Future Art Ecosystems

Vol 4. Art x Public AI

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Preface

Future Art Ecosystems (FAE) is a project that was launched in 2020 by Serpentine Arts Technologies dedicated to building 21st century cultural infrastructure to support art x advanced technologies (AxAT) for the public good. Initially solely an annual strategic briefing, conceptualised in collaboration with Rival Strategy, it was designed as a resource to support organisational development for AxAT.

In 2024, FAE has evolved into a holistic ecosystem-oriented project that builds on the insights gained through the strategic briefings *Future Art Ecosystems 1: Art x Advanced Technologies* (2020), *Future Art Ecosystems 2: Art x Metaverse* (2021), and *Future Art Ecosystems 3: Art x Decentralised Tech* (2022).

The briefings led to conversations, which led to the development of partnerships to facilitate projects that are focused on key priority areas for AxAT infrastructural development. For example, a collaboration between RadicalxChange and Serpentine Arts Technologies emerged as a result of the research for, and subsequent release of, *Future Art Ecosystems 3: Art x Decentralised Tech*. The project has grown into an ongoing body of work, *Beyond Cultures of Ownership*, which develops discourse and platforms experiments in new ownership and distribution models, such as the stewardship technology, *partial common ownership*.

FAE continues to build on the knowledge and experience developed through a decade of commissioning and producing experimental AxAT projects with artists such as Gabriel Massan, Ian Cheng, Danielle Brathwaite-Shirley, Jakob Kudsk Steensen, Jenna Sutela, and Trust among many others. In this context, the art field becomes a valuable space for experimentation that can

have an impact on emerging systems for art, technology, and society.

While each strategic briefing may represent a specific moment in the cultural technosocial context, the series as a whole represents a commitment to the development of the ideas on which it was built. This reflects the emergence of Future Art Ecosystems 4: Art x Public AI (FAE4) as both a response to the urgent issues of the moment, and an attempt to chart a long-term vision for the cultural sector at large and AxAT specifically. As with each strategic briefing, FAE4 is built on landscape mapping research, roundtables, and interviews with artists  , cultural producers, curators, technologists, policy-makers, and legal professionals. AI has been a key area of commitment since the formation of Serpentine Arts Technologies ten years ago, initially through commissioned projects, and, eventually, the founding of the Creative AI Lab by Eva Jäger and Mercedes Bunz in 2019, a collaboration between Serpentine Arts Technologies and the Department for Digital

Humanities at King's College London. We are proud that the lab now includes Alasdair Milne, Daniel Chávez Heras, Joanna Zylinska, and many more brilliant thinkers and practitioners. The Lab produces prototypes, research, and oversees a growing database of creative AI tools. The Lab has been a key driver in the steering and development of this briefing, and we are indebted to every collaborator for this ongoing partnership.

The core team responsible for the production of FAE4 includes Serpentine Arts Technologies (FAE4 is led and written by Victoria Ivanova and Eva Jäger, with Tamar Clarke-Brown, Tommie Introna, Lina Martin-Chan, Vi Trinh, Ruth Waters, and Kay Watson) along with co-producer and co-writer Alasdair Milne and co-writer Gary Zhexi Zhang.

We are immensely grateful to our advisors Mercedes Bunz (King's College London), Sebastian Berns (Queen Mary University London), Daniel Chávez Heras (King's College

London), Holly Herndon and Mat Dryhurst (Artists), Matt Prewitt (RadicalxChange), Marta Ferreira de Sá and Benedict Singleton (Rival Strategy), Reema Selhi (DACS), Katrina Sluis (The Australian National University), and Barry Threw (Gray Area), all of whom generously contributed their expertise and time to the development of this volume. We are grateful for research support from Jack Henderson and Caroline Sinders, and to all of our contributors for the conversations that have made this volume a reality.

We thank those who attended and contributed to the first Art x Public AI Workshop in June 2023 at Somerset House, a collaboration between the Creative AI Lab and the Serpentine Legal Lab (led by Alana Kushnir), where early ideas about the AI stack, governance, and regulation were shared and debated.

We have been greatly inspired by the practices of the artists ⌖ who have directly and indirectly shaped this volume through their combined artistic, intellectual, and technical expertise. In particular, thanks to CROSSLUCID whose work accompanies

this publication. We are immensely grateful to Holly Herndon and Mat Dryhurst as key collaborators, and for the honour of working together on R&D towards a major project at Serpentine North in Autumn 2024. It is through this project that an experimental use case for a data trust has been developed in collaboration with Sylvie Delacroix from the Centre for Data Futures, King's College London.

Many thanks to Jack Murray-Brown, William Kherbek, Severin Matusek, Ralph Pritchard, James Wreford of Black Shuck, and Roxy Zeiher. Thanks to the wider Serpentine team whose support enables our projects to be truly public ⊕. We are extremely grateful to Serpentine's Hans Ulrich Obrist, Artistic Director, and Bettina Korek, CEO, for their on-going support, which has been integral to the evolution of Arts Technologies at Serpentine.

We would like to offer our continued gratitude to Bloomberg Philanthropies, in particular to our Chairman Michael R. Bloomberg, Patti Harris, and Jemma Read, for partnering with us

on Serpentine's Bloomberg Connects App, which enables us to extend our audience reach.

The Serpentine Council is an extraordinary group of individuals who provide ongoing and important assistance to enable us to deliver our ambitious Art, Architecture, Civic, Ecologies, Education, Live, and Technology Programmes. We are also sincerely appreciative for support from the Corporate Members, the Americas Foundation, Patrons and Future Contemporaries of the Serpentine.

The Serpentine receives support from Arts Council England which provides an essential contribution to our work and we are grateful for their continued support.

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Line of Flight: Prelude (2024), Still.

Introduction

Images, video clips, music, and essays are being generated at jaw-dropping speed using just a few short verbal prompts.[1] Succession-calibre melodrama is unfolding in the couloirs of a company that has put out an application with the fastest growing user-base in history.[2] Artists are challenging AI companies in court, alleging permissionless use of their works in the development of a new, powerful technology.[3] Silicon Valley tech pundits are invoking the transcendent call of godly intelligence, to which we must conform, even if it could lead to human extinction.[4] Opaque, seemingly influential groups with cryptic titles – e.g., EA (effective altruism) and e/acc (effective accelerationism)—are setting the terms of what AI should mean for societies.[5]

In 2023, AI entered its main character phase on a stage where a battle is playing out for the public perception of a technology

previously predominantly associated with sci-fi depictions, such as in *The Terminator* (1984) or *Her* (2013). The theatrics surrounding AI implicate culture as one of the key arenas in the society-wide deployment of technologies that have reached a new level of maturation, the impacts of which are yet to be understood.[6]

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The narrative wars around AI aren't just about words and concepts. The ways in which AI is framed and which narratives will stick in the popular imagination are deeply entangled with the ways in which the technical elements of AI will interweave with broader societal dynamics.[7]

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Instead of approaching AI as a monolithic technology spearheaded by the imperatives of a handful of companies, it is more helpful to understand how present-day AI capabilities, rooted in data, model and compute components, come into being by means

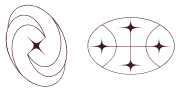
of a technical stack that integrates natural resources, systems, and technologies to produce the necessary hardware and software. This exploration breaks down analysis of the process into four specific chapters of focus.

Defining Public AI offers an overview of the present-day AI stack, providing key on-boarding information and insights addressed to a broad range of audiences across the cultural sector and beyond. How AI is to be understood, assessed, and approached can have considerable influence over the future of regulation, governance, and ownership at each layer of the AI stack. This chapter frames this process as one of negotiating AI's publicness. Control over different layers of the stack can have varying degrees of centralisation and distribution and will be dependent on who participates in the unglamorous work of devising and testing new organisational, technical, and legal mechanisms for balancing societal power relations in the age of AI.

Tech industry actors and governments are the obvious macro movers with levers to determine what happens next in the field. To either prevent or accelerate the dominance of individual actors across the AI stack, the cultural sector—as well as the art and advanced technologies (AxAT) ecosystem more specifically—have an opportunity to be part of new coalitions, to calibrate public-facing expectations, and to demonstrate different possible directions for AI development.

Chapter 1: Organisation considers how organisations as entities—but also organisation as a process in itself—are being transformed by the logics and operations of AI, which requires large quantities of high-quality training data, advanced algorithmic models and computational power. The chapter points to areas likely to be of high impact for cultural organisations and suggests proactive strategies. The chapter also points to the unique affordances of cultural institutions and other AxAT organisational actors, not to act solely as demo

stages for new products, but as value-adding stakeholders with the agency to make consequential operational and strategic decisions in the sector.



Chapter 2: Artist narrows the aperture to the scale of artistic practices, focusing on artists (as individuals or as studios and/or collectives) who work with different elements of the AI stack as a tool or a medium.[8] The chapter considers the reciprocal reshaping of the nature of artistic work with AI tools and the expectations placed on artists as producers of creative work in a context where AI tools allow users to generate endless media. The chapter considers the value that artistic skill-sets bring not just to specific strands of AI development, but also to the evolving roles and definitions of 'art' in society.

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Chapter 3: Ecosystem points to the AxAT ecosystem as a lab for public AI. But in order for this ambitious vision to become actionable by the ecosystem and wider cultural domain, further investment into the infrastructural development of AxAT is required. The chapter points to specific areas requiring such development, from obvious hurdles relating to the technical literacy of the wider cultural sector to ongoing campaigns for embedding new metrics for AxAT. The chapter concludes with recommendations for specific AxAT and public AI experiments that build on the insights from previous chapters.

This briefing is not a definitive treatment of these matters. It should be read as a call to action, a timestamp capturing the rapid transformations underway, offering—as with all Future Art Ecosystems briefings—concepts, arguments, and insights that can be integrated into individual or collective operational agendas. Critically, FAE4 emphasises challenges, but also opportunities, for setting an agenda and for steering the development of public AI.

Notes 1-8

1. Generative AI systems that made the headlines in 2023 and beginning of 2024 include Bing, ChatGPT, DALL-E, and Sora, among others.

2. Brian Callaci, *The Antitrust Lessons of the OpenAI Saga* (2023).

3. Blake Brittain, *Artists Take a New Shot at Stability, Midjourney in Updated Copyright Lawsuit* (2023).

4. Marc Andreessen, *The Techno-Optimist Manifesto* (2023).

5. Effective Altruism (EA) and Effective Accelerationism (e/acc) are two highly influential movements. See Andrew Marantz, *Among the A.I. Doomsayers* (2024).

6. Since at least the 1970s, cultural intermediation of new technologies has mirrored the use of the same technologies in war. See Michael Hirsch, *Artificial Intelligence Is Changing Every Aspect of War* (2023).

7. With natural language processing and media generation capabilities of present-day AI systems outpacing haptics and robotics, culture serves as a frontier deployment context and a testing ground. From moving image generation and executive assistance, to asset creation for simulated worlds, AI is likely to serve many different functions across media and production pipelines.

8. There are many artists who also work with AI as a topic or theme. The impacts of these practices are valuable but are not considered in any detail within this publication given FAE4's focus on technical systems and operations.

Notes 1-8

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Line of Flight: Intro (2024), Still.

Defining Public AI

AI technologies promise to affect nearly every aspect of our lives.[9] 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.[10] 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.[11] 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' 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.[12] [13] Mission-driven public-private partnerships, such as those developed to build national super-computing capabilities, state bodies cooperate with private industry to deliver specialty products and services.[14] [15] Non-governmental interest organisations, academia, and grassroots movements also operate within this ecosystem to address un-met needs, both at the level of general policy and on behalf of specifically affected communities.[16]

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A Framework for Public Claims on Resources

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 which 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' 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 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.[17]

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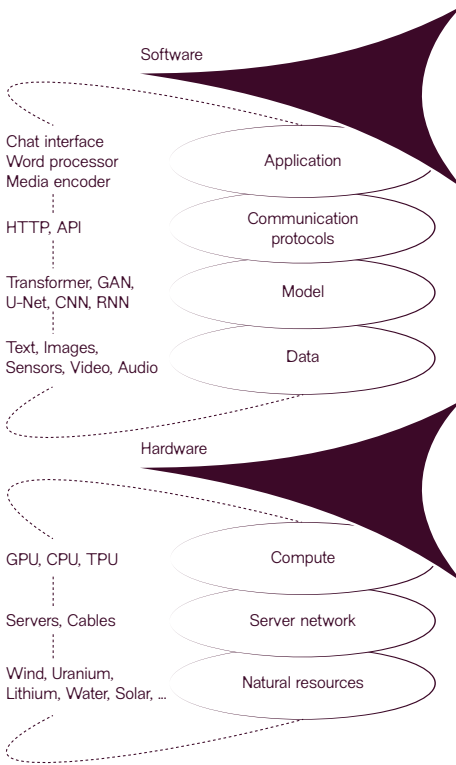
Software
Chat interface
Word processor
Media encoder
Application
HTTP, API
Communication protocols
Transformer, GAN, U-Net, CNN, RNN
Model
Text, Images, Sensors, Video, Audio
Data
Hardware
GPU, CPU, TPU
Compute
Servers, Cables
Server network
Wind, Uranium, Lithium, Water, Solar, ...
Natural resources

→ 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.[18] 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.[19] However, applications developed by the 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.[20]

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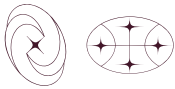

Application development is underpinned by a robust ecosystem of open research and code sharing. The development of applications relies on platforms such as GitHub (for code),

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.[21] [22] Applications are also subject to a further round of scrutiny within digital marketplaces such as Apple's App Store or Google Play.

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→ 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.[23] As a protocol, it is not regulated by any single 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 the protocol remains effective, interoperable, and up to date with evolving technological needs.[24]

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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.[25] 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.[26] 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 multiple types of data inputs, such as text, images, audio, and video.[27] 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

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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.[28]

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Building efforts have consolidated around just a few foundation models within corporate, or privately-controlled, contexts due to the massive investments that they require.[29]

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However, more recent projects have shown that smaller models are starting to compete with foundation ones.[30] [31] 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 impacts 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

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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).[32] [33]

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Whether open source or closed, not all model-makers reveal the contents of their training data, and it is believed that much of these datasets are protected by copyright. Consequently, these leading AI organisations are confronting legal challenges that have yet to result in new laws.[34] [35] [36] Meanwhile, the Responsible AI Licenses (RAIL) initiative is advocating for the development of licenses for fine-tuning and downstream usage of models that curtail misuse.[37]

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→ Data Layer

Models require high quality data for training and fine-tuning.[38] 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.[39] [40] 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 with extracted metadata and text.[41] 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.[42]

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.[43] 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.[44] [45] 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.[46] [47]

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→ 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.[48] 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.

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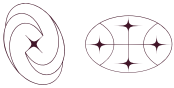

Because of high demand and intense global competition, geopolitical tensions have emerged surrounding the semiconductor industry; nations are vying for dominance in manufacturing, design, and supply chain control. In the past three years, particularly in response to Taiwan's geopolitical status as the 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 regarded now as a matter of national security and global competition.[49] 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 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.[50]

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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.[51] To operate on the internet, server networks rely on the vast system of underwater cables which 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.[52]

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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.

