "Osteoclast (I do not know how I came to be on board this ship, this novel of my ark)"


The Next Biennial Should be Curated by a Machine: Experiment AI-TNB
If you are in the UK would you like to tell us the first half of your postcode?
Skip
1/7
Start Again
Similarity: 83% "A television screen with a man on it."


The Next Biennial Should be Curated by a Machine: Experiment AI-TNB
Co-Curated Biennials
This is a repository of individual visitor journeys through the AI-generated interpretations of source artwork images and text from the Liverpool Biennial 2021. Different paths through the biennial are generated based on the similarities of the text and images, drawing connections through a machine's 'thought' process.
29/09/2021 11:57:44
28/09/2021 10:53:09
28/09/2021 10:17:44
28/09/2021 10:13:33
26/09/2021 22:10:35
22/09/2021 22:22:05
22/09/2021 11:48:38
22/09/2021 11:03:20
19/09/2021 15:00:40
17/09/2021 14:39:22
Similarity: 80% "Dateoclast (I do not know how I come to be on board this ship, this navel of my ark)"

in the woods, whilst Ines Doujak and John Barker's *Masterless Voices* has led to a dark image with half a dozen disembodied open mouths. These AI-generated images give a new dimension to the title of the artwork — but they don't create connections between them. Navigating through the experiment, visitors are presented with a triptych of images and texts, with the source artwork placed in the centre, the AI-generated image on the left and a heatmap overlaid on the source image on the right. 'Deep learning' models are used to create new links between the visual and textual material, as well as entirely new images and texts. Every page is also a trifurcation: visitors can explore the links between the original source and generated material, word and image, art and data. As visitors navigate the project, they create their own paths through the material, each such journey becoming a co-curated human-machine iteration of the Biennial saved to the project's public repository (named as Co-curated Biennials).[12]

The third and the latest iteration of the project was developed as part of the Helsinki Biennial 2023 (HB23) (curated by Joasia Krysa) as a collaboration between artist Yehwan Song and Digital Visual Studies (DVS), a Max Planck Society project hosted at the University of Zurich. Taking a slightly different approach to previous experiments these had a double role — it served as one of 29 biennial artworks (exhibited online) and at the same time it was featured as one of 5 co-curators of the overall Helsinki Biennial 2023 edition, alongside invited human curators.[13]

Entitled *Newly Formed*, this experimenst engaged specifically with

12. Experiment AI-TNB is located at: https://ai.biennial.com. The experiment was developed by Eva Cetinić (machine learning concept and implementation), MetaObjects (Ashley Lee Wong and Andrew Crowe) and Sui (web development and design), Leonardo Impett (series technical conceptualisation) and Joasia Krysa (series curator). Funded by the AhRC — Arts and humanities Research Council's programme 'Towards a National Collection', under grant Ah/V015478/1. For more information about this experiment visit: https://ai.biennial. com/#howitworks.

13. These were art organisations, research institutions, and collectives: Museum of Impossible Forms, TBA21–Academy, Critical Environmental Data at Aarhus University and ViCCA@AaltoArts (Visual Cultures, Curating and Contemporary Art at Aalto University). For further discussion on the idea of 'curatorial intelligencies' and the curatorial approach developed for Helsinki Biennial 2023 edition, see J. Krysa (2023), 'New Directions May Emerge', in P. Grönroos and J. Krysa (ed.), *Helsinki Biennial 2023: New Directions May Emerge*, 14–27, Helsinki Biennial/ Helsinki Art Museum HAM.