→ 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 20th and 21st 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 such as 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.[53] 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

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as gold and silver. Often, these metals, key to a transition to renewable energy, are extracted from the territories of the former colonies of Europe as transnational corporations accrue massive profits from this resource extraction at the expense of their workers and of local communities.[54]

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9. OpenAI, *Developing safe & responsible AI*. Link: www.openai.com/safety
p.29

10. Shrey Jain et al., *Plural Publics* (2023).
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11. Many groups are working to define ideas of public AI; they include: The Public AI Network, *Public AI White Paper* (2024); 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).
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12. This includes much of academia as well as non-profit organisations committed to stewarding the commons such as Internet Archive and Arxiv.
p.30

13. Elinor Ostrom, *Governing the Commons* (1990).
p.30

14. Mariana Mazzucato, *Public Purpose: Industrial Policy's Comeback and Government's Role in Shared Prosperity*, (2021).
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15. 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).
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16. These include organisations such as The Alan Turing Institute, Aapti Institute and Omydiar Network.
p.30

17. p.32 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* (1991).

18. p.35 OpenAI, *Introducing ChatGPT*; William van Melle, *MYCIN: a knowledge-based consultation program for infectious disease diagnosis* (1978); Bruce T. Lowerre, *The HARPY Speech Recognition System* (1976); Feng-hsiung Hsu, *Behind Deep Blue: Building the Computer that Defeated the World Chess Champion* (2002).

19. p.35 Tammy Lovell, *NHS rolls out AI tool which detects heart disease in 20 seconds* (2022). Link: www.healthcareitnews.com/news/emea/nhs-rolls-out-ai-tool-which-detects-heart-disease-20-seconds.

20. p.35 In France tax authorities used proprietary software developed by Google to identify undeclared tax revenue. See *Undeclared pools in France uncovered by AI technology*. Link: www.bbc.co.uk/news/world-europe-62717599.

21. p.36 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*. Link: www.gov.uk/government/news/new-rules-for-apps-to-boost-consumer-security-and-privacy.

22. p.36 In New York State automated hiring apps are subject to bias testing. NYC Consumer and Worker Protection, See *Automated Employment Decision Tools: Frequently Asked Questions* (2023). Link: www.nyc.gov/assets/dca/downloads/pdf/about/DCWP-AEDT-FAQ.pdf.

23. CERN, *The Birth of the Web*. Link: home.web.cern.ch/science/computing/birth-web. p37

24. Wikipedia, *HTTP*. Link: www.wikipedia.org/wiki/HTTP. p37

25. Rishi Bommasani et al., *On the Opportunities and Risks of Foundation Models* (2021). p39

26. Yann LeCun et al., *Deep Learning* (2015). p39

27. 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). Link: www.adalovelaceinstitute.org/resource/foundation-models-explainer. Rishi Bommasani et al., *On the Opportunities and Risks of Foundation Models* (2021). Link: www.arxiv.org/pdf/2108.07258.pdf. p39

28. See OpenAI's GPT-4; Google's Gemini; Meta's Llama 2; and Mistral AI. p40

29. Rishi Bommasani, et al., *On the Opportunities and Risks of Foundation Models* (2021). p40

30. Harsha Nori, *Can Generalist Foundation Models Outcompete Special-Purpose Tuning? Case Study in Medicine* (2023). p40

31. Yi Tay, *Training Great LLMs Entirely from Ground Up in the Wilderness as a Startup* (2024). p40

32. Billy Perrigo, Yann LeCun *On How An Open Source Approach Could Shape AI* (2024). p41

33. Stable Diffusion is a model by UK-based AI company Stability AI, with open source code and weights.

34. See Tim Bradshaw and Joe Miller, *New York Times sues Microsoft and OpenAI in copyright case* (2023). Link: www.ft.com/content/23c15ce1-16c5-4b2f-804e-2c0da64e1972.

35. 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). Link: www.theatlantic.com/technology/archive/2023/08/books3-ai-meta-llama-pirated-books/675063.

36. 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 forward. See Robert Hart, *White House Unveils 'Sweeping' AI Strategy as Biden Pushes for Transparency and Safety* (2023) Link: 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). Link: bills.parliament.uk/publications/53068/documents/4030.

37. See *Responsible AI Licenses (RAIL) initiative*. Link: www.licenses.ai.

38. p42 High-quality data is accurate, complete, reliable, and contains 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).

39. p42 Jia Deng et al., *ImageNet: A Large-Scale Hierarchical Image Database* (2009).

40. p42 Richard Sutton, *The Bitter Lesson* (2019).

41. p42 Common Crawl, *Our Mission*. Link: www.commoncrawl.org/mission.

42. p42 Stefan Baack, and Mozilla Insights, *Training Data for the Price of a Sandwich: Common Crawl's Impact on Generative AI* (2024). Link: foundation.mozilla.org/en/research/library/generative-ai-training-data/common-crawl.

43. p42 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 et al 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 et al v Anthropic PBC, 2023; Thomson Reuters v Ross Intelligence, 2023. UK: Getty Images v Stability AI, 2023.

44. p43 LAION, *Laion-5b: A New Era Of Open Large-Scale Multi-Modal Datasets* (2022). Link: laion.ai/blog/laion-5b.

45. p43 Alex J. Champandard on X (formerly Twitter) (2023). Link: www.twitter.com/alexjc/status/1737860015262929405

46. p43 In the UK, Health Data Research UK is a portal that enables access to health data to enable research and development. Link: hdruk.ac.uk.

47. p43 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 cooperatives. See RadicalxChange, Aapti Institute, Open Data Institute, Data Empowerment Fund, and Data Trusts Initiative.

48. p44 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.

49. p45 Paresh Dave, *OpenAI Agreed to Buy $51 Million of AI Chips From a Startup Backed by CEO Sam Altman* (2023). Link: www.wired.com/story/openai-buy-ai-chips-startup-sam-altman.

50. p45 Anna Tong et al., *Exclusive: ChatGPT-owner OpenAI is exploring making its own AI chips* (2023). .

51. p47 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.

52. p47 Debbie Weinstein, *Our $1 billion investment in a new UK data centre* (2024). Link: blog.google/around-the-globe/google-europe/united-kingdom/google-1-billion-investment-in-a-new-uk-data-centre.

53. TUC, *Public ownership of clean power: lower bills, climate action, decent jobs* (2022).

54. Jake Simms and Andy Whitmore, with contributions from Kim Pratt, *Unearthing injustice: A global approach to transition minerals* (2023).

Previous page © CROSSLUCID
Line of Flight: Organisation (2024), Still.

1

Organisation

The concept of 'organisation' ⊕ both refers to an entity—*an* organisation ⊕—acting in pursuit of a set of goals, and to the process of organising. Every new technical advancement in information-gathering, processing, and circulation has created affordances and challenges for how organisation ⊕ is structured as a process, and what it enables; think of the telegraph, the printing press, the digital computer, or the internet. That the dominant form of organisation ⊕ today is achieved through techno-social units that persist across geographies and generations is in large part owed to the aforementioned technologies. The confrontation of the AI stack with the *du jour* systems of organisation ⊕ has the capacity to inaugurate a new chapter in how organisations ⊕ function, how they are structured, their daily operations and their mandates, as well as in the more fundamental sense of what kinds of societies they enable.

While 'culture' is something that happens everywhere all the time within societies, what becomes recognised as culture is a result of collective recognition through the variable lenses of community, audience, and nation.[55] In most democratic societies, the cultural sector is positioned in the role of organisational mediator mirroring a collective recognition in its historical, contemporary and future-oriented forms, and transforms that recognition into a resource with, at the very least, a thin notion of publicness attached to it (i.e., access). More generally, cultural institutions conserve and generate meaning through the information encapsulated by their collections, archives, and activities. At the same time, new types of cultural organisations emerge to attend to new societal needs and conditions. When culture is deeply imbricated with information flows and digital interfaces at every scale, cultural organisations are, at once, users and producers of advanced technological societies, investors, and investees in its social and economic affordances.[56]

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At present, the cultural sector might not figure as a prominent space for determining how AI shapes, and will be shaped by, host societies. However, its role as an organisational ⊕ mediator of collective cultural recognition inadvertently makes it the most critical, and least obvious, battlefield for the advancement of AI as an existentially and operationally transformative technology.[57]

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To understand why that is so, and how that role can be performed with greater strategic acumen and direction, it is necessary to attend to how the core elements of today's AI—DATA, MODEL, and COMPUTE—are recoding what organisations ⊕ are and can be across the cultural space.[58] This chapter highlights the different emerging fronts that present-day cultural institutions should be aware of as they face questions concerning the manner in which their identity, mission, and operational frameworks dovetail with questions of AI's publicness ⊕.

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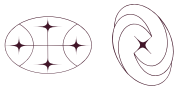
DATA: Civic Organisations as Dormant Data Keepers

Data is an essential resource without which AI models could not exist. The most recent generation of large language models (LLMs) rely on vast pools of online data to shape their capabilities. Given that all organisations, and those who interact with them, produce data, the question of how data is owned, governed, and made available to train AI models becomes a key operational and possibly existential one for many organisations.



In December 2023, *The New York Times* filed a lawsuit against Microsoft and OpenAI for copyright infringement concerning OpenAI's use of the publisher's content to train ChatGPT. The case marks, to date, the apogee in an evolving tug of war between two perspectives: 'fair use' versus 'copyright infringement/unjust enrichment'. The former is aligned to a vision of AI technology as

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a creative and transformative augmentation of networked intelligence. The latter foresees concerns with proprietary technologies expropriating from the commons. While the notion of 'fair use' is specific to the US jurisdiction, and 'copyright' is only one possible means for challenging the status quo at present, this dichotomy underlines the lack of agreement as to how the value transfer from data to model should be structured both economically and legally.[59] All organisations become interfaces between data producers and AI models. This condition expands the remit of publicness to include organisations that don't necessarily have an explicit public mission, transforming them into *dormant data keepers*. What follows situates this emerging organisational mandate within the broader negotiations of data relations, highlighting the specific new modalities for cultural organisations to consider as an aspect of their operations.

→ The Dawn of Organisational Self-Knowledge

An organisation's internal materials—archives, CRM, briefs, minutes, contracts, etc.—hold a wealth of knowledge about the organisation that, when networked, can provide a richer level of insight into how an organisation functions, and what it can infer about its own operations. The cross-integration of different types of data could make use of applications based on an LLM-driven interface, via which data from a range of intra-organisational and extra-organisational sources are integrated and queried. These AI applications would sit at a meta level, different from traditional data management softwares such as Salesforce.[60] The appearance of a horizon where customisable AI models that learn from organisation-specific materials make everything about organisations queryable via natural language should be on organisational agendas.

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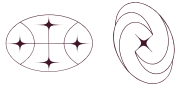

Within organisations, the role of Data Officer emerged in response to data protection laws such as GDPR and carries the primary responsibility of safeguarding personal data.[61] The recognition that organisations are keepers of many different forms of data will require further expansion of related roles within organisations; this remit will intersect with organisational strategic priorities in novel and challenging ways. While data policy questions around privacy, security, access permissions, and other risks will reach a new level of complexity, there are significant affordances of integrating AI tools in organisations in order to increase organisational self-knowledge. Through language, these applications can participate in—rather than be subject to—the organisation's agenda setting.[62]

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Rather than processing information or automating workflows, AI tools are likely to alter the logics, forms, and interfaces of organisations which are materially designed around human resources, time, and knowledge constraints. However, this can only

happen if organisations know enough about the data they are producing, and how to advocate for its diverse applications and utilities (both internally and externally). This means advancing technical literacy across the organisation's workforce, so that workers are able to take a proactive approach to shaping how the technology transforms their organisation rather than being subjected to top-down deployment of ready-made products (see Minotaur vs Centaur Framework below).

There are complete art historical movements that are not even covered in current datasets. And therefore they are exiting our digital cultural memory. Plus, the issue of online context collapse that evades the way we understand histories and amongst them, of course, art histories. Our responsibility as museum workers is to expand those data-sets [and their attendant contexts], and account for everything that the dataset does not include.
—Noam Segal

Public institutions including census registrars, libraries, or healthcare services understand themselves to be the holders of valuable data, and embrace their role as advocates (and brokers) for their use.[63] For example, one of the many NHS datasets includes the National COVID-19 Chest Imaging Database (NCCID) created during the pandemic as part of the AI in Imaging programme at the NHS AI.[64] The dataset was instrumental in advancing the new NHS AI screening technologies for health and social care.[65]

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Data is not this mystery thing. Data might be a photograph. It might be a tweet.
—Oonagh Murphy

With the coming integration of AI systems across many domains, organisations that hold cultural datasets can now consider themselves to have operationally-aligned responsibilities and priorities to other industries and organisations that hold valuable public data. Whereas cultural organisations have tended to confine their identity affiliations to other cultural organisations, prioritising data stewardship and governance means that cultural organisations can think strategically about their datasets in line with other types of organisations trying to achieve similar structural dynamics related to their internally set (by policy) or externally mandated (by law) obligations.

Some libraries and research institutions already consider their collections, and the metadata around those collections, to be essential to the services they provide (e.g., the British Library, the London Natural History Museum).[66] However, the ability to leverage these datasets requires robust infrastructure

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both to create and to maintain the datasets (i.e., digitisation, analysis, and distribution), on the one hand; and to develop new capabilities when training models with these datasets on the other (i.e. making new internal or public-facing applications). In many instances, the development of infrastructure has been outsourced to the private sector. For example, cultural institutions across the globe have relied on Google Arts & Culture to digitise their collections. Meanwhile, the NHS recently licensed Palantir to create a distribution system for patient data access.[67]

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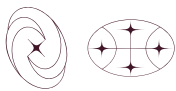
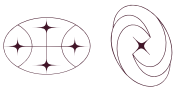


In order for organisations to make the best use of the value that their data holds as a public resource in the coming era of training data economies, transferable learnings and AI-specific know-how will need to emerge as a form of professional training. Cultural institutions will need to reorient some of the extant definitions around their public missions and values in respect to data. This includes understanding how to correctly

price the labour of maintaining and evolving institutions at the foundation of these data-sets, as well as how to structure the technical, economic, and legal terms on which their relationships with developers of AI models are to be constructed.



To address the inegalitarian harms of datafication—and develop socially beneficial alternatives—will require democratising data social relations: moving from individual data subject rights, to more democratic institutions of data governance.
— Salomé Viljoen [68]

→ Data Is Relational

Publics produce many types of data. Data, in aggregate, produce publics —groups who may not have recognised themselves as allies, but who, through networked datasets, are part of a collective able to bargain for data rights.[69] Much is missed in the metaphor of data as private property. Data becomes economically useful and valuable in relationship to other data.[70] Data is not owned, as such; its value is produced, contextualised and operationalised as indexable insights into the world, whether that means Uber using public transport network data for logistics calculations, or ChatGPT using Reddit posts to build an articulate language model.

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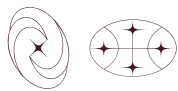

In its current form, legislation such as the GDPR in the EU can only protect the interests of individuals who incur harm from the improper use of their data, rather than protecting the interest of digital publics whose behaviours are both shaped by

and constitute the value being extracted from them. While GDPR is necessary for personal security, data on the open market for analysis, or model training, is only valuable in relation to other data, which brings the paradigm of individual data ownership under stress.[71] To consider the protections and bargaining vehicles from a relational perspective highlights the need for data governance at the organisational scale.[72]

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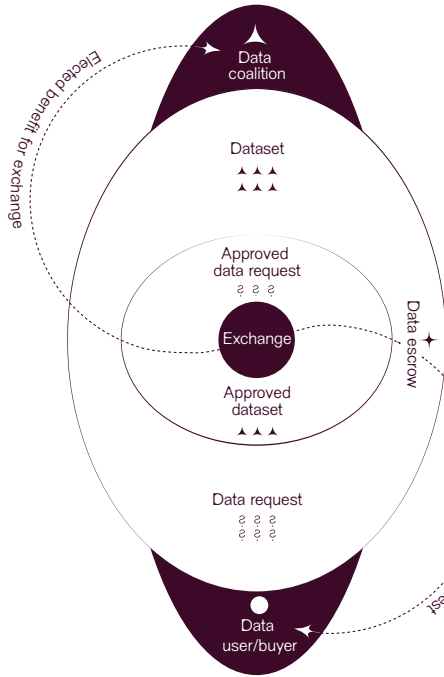

Data stewards (e.g. coalitions, trusts and escrows): new actors in the data economy responsible for negotiating collective rights

→ Trusted Data Stewards

We're at the beginning of public organisations making a developmental shift: realising that they are owners of data that belongs to the public. These actors will need to understand that the data they hold might be meaningful for citizens and that they might be mandated to provide this data in a useful way. There needs to be a big cultural shift to seeing providing data and governing data as a service for the public sector.
—Theresa Züger

One way to address the question of organisation around relational data is not through the lens of private ownership, but by considering new supporting infrastructure for trusted data stewardship. A novel family of organisational forms has been proposed and tested under the wider umbrella of data coalitions: data trusts, data collectives, data unions, and data cooperatives.[73] Their governance models reflect a commitment to a thick public framework of claims over data as a collectively stewarded resource. However, for the time being, data coalitions remain a niche experimental space and are legally ambiguous. This is, in part, a product of the undermaturation of the ecosystem. There is an insufficient level of awareness amongst organisations about how the economic and infrastructural landscape is being reshaped by AI, and what collective responses are required to steer the political economy of data markets, and their governance forms, towards ensuring thick forms of publicness.

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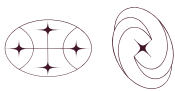

Trust and verifiability protocols between data producers and stewarding organisations, as well as between stewarding organisations and data clients, will form the necessary scaffolding for this emerging ecosystem where 'escrow agents' or 'data trustees' can act as trusted intermediaries to broker terms of data and value exchange. New tools are emerging, cryptographic protocols such as zero-knowledge proofs that allow information to be verified without revealing its contents, and federated learning, which allows for the training of AI models without centralising data.[74] [75]

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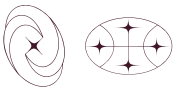

→ Sovereign AI & Dataset Gatekeeping

The idea of 'Sovereign AI' addresses the problem of ensuring a nation's ability to produce AI capabilities using its own infrastructure, data, workforce, and business networks.[76] Insights into cultural complexities often live in the public cultural sector, spaces where cultural meaning, archiving and contestation happen. This poses questions about ownership at every level of the AI stack, but particularly related to the datasets that nations wish to control, preserve, and advance. For example, Spain is currently building its own publicly funded LLM, which will feature Spanish, Catalan, and Basque, as well as other languages spoken in Spain.[77]

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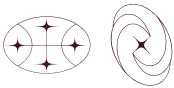
In these instances, existing public cultural institutions are positioned most closely to the production and provision of data services. They may be in a strong position to shape the narrative around how cultural data and resources are built, deployed, and stewarded.

We see the opportunity of accompanying the technical transformation that is happening anyway. And I'm not just talking about regulations, but a real international, a global, or even planetary, governance framework that goes beyond our human-centric approach. And preparing, ultimately, our stakeholders for that. We like to say that in the future, all diplomacy will be tech diplomacy.
—Martin Rauchbauer

At the level of the cultural sector, public institutions must understand themselves as intermediators of the role of AI in society. As with any significant technocultural shift, this is merely an extension of their existing soft power in shaping contemporary cultural narratives and cultivating historically and contextually grounded avant-garde voices and ideas. The two main barriers at present are a resistance to making technical expertise a priority, and the development of the intersectoral standards that the scale of the foundation models' inputs (datasets) and outputs (societal impact) demand. For example, the impacts of AI models cut across the domains of education, language, and visual culture, and require cultural organisations, policy-makers, media companies, researchers, and tech companies to form alliances. Working groups formed across institutions or deliberative assemblies for public input could lead to the achievement of concrete goals and the production of useful frameworks. One example of such a collaborative framework formed around shared objectives is the UN SDG Data Alliance, a multi-stakeholder partnership for producing, governing, and sharing geospatial data and processing capabilities across

developing countries in order to produce insights oriented towards achieving the UN's sustainable development goals. Similarly, institutions across domains are not only keepers of their own data, but serve to benefit from forming coalitions around mutual objectives, new use cases, and governance practices.



LLMs represent an exceptionally narrow strand of a very diverse research field that takes a range of approaches to what 'intelligence' means. By choosing to make AI synonymous with LLMs one ends up making narrow claims on 'intelligence'.
—Agnes Cameron

MODEL: Culture Shaping Model Shaping Culture

Models are ambiguous entities that are proving hard to define both legally and conceptually. There is an inherent tension between the *modus operandi* of the law and that of technical developments. Judgements made through civil society mechanisms—whether philosophical or legal—that make prescriptive demands on those developing AI systems may lag behind technological development, and expectations codified into legal concepts may elide technical decision-making processes that appear opaque (even to those developing them). Nevertheless, incoming legislation, such as the EU AI Act or the Blueprint for the AI Bill of Rights in the US, as well as the work of dedicated public AI-oriented organisations, sets some of the apex terms of the negotiation between the tech sector and the public.[78] Given that we are still in the stage where foundation models are to be defined as legal and public-facing entities, what happens culturally in different societies, as well as what positions and narratives cultural institutions adopt and perpetuate, will matter.

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→ Disambiguating Technical Opacity and Transparency

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Models are seen as opaque because some of their decision-making processes remain unexplained. 'AI explainability' is a term used in long-running debates about AI referring to attempts at philosophical anatomies of the decision-making process in models, and to computer science approaches to 'explainable AI' architectures, as well as explainability mechanisms which provide *post hoc* explanatory theories as to why an AI system chose one outcome over another.[79] [80]

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But at the organisational scale, 'transparency' and 'accountability' mean something quite distinct, going beyond the explicability or interpretability of solely software-level considerations.[81] Instead, questions are posed about the entire AI training pipeline as a holistic technology: what training data were used, on what architecture, based on

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which design decisions, and what fine-tuning methods were used. In such cases, questions of *how* a certain decision was made by the system, rather than an explanation as to *why*, becomes, overall, a much more pertinent organisational question. Crucially, this concern should be separated out from the educational function of teaching a public how AI systems work, an educational project which has been explored by many states, organisations, and artists.[82]

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Delineating explicability and transparency from 'demystifying' complex systems

The situation at other layers of the AI stack is evolving. More scrutiny is being directed to datasets—this has increasingly become a subject of interest to artists who find this media-centred domain to be native to their skill set (see Chapter 2). Each tech company deploys a divergent strategy in relation to hardware. While Meta has brought its chip R&D in-house to reduce reliance on NVIDIA, HuggingFace adopts a seemingly non-competitive strategy—or it distributes its risk exposure, depending on how their operation is interpreted—by partnering with multiple hardware suppliers.[83] OpenAI, meanwhile, is seeking to raise trillions to build its own chip manufacturing venture.[84]

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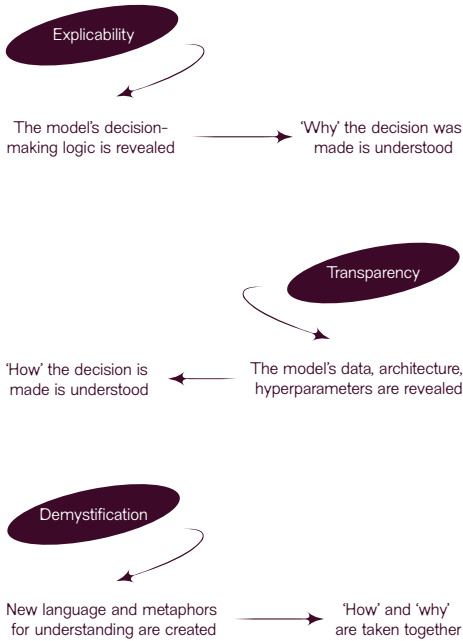
The model is at the heart of the AI technology pipeline as far as the specific directionality of AI's impacts on society are concerned. While it is true that models would not be able to perform without access to data and compute, it is the model, once fine-tuned, that determines the nature of the compression, and the kinds of interpretation, reasoning, and decision-making that


Explicability
The model's decision-making logic is revealed
'Why' the decision was made is understood
Transparency
'How' the decision is made is understood
The model's data, architecture, hyperparameters are revealed
Demystification
New language and metaphors for understanding are created
'How' and 'why' are taken together

can emerge in the application of the technology. For this reason, it might be useful, for the sake of analysis, to isolate the model as a separate entity in some negotiations (e.g., when it is necessary to locate accountability for specific outcomes), and to see it integrally connected to data and compute levels in other negotiations (e.g., antitrust, and ensuring that no monopoly or collusion occur at the level of the data-model-compute trifecta).

→ Cultivating Trust and Verifiability

Trust and verifiability protocols that are technically integrated across the AI stack will become a necessity as our interactions with opaque systems increase. Not only will users want to know if model outputs can be trusted, there will also be a need to verify our own identities (i.e. proof of personhood) as well as the credentials of the media around us.[85] The development of capabilities to track provenance and attribution by bridging blockchain infrastructure with running of models is a new frontier that promises major advances in the years to come.[86]

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Compression is possession.
—Matt Prewitt

→ Models Offer a New Compression Technique

The search for legal definitions and governance solutions cannot be collapsed with technical fixes, and there are strategic reasons to not commit to a singular ontological lens and legal pathway. Therefore, it is appropriate to experiment with different metaphorical framings that depart from the core logics of the foundation model as it exists today and which can inform deeper shifts around the ways in which governance for the public good is enacted.

Models compress data and communicate their insights in various human- and machine-readable ways. Models offer a new compression technique, which, at a minimum, allows for 'middle of the road' synthesising and summarising a vast collection of sources, and, at best, produces new kinds of syntheses. Functionally, this process is analogous to other forms of

compression techniques such as writing and printing, with the important caveat that the scale of AI model compression transcends previous human-industrial capabilities. Just as the development of copyright and patent law tracked with the development of compression technologies at a new scale (in that case, the printing press), it is appropriate to consider whether a new IP category is necessary for the scale of compression that foundation models instantiate.

96 What does it mean to build in the public interest? Having people weigh in on every decision isn't the answer, so we're in the process of understanding how much of that is useful, knowing how to infer their interest and creating governance structures in which they can participate.
—Saffron Huang

→ New Public Mission Mechanisms

The idea of publicly ⊕ funded foundation models is slowly taking hold. Several announcements have recently reported investments in this public ⊕ mission: Chicago's Argonne National Laboratory has started to build the trillion-parameter model AuroraGPT.[87] UK's government confirmed a large investment into supercomputer facilities in Bristol dedicated to building Isambard-AI. Spain has announced a large language model trained in Spanish, and in the country's co-official languages, located at Barcelona Supercomputing Centre.

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Research initiatives such as Collective Intelligence Project (CIP) position themselves as incubators for new governance models for the age of AI. Departing from the notion that new levers of collective input are required for a technology that is leveraging collective intelligence, CIP is focused on designing mechanisms for public ⊕ participation in the

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development of large language models at companies such as OpenAI and Anthropic.[88] For now, CIP positions their work as a series of experiments identifying the right avenues for bringing the public into the developmental process.

Such an initiative reflects the importance of a new class of third parties that can operate as an ingress point where mediation is required between a public and an organisation (typically a corporation) developing a societally significant technology. What is critical to bear in mind is that the mediation is not purely diplomatic, but offers mechanisms that can be technically integrated. With many AI models today relying on media production for training data for a certain subset of compressions and queries, the cultural sector offers a context-specific domain for the incubation of new mechanisms for such public scrutiny.

→ Alignment's Shadow Negotiations

Within the narrow, technical definition of 'alignment', measures need to be designed to ensure that AI models perform their objectives in a way that does not cause negative externalities. However, today there is a broader politics around 'alignment' that addresses the concern with negative externalities to the level of existential risk for humanity.[89] The latter view is propagated by a group known as Effective Altruists (EA), which includes many prominent tech-world figures such as Elon Musk, Sam Bankman-Fried, and Facebook co-founder Dustin Moskovitz. Lobbying efforts by this broad group, drawn from the Silicon Valley establishment, have been influencing political policy with their own agendas (either directly or through affiliated research institutes and donor organisations ⊕).[90] Given that these entities are unaccountable to public ⊕ funding or oversight, the UK Parliament has voiced concerns over regulatory capture if officials rely on a narrow pool of private sector-funded expertise.[91]

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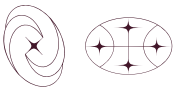
While cultural institutions may not be directly involved in these shadow negotiations, they are platforms for advancing publicly-interfaced narratives, and, as such, bear a responsibility to understand how their positioning plays into larger narrative wars.

→ Ways of Seeing in Latent Space

Cultural organisations are curators and stewards of past and future archives of what society deems to be valuable as cultural data, through the production of physical collections and, increasingly, digitised archives. The narratives that weave connections between these data points become part of the institution's criteria of truth. It is the mandate of these organisations to introduce new data points that challenge their pre-existing views (e.g. decolonisation of collections), or, more broadly, challenge who is 'important' and why. They may also offer an evolutionary timeline for changes (e.g., evolving historical context).

A similar process also takes place in the training of AI models on media and metadata to create a model's embeddings, the low-dimensional mathematical silhouette of high-dimensional real-world information about the data. When embeddings are generated

they expose relationships between concepts, i.e. their context and meaning. Creating an intervention at the level of embeddings would mean being part of the foundation models' development team. However, fine-tuning by adding further context and specificities can also build new meanings into the model and change its outputs. This opens up a new organisational space with an 'old' mandate of creating frameworks for how meaning is mediated through AI that cultural workers, artists, critics, audience, etc. are well-positioned to take up.



→ Minotaur vs Centaur Framework of Operational Transformation

Attempts at 'digital transformation' within the cultural sector have highlighted the struggle of cultural organisations ⊕ to respond operationally to new technological landscapes. While this has often been attributed to a lack of relevant technical literacy and know-how within cultural organisations ⊕, an equally important but underexplored dimension lies with the relative poverty of organisational ⊕ design innovation, as well as the lack of capacity for necessary risk-taking in order to transform how organisations ⊕ function. The stereotypical formulation sees cultural organisations ⊕ forced to play 'catch-up', with external forces pushing the cultural sector to streamline investment into surface-level applications. While there are definite benefits in such an approach, when it comes to certain software integrations (e.g., Salesforce, Mailchimp, Notion) reducing technical innovation within organisations ⊕ to narrow systems migrations for existing functions and KPIs forecloses the opportunity to explore more meaningful holistic innovation.