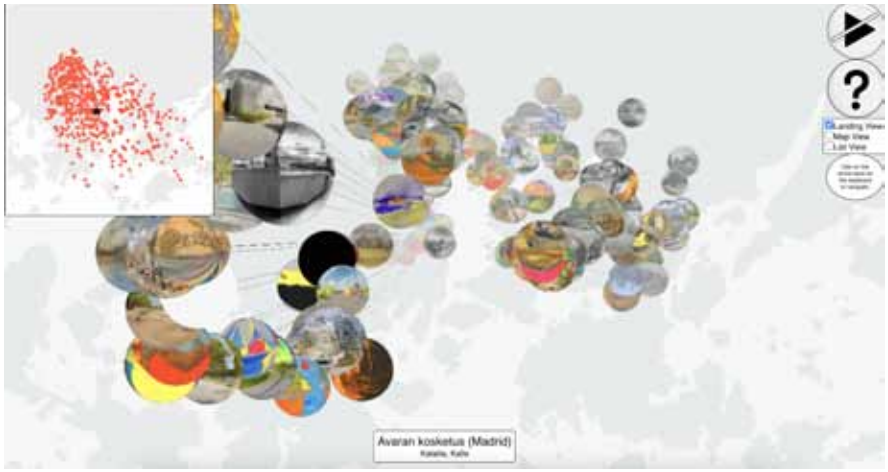
the collection of Helsinki Art Museum (HAM), to open up collection to wider public access and to facilitate public co-creation of new interpretations from the collection, and effectively public co-curation of the collecton together with AI. In practical terms, the experiment takes the form of an online 3D map of Helsinki inviting visitors to navigate and interact with HAM's public art collection based on their location in the city. Responding to data from artworks and geolocations, the AI algorithm generates new artwork selections from the collection. This is performed by different machine learning models and software 'acknowledging the machinic perception of the artworks and to some extent the machinic interpretation of the HAM collection and its connections to the urban fabric of Helsinki.'[14] To quote the project description further: 'Machine curation involves the processing of synthetic metadata with AI algorithms. This synthetic metadata represents encoded information. What results is a newly formed entanglement emerging from the combined agencies of the model, the visitors, the city, and the collections.'[15] Together, this blended curatorial vision adds a new perceptual layer to the biennial narrative each time visitors interact with the website, effectively producing new iterations of the biennial based on works in the collection. [fig. 10, 11, 12]

In undertaking these experiments, the overall intention is to explore applications of AI to curating, to alternative forms of exhibition-making and curatorial agency that question hard distinctions between humans and machines, and to question the anthropocentric curatorial paradigm that reproduces the universalist worldview.[16]

14. For further details on this experiment see two papers written by Digital Visual Studies (DVS) researchers and co-authors of the project Darío Negueruela del Castillo, Iacopo Neri, Pepe Ballesteros, Valentine Bernasconi, Ludovica Schaerf, 'New Directions May Emerge: AI Curation of Helsinki's Cultural Landscape' in Olivér Horváth (ed.) *Designing Digital Humanities, Disegno Journal*, Fall 2023. ISSN 2416-156X; and Ludovica Schaerf, Pepe Ballesteros, Valentine Bernasconi, Iacopo Neri and Dario Negueruela del Castillo, 'AI Art Curation: ReImagining the City of Helsinki on Occasion of Its Biennial'. arXiv. https://doi.org/10.48550/ARXIV.2306.03753. See also a research paper featuring the project as a case study by Ipek Yeginsu, 'The impact of Artificial Intelligence on the "curator-as-artist": revisiting Ventzislavov's concept in two cases of AI-based curating', *AI & SOCIETY*, Springer, July 2025, DOI:10.1007/s00146-025-02462-z.

15. Ibid., 52.

16. 16. See Kadish Morris, 'Liverpool Biennial — bleeps, bones, and a machine that curates', The Observer, 28 March 2021, https://www.theguardian.com/artanddesign/2021/



Figures 10, 11, 12: *Newly Formed* (2023), Yehwan Song and Digital Visual Studies, curator Joasia Krysa. Homepage of the project website: http://newlyformedcity.net.

In this scenario, machine learning algorithms are considered beyond the 'search engine' paradigm in which they have been used by museums and galleries, and instead as curatorial agents, working in parallel to human curators.[17, 18] This conceptual shift raises a number of issues, such as the degree to which creativity is compromised by the 'intelligent' machines we use, how decisions are made, as well as the issue of bias in curating and in AI.[19] The art world, much like a training dataset, is heavily biased, and exhibitions and biennials reflect this, for instance in the selection of artists and artworks, or topics for exhibitions, shaping larger narratives, histories and visions of the world. This in itself does not have to be necessarily negative, but when aggregated towards one particular representation or a worldview that excludes and dominates, it becomes much more problematic.[20] Once the two paradigms — AI and art world — are

mar/28/liverpool-biennial-review-bleeps-bones-and-a-machine-that-curates.