Transformation can only arise where a sufficient degree of engagement with the technical affordances meets a daring approach to rethinking organisations from the ground up. While finding the sweet spot between 'operational' and 'transformational' when interfacing with new technological landscapes may be ambitious, particularly as there is no universal out-of-box solution, the gambit has the potential of offering organisations the kind of edge that they likely will need in circumstances where the general relevance of cultural institutions is constantly brought into question.

The contrasting approaches of top-down digital product integration versus ground-up/ decentralised experimentation by employees of organisations with new tools dovetail with 'Minotaur versus Centaur' approaches to integrating AI tools into organisations. The former approach follows the familiar lines of vertical centralised control whereby workers are subjected to planning and management by a newly integrated AI application, to which

they are expected to conform. The latter describes human workers managing how AI will carry out specialised tasks within workflows. The Centaur (the mythological human-headed, horse-bodied chimera) approach involves organisations adopting bottom-up operational R&D for specific teams as well as for the entire organisation. This means granting workers agency over how AI applications are integrated, whilst promoting documentation, reflection, and a proactive stance on modifying workflows and operational habits. This approach is also much better suited to iterating on holistic organisational innovation given the risks associated with transforming operations in a centralised manner.[92]

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COMPUTE: High Barriers to Cultural Entry

The training and running of models requires GPUs (graphics processing units), which are highly complex and resource-intensive to produce. Manufacturing these cutting-edge semiconductor devices requires state-of-the-art fabrication plants capable of etching transistors only a few nanometers wide, entailing billions of dollars in initial investment for construction, and highly specialised production pipelines. Unlike the data and model elements of the AI stack, where inroads into negotiating their publicness are currently present from an organisational perspective, negotiating the publicness of compute is a highly constrained political game.

→ Supply-chain Geopolitics

GPUs' production process involves a sophisticated global supply chain for high-purity materials and components, necessitating robust logistics and international cooperation. The need for political and economic stability through cooperation or domination to sustain such a long-term and capital-intensive venture means only a handful of countries can realistically aspire to establish and maintain their own GPU manufacturing capabilities.[93] US export restrictions on the three main chips producers, all US-based, to China and parts of the Middle East, paint an explicit picture of the geopolitical stakes that are at the heart of the control over computational technologies.[94]

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→ IP Empire

GPUs are complex pieces of hardware that incorporate various technologies protected by intellectual property rights, including patents and copyrights. IP law covers a wide range of elements from the hardware design (e.g., the architecture, specific circuits, and manufacturing techniques) to the software that drives them (e.g., drivers, firmware, and application programming interfaces (APIs)). Additionally, GPUs may involve third-party technologies that are licensed by the GPU manufacturer to enhance their product's capabilities, such as specialised computing algorithms or software libraries. Navigating the maze of intellectual property rights, and international and national regulations, adds another layer of complexity for new entrants, making market entry only available to actors who can deal with this scale of challenge. For example, OpenAI's ambitious efforts to raise trillions to create its own transnational chip-building coalition between chip-makers, model-makers, and power suppliers is likely to be replicated by rivals.[95]

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→ State as a Broker of Compute Allocations

While the UK may have fomented policy to support UK-based AI innovation, it is still reliant on other nations and organisations to supply it with hardware, at least for now. The new open science Isambard-AI Supercompute Cluster, for example, is being provisioned with 5,000 Nvidia GH200 superchips, and the American multinational Hewlett Packard Enterprise won tender for the project.[96] At present, the state is the central broker of how access and distribution of compute are to be governed. For the cultural sector to develop its own AI capabilities and to participate in the evolving public AI ecosystem, arguments and mechanisms for influencing the state's rationale of allocating computing resources will be required.[97] [98]

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→ Experiments and Research for a Less Computationally Intensive AI Stack

Some projects are exploring decentralised computation as a means of changing the way that users can access and share computational resources  , potentially removing the reliance on centralised data storage.[99] However, the decentralised approach would require major advances in reducing the computational intensity of deep learning. The scale of individual cultural projects may offer a productive testing site for these alternative technological visions; however, the cultural sector must equally be careful about promoting 'pastoral visions' of minor tech that are only viable within relatively privileged settings of western formally democratic states.[100]

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55. 

The 1982 Mexico Declaration on Cultural Policies by UNESCO defines culture as the distinct spiritual, material, intellectual, and emotional features characterising a society and encompasses arts, lifestyle, human rights, value systems, traditions, and beliefs which form part of the organisation's remit to protect heritage and foster creativity as a right. UNESCO, *About the Culture Sector*. Link: www.unesco.org/en/culture/about.

56. 

Michel Feher, *Rated Agency: Investee Politics in a Speculative Age* (2019).

57. 

Benjamin Bratton, *A New Philosophy Of Planetary Computation* (2022). Link: www.noemamag.com/a-new-philosophy-of-planetary-computation.

58. 

Separating the data and model layers can create an artificial distinction, as they are deeply technically entangled. The distinction reflects the fact they should be treated as different types of resources as they stem from different sources.

59. 'Though best known for generating convincing text and images, LLMs such as OpenAI's GPT-4, and Google's Gemini are likely to have greater social impacts as the executive centre for complex systems that integrate additional tools for learning about the world and acting on it.' See Seth Lazar, *Frontier AI Ethics* (2022). Link: www.aeon.co/essays/can-philosophy-help-us-get-a-grip-on-the-consequences-of-ai.

60. 

'The case of Oracle America, Inc. v Google, Inc. from 2010 highlighted the volatility of relying on 'fair use' in the contexts of digital economies and product development. The case concerned the claim that Google's use of the definition and SSO of Java APIs, as originally developed

by Sun Technologies, constitutes fair use. The Federal Court made a judgement in favour of Oracle America, noting that the use did not constitute 'fair use' as the developer of Android phones allowed Google to enter a market with a competitive advantage over Oracle America. The Supreme Court reversed the decision, instead emphasising the transformative nature of the usage as key to constituting 'fair use'.

61. This is related but distinct to existing management tools such as Salesforce or Notion developing LLM capabilities in order to augment their products.

62. Even organisations who do not explicitly maintain databases are still responsible for the personal information of their employees and their associates thanks to GDPR regulations.

63. Seth Lazar, *Frontier AI Ethics* (2022). Link: www.aeon.co/essays/can-philosophy-help-us-get-a-grip-on-the-consequences-of-ai

64. Citizens' data is governed in two main categories for personal data that identify a natural person, including financial records, online browsing and consumer activity, and also sensitive data or 'special category' data that relates to health, biometric data, race, religion, sexual orientation, political opinions, and ethnic origins. See Information Commissioner's Office, *What is personal data?*. Link: www.ico.org.uk/for-organisations/uk-gdpr-guidance-and-resources/personal-information-what-is-it/what-is-personal-data/what-is-personal-data

65. The National COVID-19 Chest Imaging Database (NCCID) is part of the AI in Imaging programme at the NHS AI Lab. Lab. NHS England, *National COVID-19 Chest Imaging Database (NCCID)*. Link: transform.england.nhs.uk/covid-19-response/data-and-covid-19/national-covid-19-chest-imaging-database-nccid.

66. NHS England, *AI in imaging*. Link: transform.england.nhs.uk/ai-lab/ai-lab-programmes/ai-in-imaging. p.73

67. For example, the Natural History Museum in London has scanned 80 million specimens for the Distributed System of Scientific Collections (DISSCO) Distributed System of Scientific Collections. National History Museum, *Digital Collections*. Link: www.nhm.ac.uk/our-science/services/collections/digital.html. p.74

68. NHS England, *Federated Data Platform*. Link: www.england.nhs.uk/digitaltechnology/digitising-connecting-and-transforming-health-and-care. p.75

69. Salomé Viljoen, *A Relational Theory of Data Governance* (2021). p.76

70. Here, 'the public' is not a pre-existing entity, but rather a cluster of temporarily organised communities negotiating future trajectories for the larger community's benefit. See John Dewey, *The Public and Its Problems* (1927). p.77

71. Mercedes Bunz and Photini Vrikki, *From Big to Democratic Data: Why the Rise of AI Needs Data Solidarity* (2022). p.77

72. Salomé Viljoen, *A Relational Theory of Data Governance* (2021). p.78

73. Sylvie Delacroix, *Sustainable Data Rivers?* (2023). p.78

74. See RadicalxChange, Open Data Institute, Data Empowerment Fund Aapti Institute, Data Futures Institute at Kings College London, Data Trust Initiative and Ada Lovelace Institute. p.81

75. Andrew Trask, *Introducing OpenMined Research* (2020). p.82

76. p.82 Priyanka Mary Mammen, *Federated Learning: Opportunities and Challenges* (2021).

77. p.83 Keith Strier (for Nvidia), *What Is Sovereign AI?* (2024).

78. p.83 Computerworld, *Spain Will Create Foundational AI Model in Local Languages* (2024). Link: www.computerworld.com/article/3713243/spain-will-create-foundational-ai-model-in-local-languages.html.

79. p.87 Executive Office of the President of the United States, Blueprint for an AI Bill of Rights. Link: www.whitehouse.gov/ostp/ai-bill-of-rights.

80. p.88 Scott Robbins, *A Misdirected Principle with a Catch: Explicability for AI* (2019).

81. p.88 'The ability to explain the model generally is now the gold standard for building trust and deployment of artificial intelligence systems in critical domains,' See Dwivedi et al., *Explainable AI (XAI): Core Ideas, Techniques, and Solutions* (2023).

82. p.88 Scott Robbins, *A Misdirected Principle with a Catch: Explicability for AI* (2019).

83. p.89 See Alasdair Milne, *Turret Theory: Training the Human with dmsfctn's Godmode Epochs* (2023). Link: www.serpentinegalleries.org/arts-technologies/turret-theory.

84. p.90 Santosh Janardhan, *Reimagining Our Infrastructure for the AI Age* (2023). Link: www.reuters.com/technology/meta-deploy-in-house-custom-chips-this-year-power-ai-drive-memo-2024-02-01.

85. 
Tong et al., *Exclusive: ChatGPT-owner OpenAI is Exploring Making its Own AI Chips* (2023). Link: www.reuters.com/technology/chatgpt-owner-openai-is-exploring-making-its-own-ai-chips-sources-2023-10-06.

86. 
Puja Ohlhaver et al., *Compressed to 0: The Silent Strings of Proof of Personhood* (2024). Link: papers.ssrn.com/sol3/papers.cfm?abstract_id=4749892.

87. 
Steve Vassallo, AI x Blockchain: *The Next Level* (2023). Link: www.forbes.com/sites/stevevassallo/2023/06/13/ai-x-blockchain-the-next-level/?sh=e68fba3411c6.

88. 
Keumars Afifi-Sabet, *The GPT to Rule Them All: Training for One Trillion Parameter Model Backed by Intel and US Government Has Just Begun* (2023). Link: www.techradar.com/the-gpt-to-rule-them-all-training-for-one-trillion-parameter-model-by-intel-has-just-begun.

89. 
Anthropic & Collective Intelligence Project, *Collective Constitutional AI: Aligning a Language Model with Public Input* (2023). Link: www.anthropic.com/news/collective-constitutional-ai-aligning-a-language-model-with-public-input.

90. 
See Centre for the Study of Existential Risk, *Risks from Artificial Intelligence*. Link: www.cser.ac.uk/research/risks-from-artificial-intelligence.

91. 
See Centre for Effective Altruism, *History*. Link: www.centreforeffectivealtruism.org/history.

92. p.99 'Throughout our inquiry we encountered mounting concern about regulatory capture. This might occur through lobbying, or because officials lack technical know-how and come to rely on a narrow pool of private sector expertise to inform policy and standards. Similar problems may emerge from groupthink. These might lead to regulatory frameworks which favour a select group of commercial rather than public interests, for example by creating barriers to new competitors entering the market'. *Communications and Digital Committee, Large Language Models and Generative AI* (2024). Link: publications.parliament.uk/pa/ld5804/ldselect/ldcomm/54/5402.htm.

93. p.105 Robert J. Sparrow & Adam Henschke, *Minotaurs, Not Centaurs: The Future of Manned-Unmanned Teaming* (2023). Also see: Ethan Mollick, *On Holding Back the Strange AI Tide* (2023). Link: www.oneusefulthing.org/p/on-holding-back-the-strange-ai-tide.

94. p.107 Lucy Rodger et al., *Inside the Miracle of Modern Chip Manufacturing* (2024). Link: ig.ft.com/microchips.

95. p.107 Stephen Nellis and Max A. Cherney, *US Curbs AI Chip Exports from Nvidia and AMD to Some Middle East Countries* (2023). Link: www.reuters.com/technology/us-restricts-exports-some-nvidia-chips-middle-east-countries-filing-2023-08-30.

96. p.108 Keach Hagey & Asa Fitch, *Sam Altman Seeks Trillions of Dollars to Reshape Business of Chips and AI* (2024). Link: www.wsj.com/tech/ai/sam-altman-seeks-trillions-of-dollars-to-reshape-business-of-chips-and-ai-89ab3db0.

97. See *Unprecedented £225m investment to create UK's most powerful supercomputer in Bristol* (2023). Link: www.bristol.ac.uk/news/2023/november/supercomputer-announcement.html.
p.109

98. 'Bridging the digital divide and developing a sustainable compute ecosystem will depend on how well leaders are able to navigate their relationships with private sector companies, which will be key partners when it comes to enabling growth'. See Bridget Boakye et al., *State of Compute Access: How to Bridge the New Digital Divide* (2023). Link: www.institute.global/insights/tech-and-digitalisation/state-of-compute-access-how-to-bridge-the-new-digital-divide.
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99. For example, research is currently being undertaken towards policy recommendations revolving around the use of subsidies and taxation to promote socially beneficial deployments of AI through compute allocations.
p.109

100. See Golem. Link: www.golem.network.
p.110

101. Daniel Chávez Heras, *The Digital Pastoral: a Minor Critique of Minor Tech* (2023). Link: darc.au.dk/publications/peer-reviewed-newspaper.
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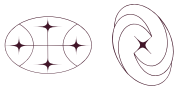
Line of Flight: Artist (2024), Still.

2

Artist

The common conception of what an 'artist' does involves the production of creative work. This very broad definition encompasses other, narrower labels supported by social conventions and organisational niches, including fine artists, medium-specific artists, contemporary artists, artists who work for hire (e.g., designers, illustrators, and creative directors), and artists as defined by their industries (e.g., film directors and fashion designers). Artists who work with advanced technologies cut across all of these domains, frequently operating across several simultaneously. Currently, artistic work is organised depending on the economic specificities and societal expectations attached to each specific genre or form. The entanglement between *how* artists work and *what* they produce enacts a complex dynamic between the integration of AI into individual and organisational workflows, setting up a dynamic of feedback and emergence that exceeds the framing of automation and the question of the replacement of artists by machines. This chapter refers to artists working across the AI tech stack, engaging with the application and model layers through

consumer-facing and specialist tools.[102] In order to do justice to the breadth of unfolding transitions and scenarios in the context of AI, a comprehensive treatment of the different operational planes that constitute the structural core of AxAT artistic work is necessary. FAE identifies labour, crafting, aesthetics, systems, worldbuilding, and tech development as the six planes according to which the unique qualities of artistic work can be meaningfully rendered in relation to AI technology as a medium. The question of what happens on these planes when AI systems are deployed may offer insights into wider questions AI technologies are posing for society.



Training Data as Shadow Labour

The increasing integration of AI across various sectors is sparking widespread concern over the fear of becoming obsolete (FOBO). According to an IMF report, 60% of workers will be impacted by AI through job automation, and there will be changes in how critical decision-making such as hiring and disciplinary actions are operated.[103] Many artists are nervous about their practice and skills becoming irrelevant as a result of generative AI outputs: DACS' report on AI and Artists' Work reported 77% of artists felt that AI will replace jobs and opportunities.[104] The increased emphasis on labour rights is underscored by recent high profile collective bargaining battles such as the 2023 Writers' Guild strike in Hollywood.

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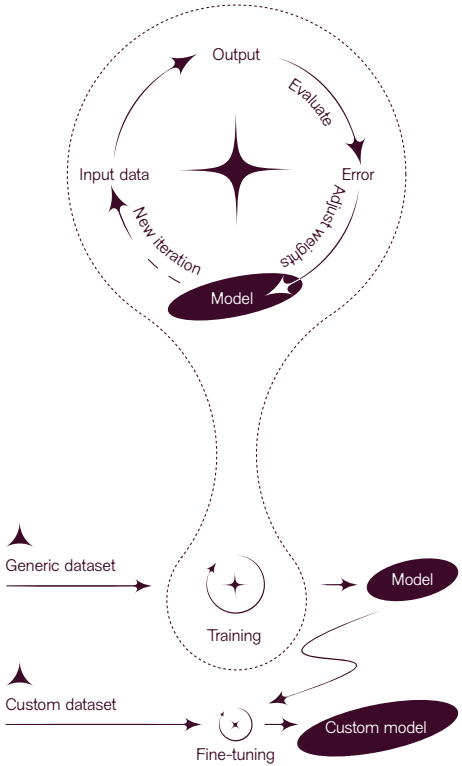

Process for training pre-trained and fine-tuned models

Concurrently, government efforts, such as the Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence in the US and the EU AI Act are attempts to use regulatory frameworks to safeguard workers whilst legislating other guardrails for AI applications.[105] Whereas artistic labour that exists within commercial and formal industry sectors could fall under these provisions (because it is comparable to other forms of wage labour), what sets a good deal of artistic labour apart is the fact that it exists in regulatory no-man's land, and, as such, represents the 'worst case' scenario of regulatory efforts falling flat.[106] One regulatory regime that safeguards artists is IP rights, expressed as a means of recognition and value of artistic labour.

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All media is now training data.
—Herndon Dryhurst Studio

The AI models that we have today derive from the human labour which comprises its training data. Large models are trained on vast quantities of text and imagery originating from the long arc of human cultural production, from chat rooms to digitised centuries-old encyclopaedias. In the early days of Web2, Flickr, Tumblr, and DeviantArt were used by artists to share their work with a newly emerging distributed audience. The shift from Web1 to the Web2 platform economy model turned everyone into a 'content creator', whether they were artists or not, all whilst centralising bodies of data, which today serve as training data for AI models.[107] In the context of large datasets such as Common Crawl, artists' data, from fan art to install shots, are indistinguishable from other data in a repository, even though the conditions of production and the relationship to culture may be very different. However, there are numerous strategies emerging for artists specifically to meet the challenges of the 'data as shadow labour' regime.

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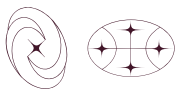

→ Leverage IP for Opt In Returns

IP litigation from artists (predominantly in the USA) claims that AI training uses artists' work without permission, and without the financial returns they are entitled to under law. In the USA, at least 10 cases were launched against AI developers and owners in 2023. One landmark case has been brought to the UK courts by Getty Images.[108] Many cases are still in progress, but the process of litigation points to deeper issues of transparency and responsibility in a creative economy being transformed by AI. Nondisclosure of training data prevents individuals from knowing how their works are used. Litigation has the potential to create a route for entities that develop AI systems to become transparent about training data.[109]

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Artist

However, the longer-term efficacy of litigation is questionable given the high costs and resource barriers that most artists cannot overcome, as well as the potential of pending judgments favouring AI companies.

I think we can be quite imaginative in how we use the IP framework of recognition and value in a creative work, and have more innovative ways of compensating and remunerating people in that process.
—Reema Selhi

→ Leverage Spawning for Opt Out Bargaining Power

One alternative is to foster an environment for meaningful bargaining and collective action. IP has great utility in this case, but safeguards are needed to prevent monopolisation by platforms that constrain downward revenue streams to the point that remuneration to most artists becomes negligible. Such safeguards can't come from quantifiable mechanisms such as pricing, but instead need to emerge from such tried and tested routes as collective bargaining.
The brainchild of founder Jordan Meyer and artists Holly Herndon and Mat Dryhurst, Spawning introduces a consent layer to the internet by giving users the possibility to opt-out from their data being used in training.[110]

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Spawning's browser extension allows users to add any media to the Do Not Train registry and to highlight content that has already been registered. Complementary software can

then block scrapers from accessing website contents, and from searching for content in popular data sets. Spawning targets internet users as well as developers. StabilityAI has integrated Spawning into their workflow to cross-check their training data sets before training models [111].

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While the opt-out strategy may resemble a protectionist measure that is only as good as the willingness of the actors behind the training to enforce it, it offers a new form of bargaining power not just to artists but to all internet users.

→ Data Brokerage for a Networked Commons

With an increasing awareness of data as shadow labour, data brokerage is likely to emerge as an AI-era form of collective bargaining. In sharp contrast to the individualising tendencies of the art market, artists now have an opportunity to collectivise around their economic value as training data producers and to test new modes of organising with trusted data stewards (see Chapter 1), such as forming data unions or data trusts.[112] While such entities may need to be hosted and/or steered by existing organisations (see *Leverage Spawning for Opt Out Bargaining Power* above), if adopted widely across cultural communities, they could set an important precedent for wider public utility and common sense understanding of the role that such intermediating entities could play within an AI-driven economy.

Artist

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→ Emerging Accountability Mechanisms

When the outputs generated from such tools as Midjourney, Stable Diffusion, and ChatGPT are considered as artistic artefacts, questions of provenance, permission and attribution emerge. The IP of the artefact produced by generative AI is currently either automatically in the public domain (e.g., Midjourney), or is assigned to the prompter (e.g., GPT-4).[113] Traceability, accountability and attribution norms will be critical technical and cultural frontiers as new mechanisms are introduced to support traceability and to combat permissionless use of training data, AI models, and their outputs (see *Cultivating Trust and Verifiability* in Chapter 1). Today these frontiers include the use of blockchain technologies to track machine learning provenance,[114] metadata standards such as OpenAI C2PA metadata framework,[115] and watermarking and identification tools such as SynthID by DeepMind.[116] Where the traceability of data is opaque and unaccountable, techniques have been developed such as Kudurru, developed by Spawning, which poisons or attacks the network as a form of resistance to data malfeasance.[117] [118]

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→ Synthetic Crafting

The concept of 'crafting' as an 'activity involving skill in making things by hand' may seem anachronistic for the era of contemporary art—in which art-making is generally led by conceptual rather than skill-based concerns—and too anthropocentric for the era of AI.[119] However, the historical space of art and (advanced) technologies has always differentiated itself from contemporary art precisely in its craft-like sensibility towards technological systems, whereas the merging of human and machine logics and capabilities highlights a synthesis that artists interested in advanced technologies have been forging since at least the 1960s.[120] [121] [122]

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These tools offer access and insight into the various capabilities of deep learning models . For instance, ChatGPT is an interface into LLMs such as GPT-4 and their transformer architecture. Other tools that use API access to build on top of GPT-4 may be fine-tuned on additional expert information

(e.g. CaseText, a legal advice chatbot), but they are indebted, both financially and technically, to the foundation model .[123] Some tools even aggregate foundation models , e.g., Perplexity, a co-pilot interface which pulls from both GPT-4 and Claude. Through using—and jailbreaking—the tool, insight is gained into its affordances as well as its limits.[124]

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→ Iteration at the Core of Synthetic Crafting

Iterative and durational learning are intrinsic to crafting for humans and for machine learning. Refinement follows reflection, and is never finished, it merely pauses. Every time a model is prompted, it 'runs a course' of the model architecture. Different prompts can produce variable results. These iterative runs can be seen as agents completing a task. With each prompt an agent produces, learnings that inform the next agent are produced. Working iteratively can lead to a more profound understanding of what the tools offer, as it allows for testing them out and taking them to new places.

This type of commitment to working closely with a technological system can give those engaged in synthetic crafting unique insights through competency, reciprocal learning, and higher exposure to the glitches and edge cases that a new model might reveal over

time. It also means that artists who have skills that predate AI's advance, and that speak to the sensibilities being harnessed, have an essential knowledge base for mastering and expanding the possibilities of these tools. For example, when Adobe Suite was first released, painters, photographers, and physical retouchers were well placed to leverage and explore the tools as they had a deep understanding of how image production works.[125]

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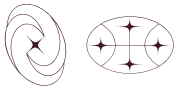

→ Edging into Unchartered Territory

Artist

Typically, we are inclined to downgrade models as we believe these older, less optimised versions offer untapped potential for exploring unique sensibilities and narratives, a feature that the newer commercial models oftentimes don't accommodate.
—CROSSLUCID

We are still at the very beginning of understanding the particular affordances of AI technologies. Though certain model architectures are developed for specific purposes, their long-tail affordances might emerge later. In such instances, the core affordances of a model are only discovered when it is adapted from one deployment context—often its original intended purpose—and placed in a new one.[126] Artistic experimentation often plays the role of repurposing tools from one context to another, finding a new perspective on an existing operation, or a latent operation within a new system of meaning.

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→ From Deskilling to Reskilling

Delegating skilled labour to a black box technology potentially reduces agency over production processes. What is found in efficiency gains risks exposure to deskilling, and could disincentivise a sustained engagement in honing a pre-existing craft or set of skills. Certain skills, such as animation or the writing of code, are becoming subject to varying degrees of automation, putting a wider range of present-day skill sets and forms of labour at risk.

However, historically, the loss and acquisition of human skills has always been a dynamic process; while some skills may become less widespread, others proliferate, and yet others make a come-back following an era of near total disappearance as cultural actors seek novel tools and ways of working, and as social and market demands shift.[127] What pre-AI crafts will be preserved and who will benefit from those efforts will be matters for the joint efforts of communities, government, cultural institutions, and private investment. Though the impact of the new AI tools is still unfolding, a number of specific consequences can already be identified.

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Tendencies in modern and contemporary art led to macrotrends of 'embodied' deskilling, refocusing on cognitive or conceptual contributions in artistic practice. This yielded a loosening of constraints, important for both conceptual and new media practices in the 20th century, and the turn towards research-driven practice more recently. With this latter phase, and the internal pressures of the artistic labour market, came the need for maintaining the stereotypical 'knowledge worker' skill set, while simultaneously requiring 'hard' practical and technical skills. The need for technical skills and digital literacy has led to a reskilling phase in education. For example, in the computational arts, which are often self-taught, alongside the growing sector of specialised institutional educational programmes such as those provided at the School of Digital Arts, Manchester Metropolitan University, University of the Arts London, as well as at New York University's Tisch School of the Arts.[128] This wider reskilling has not been limited strictly to computational arts, and, in many cases, leans on fluency in research methodologies from both the social sciences and the humanities, from ethnography to data analysis.[129]

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p179

Overall, this reskilling has culminated in a proliferation of specialisations within the machine learning domain. Here, specific expertise and literacies—e.g., in-game AI, synthetic data, generative systems, language models, specific coding languages for integration work, such as C++ for machine learning and Unreal Engine—can be combined with specific artistic or cultural skills or knowledge to produce re-triangulated specialisations. Consider, for example, the case of the poet Sasha Stiles who works fine-tuning small language models, or the graphic designer Eric Hu who builds bespoke generative systems for the layout of assets.[130] New mixes of divergent skills lead to new possibilities for building a unique micro-disciplinary space for exploration.

Artist

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→ From Model Querying to Seamless Intermediation

The ascent of prompt-engineering as an AI-era craft-based skill is another example which requires a certain level of domain-specific knowledge and erudition.[131] Prompt engineering has been compared to writing practice as a craft, but also as a form of conceptual labour.

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Prompt-engineering can also be seen as an emerging method to 'query' an AI model as a search space—a contingent practice in drawing out important insights. Yet, prompt-engineering as it exists today might be specific to our moment, as newer more malleable interfaces are developed. Examples of potential futures might include user-friendly programming interfaces, such as the music app Semilla.ai, but also cloud service platforms such as NVIDIA's Omniverse in which many models and software environments can be used together.[132]

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Semi-Autonomous Aesthetics

The last decade has seen the re-emergence of artificial neural networks as the dominant computational paradigm in AI. Machine learning outputs from 'early' systems, for instance Google's DeepDream, were initially interpreted as oneiric generative worlds, with their aesthetics capturing the imagination of the general public [133]. With aesthetics acting as an interface to technical systems, something always remains encrypted, or autonomous from human intentionality.

p180

Forays into aesthetic research, including data visualisations that surface and scrutinise the algorithmic tendencies of AI, became a core domain of artists' work in the late 2010s.[134] Here the 'internal' workings of the artificial neural network, and the dataset it pulls from, were the primary subjects of exploration. Semi-autonomous aesthetic outputs provided nonlinguistic insights into systems operating on the basis of non-symbolic pattern recognition.[135] As a testament to the

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p180

speed with which this technocultural space is evolving, this suite of tactics for visualising the operations of an artificial neural network has already been canonised even as new strategies (discussed below) emerge, and the anatomy of machine learning decision-making becomes increasingly theorised.[136]

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The stabilisation of a specific aesthetic can be explained with recourse to the data that the model is trained on, but this does not tell the whole story. Machine learning architectures have an optimising logic which, in part, determines their outputs. This could be understood as the artificial neural network's tendency to converge during the optimisation process. Optimisation strives to locate the 'median' result within the dataset. The delivery mechanism of algorithmic feeds produces a similar convergence effect: 'mid' content is self-perpetuating.[137] In combination with other guardrails, some machine learning tools can become toothless for artistic purposes, imposing safeguarding constraints intended to delimit the possibility space for critically exploring, especially in relation to challenging topics. Artists including Terence Broad are specifically interested in models that diverge, exploding new possibility spaces within the model's typical logic.[138]

Artist
p180
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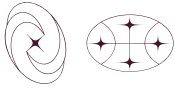
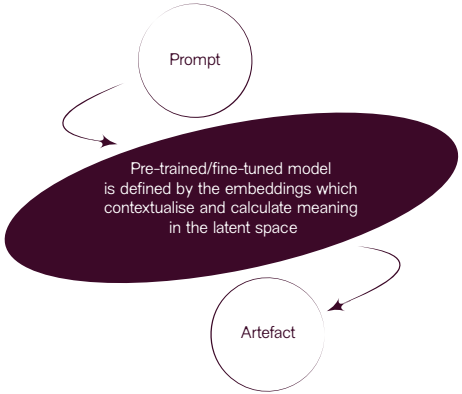
→ Style Capture

Artists with a large enough presence in prevalent datasets (e.g. Common Crawl or LAION-5B), or artists whose portfolios belong to a highly indexed dataset (in relation to a historical period, style, canon, etc.) might have their style 'captured' by generative AI models trained on relevant datasets. This can happen to an extent also when an artist or content producer works within a prevalent genre, and that genre is captured, resulting in implications for the competitive viability of their work. This means that users can produce stylistic facsimiles by prompting models.[139] This compression of artistic approach into a style transfer prompts the following questions: how will artists reconfigure their practice in the light of style capture? Will they use it to their advantage, intervening at the data layer to shape the model itself? Or will they evade it altogether by taking up strategies against data collection?

p.180




Prompt
Pre-trained/fine-tuned model
is defined by the embeddings which
contextualise and calculate meaning
in the latent space
Artefact

Artist

→ Recombinant Aesthetics in the New Weird

It is not only extant styles that can be pulled from AI models. There is a possibility of composing new styles by exploring new connections between embeddings (i.e., compressed representations of data). This can be done in the vein of crossing styles, e.g., '*Breaking Bad* by Balenciaga,' or it can allow for communities to play into their favourite tropes of fan lore while shifting their storylines in divergent directions (e.g., '*Snow Crash* but feminist') creating forks and adding fan-created storylines and characters.[140] This poses the question of whether there will be a need for new content (i.e., data points) to feed the variety of recombinant aesthetics, or whether recombinant aesthetics themselves will breed further emergence through mutations, or whether the interoperability of mutations will become what feeds the cultural desire for novelty.