17. Kate Crawford and Vladen Joler, *Anatomy of an AI System: The Amazon Echo as an Anatomical Map of Human Labor, Data and Planetary Resources*, AI Now Institute and Share Lab, 2018, https://anatomyof.ai/.

18. Leonardo Impett, 'Irresolvable contradictions in algorithmic thought', published in *Stages*, Vol.9, 2021, Liverpool Biennial, April 2021, https://www.biennial.com/journal/issue-9.

19. Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York, NY: New York University Press, 2018).

20. See also: 'Notes On A (Dis)continuous Surface', Murad Khan, in *Stages* Vol.9, https://www.biennial.com/journal/issue-9/notes-on-a-discontinuous-surface.

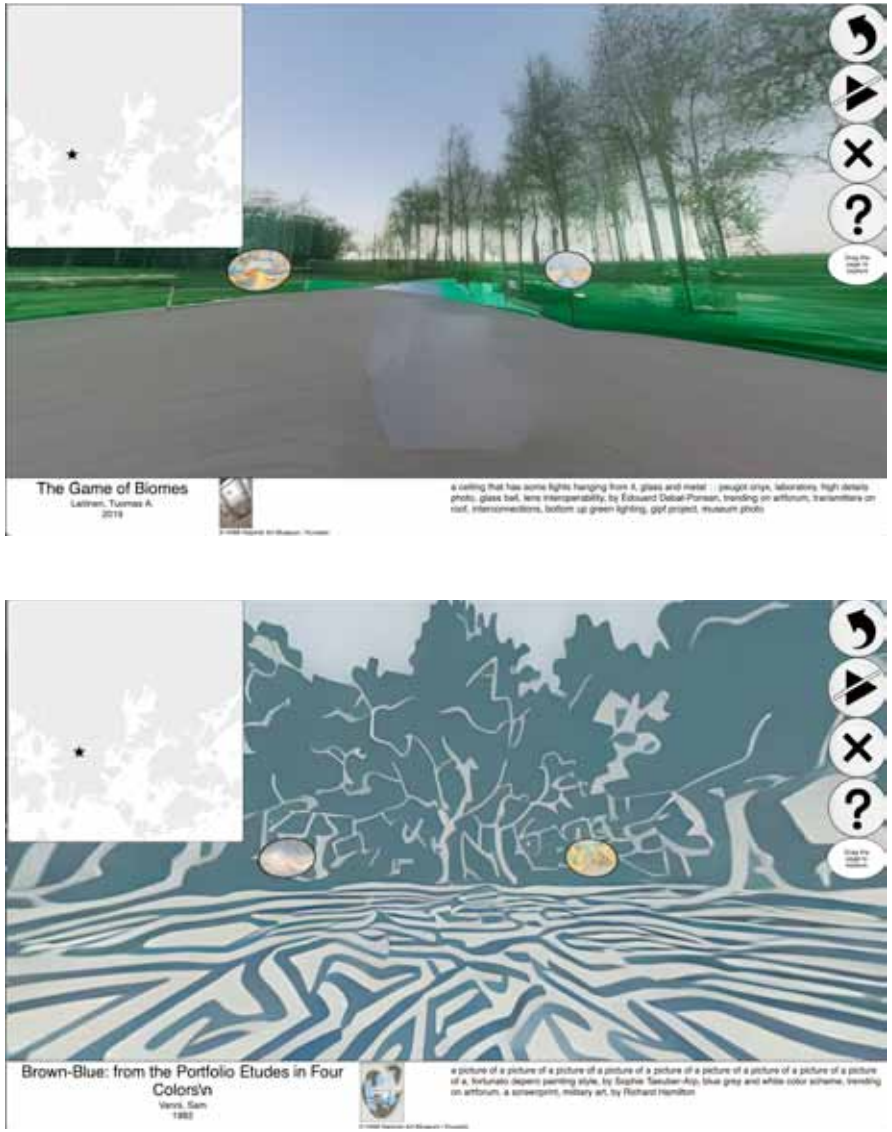


Figure 11, 12: *Newly Formed* (2023), Yehwan Song and Digital Visual Studies, curator Joasia Krysa. AI-generated images of artworks from Helsinki Art Museum collection. Replica of the original project website: http://newlyformedcity.net.