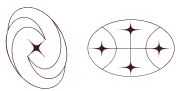
p.180

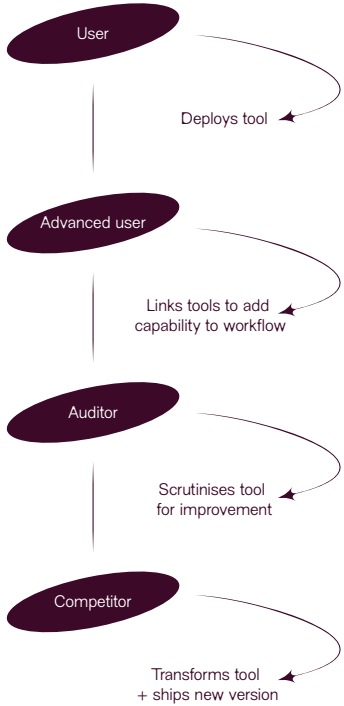
Artist

152 The most important thing when we're talking with artists is to understand their workflow. They're creating new ways to use the technology in a pipeline. They're combining different algorithms, software, and hardware and pushing the limits in a way we don't often see.
—Heather Schoell

Different artists engage with AI tools in very different ways. Though there are many strategies for engaging with or intervening at different levels of the AI stack, there is a continuum for proximity and/or depth of engagement, which leads to different forms of cross-pollination between artistic practices and the systems at the heart of evolving AI tools. The nature of engagement is not only determined by the artist's technical skill set, but also by the nature of the tools themselves. Is the tool's code open source? Is a pre-trained model freely available?[141] Is the model's training data auditable? Depending on the technical accessibility of a tool's many sides, different forms of intervention at different layers of the stack might be made possible.

p.181





The different modalities in which models are intervened upon as a medium by artists.

→ Modalities for AI Tool Deployment

There is already a long history of open machine learning tools that coder-artists p181 have been using.[142] In many such cases, these artists attempt to understand how a tool works, peering into its internal operations. Given the multiplicity of ways in which such artists interrogate AI tools, it is useful to break down a nomenclature for modes of engagement as practice modalities. Artists who use proprietary tools to produce artefacts are *users*, while those who embed those tools in more complex workflows are *advanced users*. If a tool is open source, some artists become *auditors* and are able to offer more technical scrutiny or feedback on how the tools are built, either for the developer, a wider user community, or in some cases, a decentralised community of developers working on specific larger p181 ventures.[143]

p181

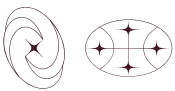
Again, if the code is open source a very small minority of artists, with the right support, can build out alternatives. An example of this is KaiberAI, a generative video tool that was developed through support from Gray Area, an art and technology organisation based in San Francisco.[144] Like KaiberAI, though, not all *competitors* remain open source: some choose to bring their tool to market as proprietary and commercial. Conversely, there is SemillaAI by Moisés Horta Valenzuela, an audio synthesis tool that diversifies the landscape of generative AI tools for sonic practice by adding an additional tool available to musicians. The tool itself is open source, and allows any user, or artist, to train their own model based on their own audio repository. A user may choose this tool over a different generative music tool, thus having been provided with an alternative to proprietary, commercial products. In this sense, SemillaAI is competing on the market with such products, to the benefit of the artistic community of users.

→ Model-Making as Meaning-Making

Architectures are generic; weights are indebted to labour, and are much more idiosyncratic.
—Moisés Horta Valenzuela

In the age of foundation models, computations across unprecedentedly vast cultural archives derive meaning through correlations within a model's embedding spaces. If culture and art-making are to play the role of diverging from inherited convention toward new modes of meaning-making, some of that work will need to take place within the technical system of meaning production itself, such as the AI model p181.[145] Artists as cultural tastemakers and pathfinders will need to find ways to intervene in the meaning-making of AI systems by being able to manipulate the metadata, context, weights, and embeddings p181.[146]

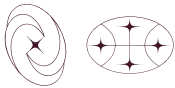
Artist



The manipulation of AI models through weights—known as fine-tuning—holds unique potential for artists to perform interrogative work. The architecture of a neural network (i.e. GAN, CNN, transformer, etc.) only becomes a valuable meaning-making agent after training on data. As such, it is the training and fine-tuning of an AI model that engenders the formal aspects of artistic

expression, whether individual or collective. Working in this mode, artists become gatherers of datasets, explorers of embedding spaces, engineers of new architectures, and fine-tuners of models. They use their own, existing and combinations of other models in their production pipelines. The schematic ontologies as to where artistic expression originates, who is its rightful holder, and on what terms (e.g., IP and moral rights), will have major bearing on what we consider art to be, how it is to be legally and economically acknowledged, and, in turn, what the agency of its meaning-making in society could be.[147]

p.181



Artist

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Machine learning tools are being integrated into broader artistic complex systems which function beyond the production of visual or textual artefacts. The integration of AI and machine learning within simulations, video games, sensory apparatuses and surveillance systems mirrors the technology's wider societal deployment, where AI becomes more embedded, rather than being the focal point of the artist's attention.
—Creative AI Lab

Some artists ⊕, instead of looking inward at the internal operations of AI tools, look outward, building tools into more complex, operative systems for research or production. These artists ⊕ craft tools, craft *with* tools, or craft tools into bigger systems. Some artists ⊕ build interesting pipelines without notable technical knowledge by pulling together proprietary tools and techniques into novel workflows.[148]

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This approach, which takes the system as an artform, is less common than methods which give primacy to some combination of process and artefact. An example is the work of Orphan Drift and Etic Lab's *Interspecies Research Communication Initiative* (2021) which aimed to build a reciprocal training programme for a machine learning agent and an octopus, adopting what they termed a 'whole-systems approach'.[149]

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From artistic practice emerge new approaches to technical and narrative aspects of machine learning, continuing

a lineage of artistic endeavours of not merely critiquing but also of building (computational) systems as tools for communication and analysis. Often these systems become a byproduct that has an ecosystem level value, either by pressing forward with a specific technical innovation—for example, Delta_Ark's work to integrate reinforcement learning into Unreal Engine—or the delivery of a tool for the community to build into future workflows, as with SemillaAI. From an organisational point of view, these projects often yield public interest and sometimes have positive impacts in their pursuit of divergent technical systems that decouple from the profit motive. However, they do require much greater resourcing, since they often necessitate teams of diverse technical and academic expertise.

From Systems-Building to Worldbuilding

We're trying to simulate ecosystems with agents that are highly adaptive. So that might mean agents with LLMs that you can talk to. But it also means that there are agents that can evolve new behaviours. We're trying to make these really complex simulated ecosystems, and trying to make artworks from inside them.
—Delta_Ark

Artists' modus operandi cannot be generalised. They are always seeking new ways of working, and this often means combining technologies and bringing different technical components into interaction as part of new workflows. Increasingly, this involves building tools into worlds.[150] Sometimes these worlds explore AI through narrative, such as Lawrence Lek's Sinofuturist cinematic universe that privileges speculative fictional exploration over forensic exploration of tools. Alice Bucknell combines narrative with AI tooling which they use to constitute containerised gameworlds, integrating a composite stack of multiple models and techniques, for example, in their latest project *The Alluvials* (2024).

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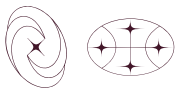

Game engines, like Unreal Engine or Unity, are currently the software environment through which experimental workflows and combinations of tooling are developed in order to build virtual worlds.[151]

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Simulating worlds also allows for the testing of ideas beyond physical constraints, e.g., limited resources or the laws of physics. AI will have a key role to play in the proliferation of virtual worlds as generative AI tools and recombinant media will present opportunities to create hyper-personalised versions of worlds, virtual environments and characters according to the specifications of creators or communities.[152] [153] [154] With users becoming both producers and consumers of generative media we might see a proliferation of 'bubble worlds'. These forked and user-specific versions of virtual worlds will be continually reshaped by their attendant communities and could join together to share in-world generative assets. [155]

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Artist

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A lifeform, or a life, is a compositional space.
—Ian Cheng

Simulated bubble worlds provide a place to develop both new machine learning techniques and new philosophies for understanding them,[156] using simulation as an accelerator for emerging paradigms of weird social organisation. This type of work operates as a 'mirror stage' in which to explore emerging hybrid human-AI patterns of agency, prototyping new relational models which will eventually produce new, dialogical forms of personal and organisational self-recognition. This problem space has precedent in works of artists working in the 2010s, such as Ian Cheng, whose work *BOB* (2018) took the 'life' of an AI agent as a medium in itself.

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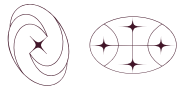

This approach is not restricted to the cultural domain: simulations are used in other contexts to train AI agents. Startup Imbue (formally Generally Intelligent) developed their own simulated training environment called Avalon wherein they conduct benchmarking experiments for reinforcement learning agents.[157]

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→ Complex System Choreography

This perspective on the artist —thinking across 'system' and 'world'—focuses more on the artist as performing a type of work with their unique skill set instead of viewing them as a metaphysically distinct type of agent who can offer opaque ethical insight into new future technologies. This echoes the art critic Jack Burnham's 1968 essay *System Esthetics*: AI shifts the conventional role of the artist and creative away from end-content producer (primarily visual, imagery, text) towards a choreographer of complex information systems.[158]

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A New Era of (Art) Tech Development

We're not trying to compete, we simply intend to remain the hosting platform that keeps the community engaged and coming back.
—Madisen Taylor

The existence of art and technology as a professional nexus would have not been possible without a new set of structural relationships that were inaugurated in the 1950s involving the public sector, the technology industry, and artists interested in technologies as an exploratory and conceptual medium.[159] Experiments in Art and Technology at Bell Labs, Artist Placement Group, XEROX-Parc, Autodesk Artist in Residence and Google Artist + Machine Intelligence all serve as era-specific archetypes of public sector and industry-hosted settings where artists were invited to collaborate with technologists. While all of these programmes placed different expectations on such collaborations and often operated under different definitions of what an artist is and can offer, ranging from visual support to philosophical sparring partners, in aggregate they have set a precedent for the societal necessity of such relations that today's AI public sector and industry landscape can leverage and evolve.

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→ Exploratory Use-Case Space

The combination of artists' appetite for risk-taking and experimentation with the low risks of art as a deployment context makes collaborations between technology developers and artists fertile soil for use-case exploration. This is true for the product-ready level of technology, but even more for R&D or community-building phases around early-stage technological applications. The specific affordances of artistic training and socialisation skills allow artists to approach new technologies with critical perspective, in some cases, including experience in cross-deploying new technologies in unexpected contexts. Under the right conditions, this can be used effectively, revealing new affordances by means of experimental use.

Apart from surfacing valuable insights and use-case prototyping, case studies can help develop a public-facing narrative around the technology. In the context of a highly

abstract and complex technology such as AI, both of these capabilities are of great value and public significance. Key to the success of such programmes going forward will be the recognition of the inherent value provided by artists and arts organisations in these experimental contexts.

→ Artist as Influencer

Technologies oriented towards creative pursuits will inevitably leverage artists in their demonstration campaigns.[160] In the generative art space, artists can endorse the use of particular models, particularly if their authorship is useful in creating value through tradable assets.[161] More generally, the production of cultural artefacts (e.g., poems, fan fiction, imagery) has been the way that a general audience interfaces with foundation models and their logic systems.

p183

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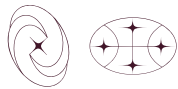

→ Case for Institutional Brokerage and Intermediation

As generative as collaborations between artists and industry can be, they are fraught with potential misalignments. Contractual misunderstandings, cultural differences, power imbalances, and the sheer asymmetry of operating scales between typical artists' studios and technology companies can often lead to friction and even collaborative breakdowns. Furthermore, within the technology sector, such programmes are usually initiated and argued for through business cases by employees who see merit in such collaborations, but whose main job lies elsewhere. The relative fragility and lack of longevity of such programmes is, in part, a result of these operational challenges.

In contrast to the 1950s, 1990s, and even into the 2010s, today there are a number of institutions, as well as smaller organisations, who specialise in supporting artistic practices that are specifically engaged with advanced technologies such as AI.[162] These organisations possess the necessary capabilities to provide the operational scaffolding for such industry to artist

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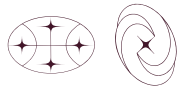
collaborations as well as offering creative directional support and avenues for integrating collaborations into a larger public context.