correlated and entangled, these inherent issues become even more evident, and it is possible to speculate on what each might learn from the other to address this. It is not just a case of identifying concerns — such as the inclusion of underrepresented communities or knowledges, or the forms of creativity produced through AI — but also an opportunity to think about the transformation of human-machine relations and curatorial practices more generally; about the emergent forms of creativity, the larger infrastructures within which it operates, and alternative practices and exhibitionary forms enabled by these entanglements of human and machine, that go some way towards rethinking the larger curatorial field.[21]

21. For a discussion of AI and Curating visit Liverpool Biennial online journal *Stages*, Vol.9, Ibid.

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Biographies

Dominik Bönisch studied culture management in Hildesheim, Germany and Budapest, Hungary. He is currently conducting research as a scientific project manager at the University of Applied Sciences, Düsseldorf (MIREVI) on the exploration of intermedia collections using AI retrieval tools. Until 2023, he led Training the Archive at the Ludwig Forum for International Art in Aachen, Germany, using AI in curatorial practice. His research interests focus on the impact of new technologies on collection and exhibition operations in GLAM institutions.

CROSSLUCID is an artist collective (est. 2018) that engages in highly collaborative, cross-disciplinary projects in co-evolution with technology. The group's work and research includes the exploration of the self as a network, emerging forms of intimacy, and the potential for pleasurable actualisation throughout the digital sphere, as well as reimagining our alliances with technology as expressions of a sympoietic biosphere and a universal post-material consciousness. Through explorations spanning filmmaking, poetic artificial intelligence, multi-layered techniques of collage, assemblage and experience-led interventions they create scenarios and build experiential formats that instigate prototyping and the rehearsing of potential futures and metamodern values.

Marialaura Ghidini is a curator and researcher whose work explores the intersections of art and digital technologies. She focuses on what often remains unseen — from platform infrastructures to corporate rhetoric — as these shape knowledge production and our relationships with the environments we inhabit. This perspective has informed projects such as the platform *or-bits.com* (2009–2015), the exhibitions *#exstrange* (2017), *UnProductive Solutions* (2023) and *We Are All Users, Till We Are Not* (MACTE Digital, 2025), the archive *curating.online* (2021) and the symposium *Codici Magici* (2023). Marialaura is co-editor, with Tara Kelton, of the publishing series *Silicon Plateau* (2018–) and is the co-author, with Gaia Tedone, of *La Natura Ibrida della Curatela Digitale — dal web all'IA* (Mimesis, 2025). https://marialaura-ghidini.hotglue.me.

Olga Goriunova is Professor at Royal Holloway University of London and author of *Art Platforms* (Routledge, 2012) and *Bleak Joys* (with M. Fuller, University of Minnesota Press, 2019). Editor of *Fun and Software* (Bloomsbury, 2014), she was a co-curator of software art platform Runme.org (2003) before the age of social platforms. She also wrote on new media idiocy, memes and lurkers, before these were mobilised by alt-right and data surveillance. Her new book *Ideal Subjects* (University of Minnesota Press, 2025) focuses on machine learning, data and subject-construction.

Francis Hunger's practice combines artistic research and media theory with the capabilities of narration through installations, radio plays and performances and internet-based art. Currently he co-teaches the Emergent Digital Media class at the Academy of Visual Arts Munich, and is co-editor of www.carrier-bag.net. Subsequent to his PhD at Bauhaus Univsersity Weimar, Hunger is now PostDoc at the Dataunion ERC project, researching about the European Union database interoperability at VUB, Brussels. Between 2021–2023 he was researcher for Training The Archive at Hartware MedienKunstVerein Dortmund, critically examining the use of AI, statistics and pattern recognition for art and curating. https://www.irmielin.org.

Leonardo Impett is Assistant Professor at Cambridge Digital Humanities, where he directs the M.Phil. He was previously Assistant Professor of Computer Science at Durham University. He has a background in information engineering and machine learning, but his current research focuses on the intersection between visual culture and computer vision: what can AI tell us about the history of art, and vice versa? Complementing this strand of research, he frequently works with curators and artists exploring the cultures, ethics and politics of AI, including for the Liverpool Biennial, the Royal Opera House and the Whitney Museum of American Art.

Victoria Ivanova is R&D Strategic Lead within the Arts Technologies team at Serpentine Galleries, London, where she leads on the Future Art Ecosystems initiative and has been instrumental in developing creative R&D infrastructure and activity. She also carries out research and consultancy on organisational systems and institutional design. Ivanova has previously worked in human rights and founded Izolyatsia, a cultural

centre in Donetsk, Ukraine, which was expropriated by the Russian militia in 2014 and subsequently turned into a torture facility.

Eva Jäger is Curator of Arts Technologies at Serpentine Galleries in London. She commissions artists working with advanced technologies and is a collaborator in teams designing novel approaches, workflows and philosophies of emerging tech. During her time at Serpentine she has worked with artists Holly Herndon and Mat Dryhurst, Jenna Sutela, Hito Steyerl, Suzanne Treister, Jakob Kudsk Steensen, Trust, 0rphan Drift, Kite, Keiken, Danielle Brathwaite-Shirley, Libby Heaney, Gabriel Massan and dmstfctn. Jäger is also part of the team working on Future Art Ecosystems as a researcher for the annual briefing and as co-investigator of the Creative AI Lab (Serpentine R&D Platform and King's College London).

Nathan Jones is Senior Lecturer in Fine Art (Digital Media) at Lancaster University and co-founder of Torque Editions. His work combines methods from new media cultures, art criticism and literary practice. This hybrid artistic research has appeared at Transmediale, Liverpool Biennial, and in various international galleries and journals. Jones' monograph *Glitch Poetics* (2022) was nominated for the N. Katherine Hayles Award. Currently, his 'distributed critique' project explores how knowledge made by artists can be networked to other disciplinary areas, such as climate science.

Murad Khan is Course Leader and Senior Lecturer on the Diploma and Graduate Diploma in Creative Computing at the University of the Arts London: Creative Computing Institute. His research explores computational techniques in cognitive science, adversarial machine learning and post-Kantian philosophies of mind. He has presented his research at Unsound Festival, Krakow, Serpentine Galleries, London, and the Goethe-Institut, Glasgow, as well as publishing in *Stages Journal* and the eflux Journal collection *Navigation Beyond Vision* (Sternberg Press). Khan is co-founder of Unit Test, a design and research studio that investigates and evaluates computational systems.

Nora N. Khan is an independent critic, essayist, curator, and educator based in Los Angeles. Her writing on philosophy of AI and emerging technologies is referenced heavily across fields. Formally, this work attempts to theorize the limits of algorithmic knowledge and locate computation's

influence on critical language. She is currently History and Theory faculty at SCI-Arc; previously she was Arts Council Professor at UCLA in Design Media Arts (2024–2025), and professor in Digital + Media at Rhode Island School of Design, where she was nominated for the John R. Frazier Award for Excellence in Teaching (2018–2021). Her books are *AI Art and the Stakes for Art Criticism* (2025), *Seeing, Naming, Knowing* (2019) and *Fear Indexing the X-Files* (2017), with Steven Warwick. She is a member of the Curatorial Ensemble of the 2026 edition of Counterpublic, one of the nation's largest public civic exhibitions, focused next on 'Near Futures'. She was the Co-Curator with Andrea Bellini of the Biennale de L'Image en Mouvement 2024, *A Cosmic Movie Camera*, hosted by Centre d'Art Contemporain Genève, and also curated *Manual Override* at The Shed (2020).