Notes 102-162

102. Creative-ai.org database and ml4a.net are two examples of resources for artists wanting to learn how to engage with AI tools. p.125

103. IMF, *Gen-AI: Artificial Intelligence and the Future of Work* (2024). Link: www.imf.org/-/media/Files/Publications/SDN/2024/English/SDNEA2024001.ashx. p.126

104. DACS, *AI and Artists' Work* (2024), p.11. Link: cdn.dacs.org.uk/uploads/documents/News/Artificial-Intelligence-and-Artists-Work-DACS.pdf?v=1708424212. p.126

105. 'Whether a union exists or not, industry and labour can establish formal mechanisms to incorporate workers into AI development and deployment.' See Executive *Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence* (2023). Link: www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence. p.128

106. There are also clear positive externalities of such tools being integrated into artists' administrative processes (which are typically significantly under-resourced). The streamlining and optimising of grant-writing, artist's statements, bios, and other collateral communication materials associated with maintaining an artistic practice are examples. p.128

107. Early Web2 platforms such as DPChallenge were later adopted as training data. See Leonardo Impett, *Touch Up My Appearance* (2023). p.129

108. Emilia David, *Getty Lawsuit Against Stability AI to Go to Trial in the UK* (2023). Link: www.theverge.com/2023/12/4/23988403/getty-lawsuit-stability-ai-copyright-infringement.
p130

109. Michael M. Grynbaum and Ryan Mac, *The Times Sues OpenAI and Microsoft Over A.I. Use of Copyrighted Work* (2023). Link: www.nytimes.com/2023/12/27/business/media/new-york-times-open-ai-microsoft-lawsuit.html.
p130

110. See www.spawning.ai.
p132

111. Melissa Heikkilä, *Artists Can Now Opt Out Of The Next Version Of Stable Diffusion* (2022). Link: www.technologyreview.com/2022/12/16/1065247/artists-can-now-opt-out-of-the-next-version-of-stable-diffusion.
p133

112. Sylvie Delacroix, Neil D Lawrence, *Bottom-up Data Trusts: Disturbing The 'One Size Fits All' Approach To Data Governance*, International Data Privacy Law, Volume 9, Issue 4, November 2019, p. 236-252,.
p134

113. OpenAI, *Terms of Use* (2024). Link: help.openai.com/en/articles/8912793-c2pa-in-dall-e-3.
p135

114. Muhammad Shafay *et al.*, *Blockchain For Deep Learning: Review And Open Challenges* (2023).
p135

115. OpenAI, *C2PA in DALL·E 3*. Link: help.openai.com/en/articles/8912793-c2pa-in-dall-e-3.
p135

116. DeepMind, *SynthID*.
Link: www.deepmind.google/technologies/synthid.
p135

117. Spawning, *Kudurru*.
Link: www.kudurru.ai.
p135

118. See also Nightshade tool.
Link: nightshade.cs.uchicago.edu/whatis.html.
p.135

119. Peter Osborne, *The Postconceptual Condition* (2018).
p.136

120. Maurice Tuchman, *A Report on the Art and Technology Program of the Los Angeles County Museum of Art, 1967-1971* (1971).
p.136

121. Sadie Plant, *Zeroes and Ones* (1997).
p.136

122. Geoff Cox et al., *Live Coding: A User's Manual* (2022).
Link: www.livecodingbook.toplap.org.
p.136

123. I.e., fine-tuning on specific datasets which can offer a specialist level of insights into a specific remit of information, such as in a model that is fine-tuned on case law and a set of specific legal cases within specific jurisdictions.
p.137

124. 'Jailbreaking' methods circumnavigate developer restrictions, usually at the software level, to broaden the range of possibilities a user can achieve with a tool.
p.137

125. See Quantel Paintbox, a forerunner to Photoshop, early access to which was granted to Richard Hamilton.
Lev Manovich, *Software Takes Command* (2013).
p.139

126. For example AlphaGo, a machine learning software initially designed to play the board game Go has been redeveloped into the architecture used for AlphaFold, a tool able to accurately predict the 3D models of protein structures, a capability that presumed to be able to accelerate research in the development of novel medicines including for Alzheimer's disease. See Demis Hassabis, *AI Could Solve Some of Humanity's Hardest Problems. It Already Has*. (2013). Link: www.nytimes.com/2023/07/11/opinion/ezra-klein-podcast-demis-hassabis.html.

p141

127. See André Leroi-Gourhan, *Gesture and Speech* (1964 [1993]).

p142

128. The School of Digital Arts at MMU was a £35m investment into an art school with state of art production facilities focusing on media production studios, immersive technologies, a gallery and music spaces that opened in 2021.

p143

129. The breadth of intersecting methodologies with AI from the humanities and beyond can be explored via the 'Resources' strand of the Creative AI Lab Database. www.creative-ai.org.

p143

130. See Sasha Stiles' practice. Link: www.sashastiles.com. See Allison Parrish's practice. Link: www.decontextualize.com.

p144

131. 'Prompt engineering' commonly refers to shaping the text prompt given to a foundation model in a particular way, in order to shape the results it returns. This can involve adding clarifications or additional information to steer it away from a default path already identified by users of that model.

p145

132. See Moisés Horta Valenzuela's more malleable interface SemillaAI.

p145

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For example, Gray Area and Google's exhibition *DeepDream: The Art of Neural Networks* (2016).

134. See Anna Riddler's *Traces of Things* (2018) or Refik Anadol's *Archive Dreaming* (2017). p.146

135. Where early AI systems used symbolic AI or rule-based AI, to define the terms of intelligent systems, connectionist AI allowed associations to emerge through a model's processing of datasets. See Geoffrey E. Hinton, *Preface to the Special Issue on Connectionist Symbol Processing* (1990). p.146

136. Scott Robbins, *A Misdirected Principle with a Catch: Explicability for AI* (2019). p.147

137. Günseli Yalcinkaya, *How did everything get so mid?* (2023). Link: www.dazeddigital.com/life-culture/article/59790/1/how-did-everything-get-so-mid-culture-basic-prepackaged-cool-fred-again. p.148

138. Broad et al., *Active Divergence with Generative Deep Learning – A Survey and Taxonomy* (2021). See Terrence Broad's website for more insight to their practice. Link: terencebroad.com/works. p.148

139. For example, text-to-image models such as DALL-E 3 can reproduce works in the style of famous painters, e.g., Hieronymus Bosch, although it is designed to refuse prompts that explicitly request the style of living artists. While it might refuse to produce works in the style of David Hockney, for example, there remain questions around whether it could be prompt engineered into doing so. p.149

140. demonflyingfox, *Breaking Bad by Balenciaga* (2023). Link: www.youtube.com/watch?v=ZUVMKuY6QvU. p.151

141. The term open weights refers to releasing only the pretrained parameters or weights of the artificial neural network model itself. p.153

142. See Machine Learning for Art repository and Serpentine & King's College London's Creative AI Lab Database. p.155

143. Artists who engage in 'auditing' also usually engage in other modes, too. See, for example, Delta_Ark's engagement with reinforcement learning for Unreal Engine. Link: www.delta.center/research#/reinforcement-learning. p.155

144. Kaiber.ai. Link: kaiber.ai p.156

145. Mercedes Bunz, *The Calculation of Meaning: On the Misunderstanding of New Artificial Intelligence as Culture* (2019). p.158

146. Mercedes Bunz & Eva Jäger, *Inquiring the Backends of Machine Learning Artworks: Making Meaning by Calculation* (2021). p.158

147. Holly+ a model and artwork created by Holly Herndon and Mat Dryhurst illustrates the complexity of artists producing work across the AI tech stack. In this work, the artists created a dataset from consenting participants, training a model together with the engineer Jules Leplace, fine-tuning it on Herndon's own voice. The work also explores recombinant IP with a strategy for shared ownership of assets created using the model. Link: holly.mirror.xyz/54ds2liOnvthjGFkokFCoal4EabytH9xjAYy1irHy94. p.159

148. For more on this see Alasdair Milne, *Re-engineering a Concept of Collaboration for Machine Learning Artistic Practice* (thesis, forthcoming, 2024). p.161

149. p.161 Interspecies Communication Research Initiative (ISCRI): A Cephalopod <-> Machine Encounter (2021). Link: www.serpentinegalleries.org/arts-technologies/interspecies-communication-research-initiative-iscri-a-cephalopod-machine-encounter.

150. p.164 See *What Models Make Worlds: Critical Imaginaries of AI* exhibition at Ford Foundation Gallery (2023). Curated by Mashinka Firunts Hakopian & Meldia Yesayan. Link: www.fordfoundation.org/about/the-ford-foundation-center-for-social-justice/ford-foundation-gallery/exhibitions/what-models-make-worlds-critical-imaginaries-of-ai.

151. p.164 See *Future Art Ecosystems 2: Art x Metaverse* (2022). Link: www.futureartecosystems.org/briefing/fae2

152. p.165 Agnieszka Polska proposes that AI tools might lead to the proliferation of individual worlds, or 'paracosms', democratising access to siloed world-dwelling. These paracosms could remain individual or become collective, depending on how one builds out the infrastructure. Agnieszka Polska, *Future Paracosms and Their Infrastructures* (2023). Link: www.e-flux.com/notes/525658/future-paracosms-and-their-infrastructures.

153. p.165 Elsewhere, Autonomous Worlds, for example, uses blockchain protocols to allow worlds to become decoupled from singular ownership, affording them the possibility of persisting indefinitely. These technologies offer the possibility. See the *Autonomous Worlds* reader (2023). Link: aw.network.

154. p.165 See Deepmind's 'Scalable Instructable Multiworld Agent' in *A generalist AI agent for 3D virtual environments* (2024). Link: deepmind.google/discover/blog/sima-generalist-ai-agent-for-3d-virtual-environments.

155. The term 'bubble worlds' emerged from a conversation between the authors and Vincent Brisebois who heads Omniverse at NVIDIA about the future of the media ecosystem in March 2024. p165

156. Whether these truth-claims can be exported into our world remains a primary challenge for simulated scenarios and worldbuilding artistic research agendas alike. p167

157. Generally Intelligent, *Avalon: A Benchmark for RL Generalization Using Procedurally Generated Worlds (2022)*. p167

158. Jack Burnham, *Systems Esthetics* (1968). Link: www.artforum.com/features/systems-esthetics-201372. p168

159. W. Patrick McCray, *Making Art Work: How Cold War Engineers and Artists Forged a New Creative Culture* (2020). p170

160. "Alex [Reben] is one of the first people we share our new models with," said Natalie Summers, a spokeswoman for OpenAI. Reben was OpenAI's first artist-in-residence in 2023. Leslie Katz, *An Artist in Residence on A.I.'s Territory* (2023). Link: www.nytimes.com/2023/12/30/technology/openai-artist-alexander-reben.html. p173

161. See community-based marketplaces for on-chain art such as fx(hash) or Zien. Link: www.fxhash.xyz, www.zien.io. p173

162. Apart from Serpentine Arts Technologies, such organisations include Gray Area in San Francisco, HEK in Basel, Museum for Moving Image and NEW INC in New York, Buffalo AKG Art Museum in Buffalo, TRANSFER Gallery, and Bitforms Gallery, amongst others. p174

Previous page © CROSSLUCID
Line of Flight: Ecosystem (2024), Still.

3

Ecosystem

As Chapters 1 and 2 lay out, 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 (AxAT) strategies can be developed, and to start acting on these strategies.

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 projects by Serpentine Arts Technologies' R&D Labs 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 into 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 into capacity 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 who support artists working with advanced technologies need to attach key performance indicators (KPIs), and, ensuingly, resources, to robust production pipelines in addition 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.[163]

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→ 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 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.[164] 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.[165] [166]

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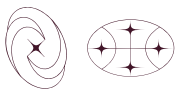
→ New Ownership and Distribution Models

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.[167] Organisations with the advanced production capabilities and the experience required to support AxAT artists are well-placed to develop and share these ownership and 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-sectoral 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 projects than audience and media engagement through footfall and clicks. Long-term 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 in 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-sectoral 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.[168]

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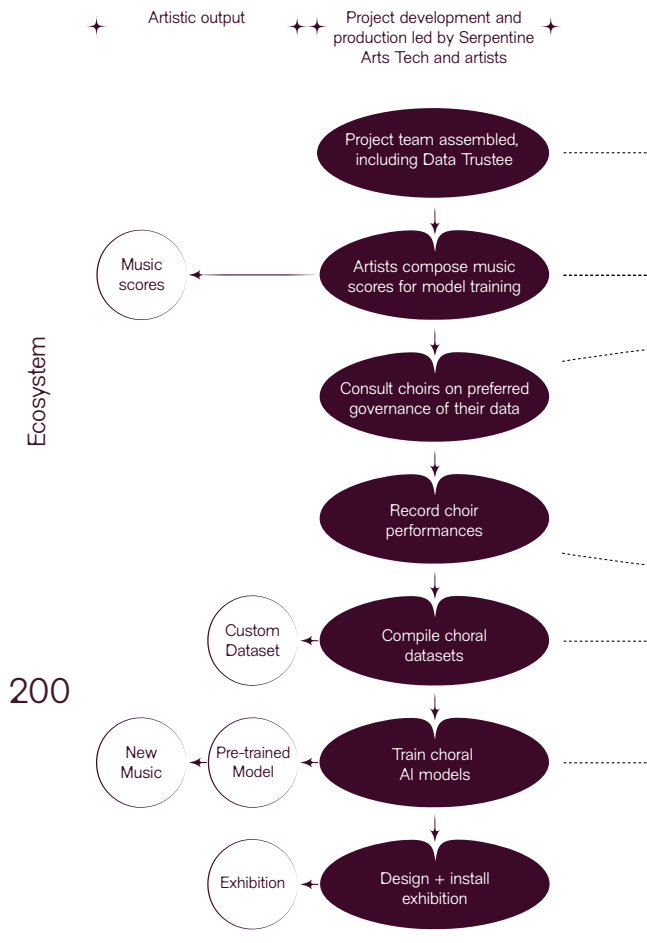
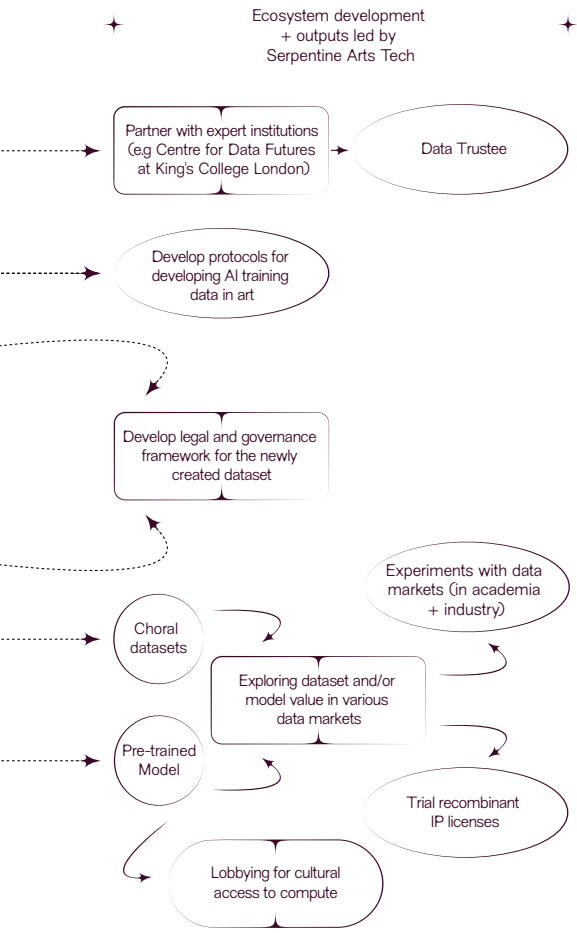

Artistic output
Project development and production led by Serpentine Arts Tech and artists
Project team assembled, including Data Trustee
Music scores
Artists compose music scores for model training
Consult choirs on preferred governance of their data
Record choir performances
Custom Dataset
Compile choral datasets
New Music
Pre-trained Model
Train choral AI models
Exhibition
Design + install exhibition
Ecosystem


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

→ 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 likely be largely automated but will require new platforms, vendors, pricing and validation mechanisms, and stewardship protocols. This presents an opportunity 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 where 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. Users 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.[169] 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.[170]

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→ Early Cross-technological Use-cases

Supporting the development of blockchain x 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) file format, a major transformation of production pipelines for various media industries and artists is likely underway. This has the potential to disrupt the huge film, TV, advertising, and online marketing labour markets.[171] [172] Users, and, thus, artists, will soon be in the 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.