Joasia Krysa is Professor of Exhibition Research and Director of the Institute of Art and Technology at Liverpool John Moores University, and holds an adjunct position at Liverpool Biennial. She has served as chief curator of Helsinki Biennial 2023 and co-curator of Liverpool Biennial 2016 and dOCUMENTA (13) (2012). Working at the inter-section of art and technology, her curatorial work was presented at institutions including The Whitney Museum of American Art New York, KANAL Centre Pompidou Brussels, ZKM Center for Art and Media Karlsruhe, Helsinki Art Museum, and Tate Modern London. Publications include co-edited books *Curating Superintelligences: A Reader on AI and Future Curating* (Open Humanities Press 2025), *New Directions May Emerge* (Helsinki Art Museum/ Helsinki Biennial 2023), *Writing and Unwriting* (Media) Art Histories (MIT Press 2015), a chapter in *Bloomsbury Encyclopaedia of New Media Art* (2025), and forthcoming book *The Routledge Companion to Art and Technology.*

Jason Edward Lewis (Kanaka Maoli/ Samoan) and **Skawennati (Kanien'kehá:ka)** are co-directors of Aboriginal Territories in Cyberspace, a research-creation platform for Indigenous digital media based in Tiohtiá:ke (Montreal). Lewis is a theorist and artist who works with software and poetry. He has exhibited and published widely, and is the co-founder of the Indigenous Futures Research Centre. He is also Professor of Computation Arts at Concordia University, where he is the University Research Chair in Computational Media and the Indigenous Future Imaginary. From her perspective as an urban Kanien'kehá:ka (Mohawk) woman and as a cyberpunk avatar, Skawennati creates

images, textiles, sculpture and machinimas. For over two decades, she has exhibited her artworks internationally. In 2021 Skawennati received an Honorary Doctorate from the Minneapolis College of Art and Design.

Nicolas Malevé is a researcher, visual artist, computer programmer. Initially trained as a visual artist, he investigates the socio-technical networks of machine learning and their artistic and epistemic implications. His doctoral research, Algorithms of vision, was framed as a collaboration with the Center for the Study of the Networked Image (CSNI) at London South Bank University and The Photographers' Gallery, London. His scholarly research evolves in parallel to his art practice engaging with the computational image. He is currently a postdoctoral researcher at The Sciences Po School of Law and Medialab, Paris.

Gabriel Menotti is Associate Professor and Director of Curatorial Studies at Queen's University, Film and Media Department. He works as an independent curator in the field of media practices and has published extensively on the subject of images, institutions, and technology. His latest book is the anthology *Barbarian Currents: Half a Century of Brazilian Media Arts* (co-edited with German Nunez, Open Humanities Press, 2025). Menotti is also one of the coordinators of the Besides the Screen research network and festival.

Lívia Nolasco-Rózsás is a curator, art historian, author and educator. She has curated exhibitions at institutions focusing on contemporary and media art such as ZKM | Karlsruhe, Nam June Paik Art Center, and Ludwig Museum Budapest. From 2019 to 2023, she served as the curatorial and scientific head of the *Beyond Matter* project at ZKM, collaborating with institutions such as Centre Pompidou, Paris. Published extensively, Nolasco-Rózsás recently edited the volume *Beyond Matter, Within Space: Curatorial and Art Mediation Techniques on the Verge of Virtual Reality* (2023). Since 2023, she has lectured in curation and media practice at University College London, while concurrently participating in a research project on digital exhibition practices at ECAL Lausanne.

Alasdair Milne is a PhD researcher with Serpentine Gallery's Creative AI Lab and King's College London, working across the philosophy of technology and curatorial R&D. For Creative AI Lab he studies how machine learning is increasingly integrated into artistic workflows, becoming part of broader and more complex systems of tooling. He

researches curatorial methods for how best to support such emerging practices, records histories of their construction, and develops practice-informed theories in parallel. He is also a research fellow at Gray Area in San Francisco, a vital case study towards an understanding of institutional infrastructures for ambitious artistic projects that draw together expertise not just between the artistic and the technical, but also from diverse disciplines.

Christiane Paul is Curator of Digital Art at the Whitney Museum of American Art, and Professor Emerita in the School of Media Studies at The New School. She is the recipient of 2023 MediaArthistories International Award and the Thoma Foundation's 2016 Arts Writing Award in Digital Art, and her books include *Digital Art* (Thames and Hudson, 4th ed., 2023) and *A Companion to Digital Art* (Blackwell- Wiley, 2016). At the Whitney Museum she curated exhibitions including *Marina Zurkow: Parting Worlds* (2025) and *Harold Cohen: AARON* (2024), and is responsible for *artport*, the museum's portal to Internet art.

Helen V. Pritchard is an artist-designer, geographer and queer love theorist. Their work considers the impacts of computation on social and environmental justice and how they configure the possibilities for life — or who gets to have a life — in intimate and significant ways. Pritchard is Professor and Head of Research IXDM, Basel Academy of Art and Design, University of Applied Sciences and Arts Northwestern Switzerland FHNW, where they teach on the MA Transversal Design. They also co-organise with The Institute for Technology in the Public Interest (TITiPI); https://www.helenpritchard.info.

Mikhel Proulx researches contemporary art and network culture. He holds a PhD from the Department of Art History at Concordia University, and has other degrees in drawing, media design and art history. He has lived in Berlin, Calgary and Jerusalem and currently resides in Montreal.

Tom Schofield is an artist, designer and researcher whose practice and research explore themes of power, justice and exploitation in socio-technical arrangements. His work often explores alternative or reimagined histories and futures of technologies by remaking them under the influence of ideas from fiction or magic. He teaches creative and critical technology practices at Culture Lab, Newcastle University,

and frequently works with young children in speculative approaches to contemporary technology design.

Sam Skinner is an artist, curator and publisher working on intersections between community, technology and horticulture. He co-directs Torque Editions. Skinner completed a practice-based PhD at Manchester School of Art in 2019, which investigated the history of observatories and observation, with research translating into co-curation of *The New Observatory* exhibition at FACT, Liverpool, and the artist book *Obs*, published by Broken Dimanche Press. Skinner was co-chair of Working Group 1 of the COST Action on New Materialism and co-edited the project *almanac*. He is lecturer in Art at Oxford Brookes University.

Katrina Sluis is Associate Professor at the School of Art and Design, Australian National University, Canberra, where she is Head of Photography & Media Arts and leads the Computational Culture Lab. Prior to this, she was a founding Co-Director of the Centre of the Study of the Networked Image, London South Bank University and Senior Curator (Digital Programmes) at The Photographers' Gallery, London. With Andrew Dewdney she is the co-editor of *The Networked Image in Post-Digital Culture* (Routledge 2022).

Winnie Soon is a Hong Kong-born artist coder and researcher interested in the cultural implications of digital infrastructure that addresses wider power asymmetries. Their works appear in museums, galleries, festivals, distributed networks, papers and alternative written forms, including co-authored books entitled *Boundary Images*, *Aesthetic Programming* and *Fix My Code*. Soon is Associate Professor & Director of Studies — UG Art and Technology at the Slade School of Fine Art, UCL. http//www.siusoon.net.

Gaia Tedone is a curator and researcher who explores the impact of artificial intelligence on processes of co-creation and co-curation within and beyond the art field. In 2019, she completed her PhD at the Centre for the Study of the Networked Image, London South Bank University. She teaches in Milan at Università Cattolica del Sacro Cuore and at Scuola Politecnica di Design. She is the co-author, with Marialaura Ghidini, of La Natura Ibrida della Curatela Digitale — dal web all'IA (Mimesis, 2025).

Suzanne Treister has been a pioneer in the field of new media since the late 1980s, and works simultaneously across video, the internet, interactive technologies, photography, drawing and watercolour. Often spanning several years, her expansive cross-media projects engage with eccentric narratives and unconventional bodies of research. The relationship between emerging technologies, society, alternative belief systems and the potential futures of humanity constitutes an ongoing focus of her work. http://www.suzannetreister.net/.

Magdalena Tyżlik-Carver is Associate Professor of Digital Communication and Culture, director of the Centre for Critical Data Practices at Aarhus University, and an independent curator. Her research explores data-driven digital transformation in knowledge practices. She develops participatory methods for data practices beyond BigTech extractivism through speculative approaches and open-data principles in research and educational projects, such as *Fermenting Data* and *Curating Data*. She is co-author of *Boundary Images* (University of Minnesota Press, 2023) and co-editor of *Executing Practices* (Open Humanities Press, 2018).