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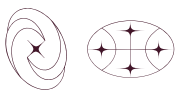

As new operational and business models will start to emerge at the scale of media and entertainment industries, the art field's capacity to be positioned alongside industry players will be contingent on a

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.[173]

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A similar dynamic may unfold as the market for the integration of blockchain and AI technologies starts to emerge.[174] 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 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 and AI's technological capabilities can mutually support each other.[175] For example, prioritising

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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).[176]

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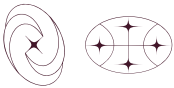

→ Lobbying for Deeper AI systems Access and Compute Quotas on Behalf of the Cultural Sector

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 what is 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, which is expected to enter into force in 2024, few jurisdictions have taken a comprehensive approach to regulating AI. The UK has set up a number of AI-related bodies, but has yet to legislate.[177] 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.[178]

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Notes 163-178

163. See Chapter 3 across all previous FAE publications: *Future Art Ecosystems 1: Art x Advanced Technologies* (2020), *Future Art Ecosystems 2: Art x Metaverse* (2022), and *Future Art Ecosystems 3: Art x Decentralised Tech* (2023). Link: www.futureartecosystems.org/briefings.
p.191

164. *Towards a National Collection*. Link: www.nationalcollection.org.uk.
p.193

165. This could include developing a framework for permitting 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.
p.193

166. The Museums + AI Network, and the resulting AI: *A Museum Planning Toolkit* is an earlier example of this concerning the museum sector specifically. Link: www.themuseumsai.network/toolkit.
p.193

167. See partial common ownership, a stewardship system for art developed by Serpentine Arts Technologies and RadicalxChange. Link: www.radicalxchange.org/wiki/pco-art.
p.195

168. For example, Transfer Data Trust offers a specific approach to the role that trusts can play in AxAT, setting up a model that 'that integrates the perpetual purpose artist trust with cooperative organisational structures'. Link: www.transfergallery.com/data-trust.
p.198

169. Currently Hugging Face serves as a community hub for collating different licences that are being deployed by developers working with AI models. Link: www.huggingface.co/docs/hub/en/repositories-licenses.
p.206

170. p.206 SAG-AFTRA is working on a new licence for voiceover actors to safely explore new job opportunities in the 'digital voice twin' landscape. Link: www.sagaftra.org/sag-aftra-and-replica-studios-introduce-groundbreaking-ai-voice-agreement-ces.

171. p.208 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, realtime distributed collaboration when developing CGI projects.

172. p.208 Deloitte's *TMT Predictions 2024* (2024). Link: www.deloitte.com/content/dam/Deloitte/at/Documents/technology-media-telecommunications/at-tmt-predictions-2024.pdf.

173. p.209 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. CoSTAR does not include the art field. Link: www.ukri.org/councils/ahrc/remit-programmes-and-priorities/convergent-screen-technologies-and-performance-in-realtime-costar.

174. p.209 *AI and Blockchain. The New Power Couple*. Link: www.kpmg.com/us/en/articles/2023/ai-blockchain-new-power-couple.html.

175. p.209 See *Future Art Ecosystems 3: Art x Decentralised Tech*. Link: www.futureartecosystems.org/briefing/fae3.

176. p.210 Jacob Horne, *How AI Is Finding Its Way Onchain* (2024). Link: www.zora.co/writings/ai-plus.

177. See Deloitte's overview, *The UK's Framework for Regulating AI. Agility is Prioritised but Future Legislation is Likely to Be Needed*. Link: www.deloitte.com/uk/en/blog/emea-centre-for-regulatory-strategy/2024/the-uks-framework-for-ai-regulation.html.

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178. 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*. Link: www.governance.ai/research-paper/brussels-effect-ai.

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Postface

In 2014, Serpentine Arts Technologies launched its first commission: AGNES, an AI chatbot living in the Serpentine website by the artist Cécile B Evans. Rather than a bot optimised to carry out mundane, repetitive, or potentially 'useful' administrative tasks, AGNES was a guide, narrator and companion to Serpentine's world. Seeking feedback and reassurance, one's interactions with AGNES were defined by her ever-shifting moods, from excitable to existential anxiety.

What followed were major AI projects as collaborations with Ian Cheng, James Bridle, Jenna Sutela, Pierre Huyghe, and Hito Steyerl, and now, ten years later, 2024 is Serpentine's year of AI. Beginning with Refik Andol, Echoes of the Earth: Living Archive, a project that envelops viewers in immersive environments that utilise years-long experimentation with visual data of coral reefs and rainforests to showcase the creative image-making potential of AI. The year will end with Holly Herndon and

Mat Dryhurst's first major solo exhibition in the UK. It will be centred on the collective creation of new vocal datasets, governance frameworks, and vocal AI models. In so doing, the project will position the process of data collection and AI model training as forms of artmaking. In the midst of significant creative and infrastructural shifts brought on by the acceleration and proliferation of AI technologies, the relevance and importance of artists, and arts organisations, to understand the mechanics and implications of these technologies, and to support vital and engaged artistic experimentation, continues to deepen.

This commitment to understand the ways that artists work with AI systems was formalised with the establishment of the Creative AI Lab in 2019 as a collaboration between the Department of Digital Humanities at King's College London and Serpentine Arts Technologies, led by Eva Jäger and Mercedes Bunz, focusing on artistic practice and prototyping to speculate about the systemic impacts of emerging tools, systems, and infrastructures within the arts and humanities, but also, significantly, in terms of wider public interest.

The release of *Future Art Ecosystems 4: Art x Public AI*, the fourth volume of the strategic briefing, is the necessary culmination of this exchange of knowledge and experience in production, research, and prototyping that will continue to enrich the cultural field and the world beyond. Providing strategies, tools, and knowledge for the sector in order to ensure the cultural sector is able to understand and impact how these technologies are developed and disseminated in our everyday lives is core to this project.

As always, FAE4 is informed by the network of practitioners and organisations across art, science, technology, research, and policy who contribute to the ever-expanding art x advanced technologies ecosystem, and with whom Serpentine Arts Technologies is so glad to continue collaborating as we explore the future of our shared worlds. We are immensely grateful for their time, expertise, and dedication.

We would like to thank Mercedes Bunz, Sebastian Berns, Jack Murray-Brown, CROSSLUCID, Mat Dryhurst, Marta Ferreira de Sá, Jack Henderson, Daniel Chávez Heras, Holly Herndon, William Kherbek,

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Finally, we would like to express our gratitude to Victoria Ivanova, R&D Strategic Lead, and Eva Jäger, Arts Technologies Curator & Creative AI Lead, for steering and leading FAE4. We also thank the entire Serpentine Arts Technologies team: Tamar Clarke-Brown, Tommie Introna, Vi Trinh, Ruth Waters, and Kay Watson.

Bettina Korek and Hans Ulrich Obrist
London, March 2024

Biographies

Agnes Cameron
is a computer hardware and software engineer, and an artist. She is based in London, UK. She has a particular interest in simulation, in tools for harnessing collective knowledge, and the representation of ideas. She works as a specialist technician and as a lecturer at University of the Arts London's Creative Computing Institute, and as a technical consultant to artists, game studios, and researchers.

Ian Cheng
is an artist based in New York.

CROSSLUCID
is an artist collective (est. 2018) that engages in highly collaborative, cross-disciplinary projects in co-evolution with technology. Their work and research include 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.

Delta_Ark
is an XRAI studio, lab and agency based in San Francisco.

Holly Herndon and Mat Dryhurst
are renowned for their pioneering work in music, machine learning, software development, and organisational experimentation. They are authors of a synthetic voice system, Spawn, that uses live performances and intimate singing groups to collect voice data and evolve a collective human-machine voice. They have also developed Holly+, a tool and a Web3 organisation that gives access to Herndon's digital voice, and offers a new economic model for creators. Most recently, the duo co-founded Spawning.ai with the mission to develop tools and strategies for artists to assert their agency in a creative economy where AI is the new normal.

Beverley Hood
is an artist and a Reader in Technological Embodiment and Creative Practice at Edinburgh College of Art, University of Edinburgh. Since the mid-1990s, she has interrogated the impact of technology and science on the body, on relationships, and on human experience broadly by means of the creation of digital media and performance arts projects. She is a co-investigator on the UKRI BRAID (Bridging Responsible AI Divides) programme, a six-year national research programme funded by the UKRI Arts and Humanities Research Council (AHRC), and led by the University of Edinburgh in partnership with the Ada Lovelace Institute and the BBC.

Saffron Huang
is the co-founder and research director of the Collective Intelligence Project. She was previously a research engineer at DeepMind working on topics such as multi-agent RL and language models, and she has worked on technology governance research with organisations including the Centre for the Governance of AI, the Ethereum Foundation, the Harvard Berkman Klein Centre, and the British Foreign Office. She co-founded Kernel magazine.

Natalie Kane
is a curator with almost a decade of expertise in digital design, art, and technology. She possesses broader expertise in design culture and on the relationship of ethics and society. She is Curator of Digital Design at the V&A, and one half of the research and curatorial project Haunted Machines. Kane also sits on the Advisory Board of The Society for Computers and Law.

Bogna Konior
is Assistant Professor of Media Theory at the Interactive Media Arts Department, and the co-director of the AI & Culture Research Centre at NYU Shanghai.

Laurence Mayer-Robitaille
has been working to advance the implementation of the Convention on the Protection and Promotion of the Diversity of Cultural Expressions since March 2007. She supports the governing bodies of the Convention in implementation, and is an expert on issues related to digital and international trade/cultural agreements. Previously, she has been employed as an expert in UNESCO's Division of Cultural Policies and Intercultural Dialogue, where she participated in the negotiations of the Convention. She holds a Ph.D. in Legal Sciences from the University of Social Sciences of Toulouse, and a Ph.D. in Law from Laval University, Quebec. In 2008, she published a reference book: Le Statut Juridique des Biens et Services Culturels dans les Accords Commerciaux Internationaux (The Judicial Status of Cultural Goods and Services in International Commercial Agreements) with by L'Harmattan, Paris.

Dr Oonagh Murphy
is a Senior Lecturer of Digital Culture at Goldsmiths, University of London. Her interdisciplinary research draws upon the fields of Museology, Arts Management, and Critical Digital Studies. She is interested in the relevance of cultural organisations in a digital age, and works with partners such as The Metropolitan Museum of Art, The National Gallery (London), and The International Red Cross and Red Crescent Museum to explore new modes of practice. She is a Turing Fellow, a member of DCMS College of Experts and an Open Data Institute Accredited Data Ethics Facilitator and Data Ethics Professional.

Matt Prewitt
is a lawyer and a prominent commentator on technology and capitalism. He is the president of RadicalxChange Foundation.

Martin Rauchbauer
is the co-founder of the Tech Diplomacy Network, a platform for practitioners representing governments, civil society, and global tech companies to tackle planetary challenges using frontier technologies. Previously, he served as Austria's first Tech Ambassador in Silicon Valley, where he shaped the emerging field of tech diplomacy, engaging personally in transatlantic digital diplomacy and digital human rights promotion. He conceptualised 'digital humanism' as a strategic focus for Austrian foreign policy. As the Executive Director at the Djerassi Resident Artists Programme, he leads one of the world's most prestigious artist residencies in California, one that supports the creativity of artists by providing uninterrupted time for work, reflection, and collegial interaction in a setting of great natural beauty.

Anna Ridler
is an artist and researcher who works with systems of knowledge and addresses questions of how technologies can be created in order to better understand the world. She is particularly interested in conceptions of the natural world. Her process often involves working with collections of information and data—particularly datasets—to create new and unusual narratives.

Heather Schoell
is senior art director of enterprise platforms marketing at NVIDIA, as well as the curator of the NVIDIA AI Art Gallery. The daughter of a biochemist and mathematician, Schoell combines her passion for art and science in her work as a creative at tech companies. She received a bachelor's degree in art from Yale University and came to NVIDIA after more than 13 years working in various roles in creative teams at Apple.

Noam Segal
centres curatorial practice at the intersection of digital, political, and social representations in contemporary art. Before joining the Guggenheim, she was the Director of Curatorial Research in the MA programme for curatorial practice at the School of Visual Arts, New York. In 2022, she served on the curatorial team of Still Present!, the twelfth Berlin Biennale for Contemporary Art. She has organised shows, performances, and symposia worldwide.

Reema Selhi
is the Head of Policy at DACS, a UK non-profit protecting artists' rights. She is a UK-qualified lawyer and an expert in copyright law. She advocates to governments on behalf of artists. She speaks regularly on the confluence of artists' rights and technology, with a specialism in the intersection of copyright and AI. Reema is a trustee at the ICA and a board member of a-n, the artists' information company.

Madisen Taylor
is the Chief of Staff / Special Operations at Hugging Face, she champions openness in AI and life. With a focus on fostering relationships with emerging ecosystems in AI, she bridges human-centric values with an optimistic perspective for AI-driven futures. She is a proponent of projects and research that delve into decentralised governance, the digital commons, and other efforts aimed at pioneering new pathways for tech-enhanced curation and collaboration.

Moisés Horta Valenzuela
is an artist, technologist and musician working in the fields of computer music, artificial intelligence, and the history and politics of emerging digital technologies. As hexorcismos, he crafts an uncanny link between ancient and contemporary technologies deploying a critical lens in the context of contemporary electronic music and the sonic arts. He has received the award of AI Newcomer (2023) by the Association of Informatics of Germany, as well as having presented artworks at Ars Electronica; NeurIPS Machine Learning for Creativity and Design workshop; MUTEK México; Transart Festival; MUTEK: AI Art Lab Montréal; Elektron Musik Studion; CTM Festival, Berlin; KTH: Royal Institute of Technology Stockholm; and Intelligent Instruments Lab Reykjavik; among other sites. He is currently working as an AI music technologist developing SEMILLA.AI, an interface for interacting with generative neural sound synthesis, and teaching and organising workshops around creative AI art practices centred on sound and image synthesis and their demystification.

Dr. Theresa Züger
is head of the Public Interest AI research group funded by the German Federal Ministry of Education and Research (BMBF). The group is concerned with the question of how AI can serve the public interest and the question of which technical and social criteria must be fulfilled for this to happen. She is also lead of the AI & Society Lab. The Lab was launched by HIIG in 2020 and is an inter- and transdisciplinary research lab at the intersection of academia, industry, and civil society. Theresa's research focuses on the political dimensions of digital technologies and cultures, with a particular interest in questions of democratic theory.

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and those who
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