Elvia Vasconcelos is a design researcher, wannabe activist, compulsive drawer and dressmaker. Their work utilises 'sketchnoting' — a form of live sketching that combines text with simple drawings — as a language to critically investigate collaborative design research processes. A strand of Vasconcelos's practice engages with the socio-political dimensions of digital technologies. Taking voice technologies as an object to critically explore the field of Artificial Intelligence, they created the *Feminist Alexa* project in 2017 — enacted through a series of public activities that investigate the ways in which gender is used in technology and the connections to gender-based discrimination in real life.

Ashley Lee Wong is Assistant Professor of Cultural Studies at the Chinese University of Hong Kong. She is Co-Founder and Artistic Director of MetaObjects, a studio that facilitates digital projects with artists and cultural institutions. Her research examines the diverse economies for sustaining artistic practices that engage with art and technology. She has published in *Visual Culture Studies*, no.3–4, 2022, *Screen Bodies*, Vol.7. no.1. 2022, and APRJA, Vol.7, no.1, 2018, and is the author of a monograph, *Ecologies of Artistic Practice: Rethinking Cultural Economies through Art and Technology* (The MIT Press, 2025).

Mi You is a Professor of Art and Economies at the University of Kassel/ documenta Institut. Her academic interests are in the social value of art, new and historical materialism, as well as the history, political theory and philosophy of Eurasia. Her recent exhibitions focus on socialising technologies and 'actionable speculations', such as *Sci-(no)-Fi* at the Academy of the Arts of the World (2019) and *Lonely Vectors* at Singapore Art Museum (2022). She was one of the curators of the 13th Shanghai Biennale (2020–21) and also serves as chair of the committee on Media Arts and Technology for the transnational NGO Common Action Forum.

Martin Zeilinger is Reader in Computational Arts & Technology at Abertay University, Dundee. He develops critical perspectives on digital art and emerging technologies, with a focus on intersections between scholarship, artistic research and curation. He is the author of *Tactical Entanglements* (meson press, 2021) and *Structures of Belonging* (Aksioma, 2023) and publishes widely on digital art in relation to AI, decentralised computing and distributed agency. https://marjz.net/.

Gary Zhexi Zhang's works explore systemic connections between cosmology, technology and economy. He operates individually, in collaboration and within organisational frameworks. He recently edited a book of fiction, essays and interviews about finance and time, *Catastrophe Time!* (Strange Attractor Press, 2023). *Dead Cat Bounce*, the opera he co-created with Waste Paper Opera, premiered at Somerset House in 2022 and toured in 2024. His most recent film and solo exhibition, *METAMERS*, was presented at EPFL Pavilions in February 2024. His works have been shown at Totalab, Shanghai; UCCA Dune, Beidaihe; Para Site, Hong Kong and Inside Out Art Museum, Beijing.

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Curating Superintelligences:
A Reader on AI and Future Curating

Edited by Joasia Krysa and Magdalena Tyżlik-Carver

This volume addresses a shift in contemporary curatorial field largely attributed to the ubiquitous presence of information and computational technologies, the rapid developments in Artificial Intelligence, and the re-claiming of subaltern knowledges. It poses questions about the implications of these "super-intelligences" for contemporary art and culture, and the new possibilities for curatorial practice and its future forms. What new understandings, relationships, and new entities can emerge once open to the possibilities afforded by expanded human and machine epistemologies?

Contributors

Dominik Bönisch, CROSSLUCID, Marialaura Ghidini, Olga Goriunova, Francis Hunger, Leonardo Impett, Victoria Ivanova, Eva Jäger, Nathan Jones, Murad Khan, Nora N. Khan, Joasia Krysa, Jason Edward Lewis (Kanaka Maoli/ Samoan), Nicolas Malevé, Gabriel Menotti, Lívia Nolasco-Rózsás, Alasdair Milne, Christiane Paul, Helen V. Pritchard, Mikhel Proulx, Tom Schofield, Skawennati (Kanien'kehá:ka), Sam Skinner, Katrina Sluis, Winnie Soon, Gaia Tedone, Suzanne Treister, Magdalena Tyżlik-Carver, Elvia Vasconcelos, Ashley Lee Wong, Mi You, Martin Zeilinger, Gary Zhexi Zhang.

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