Museum Technology: A Critical Primer

An introduction to key technologies and their social implications by a collective of museum workers.

Muse-Tech Working Group

First published in 2023

Published by the Irish
Museums Association
(IMA), Dublin.

ISBN 978-1-9162406-1-2

Designed by Victoria Brunetta,
Piquant Media, Ireland.

Printed and bound in Ireland
by Impress Printing Works.

Museum Technology: A Critical Primer

**Muse-Tech
Working Group**

Introduction 07

Contributors 14

1. Algorithms and Artificial Intelligence 17

2. Biometrics 25

3. XR and the Metaverse 33

4. Streaming Platforms 41

5. Gamification 49

6. Blockchain, NFTs, Web3 59

7. Digitisation 69

Further reading 78

> “Embedded in every tool is an ideological bias, a predisposition to construct the world as one thing rather than another, to value one thing over another, to amplify one sense or skill or attitude more loudly than another.”

Neil Postman, *Technopoly*, 1992

Introduction

This primer, and the working group that produced it, was formed to interrogate the popular conception of technology as a ‘neutral tool’ and instead to examine its underlying assumptions and consider its moral and ethical implications — lift the shiny chrome casing and disentangle the circuits that lie beneath.

Suitably, the museum is the site of this enquiry. The COVID-19 pandemic forced museums and cultural venues across the world to embrace virtual modes of engagement and accelerated the trend towards digitisation. While this rapid shift brought many benefits — enabling the public to connect and engage with cultural organisations while their doors were shut — there have since been scant opportunities for museum and cultural workers to pause and reflect on the implications for our sector. Indeed, this working group was formed partly due to a frustration that the discourses on technology in cultural heritage tend to be promotional and uncritical, starting from an assumption that all upgrades are inherently good and progressive, and unwilling to ask the difficult questions that any ‘not-for-profit, permanent institution in the service of society’ must.[1]

The working group was initiated in October 2021 and is composed of individuals from a cross-section of museums on

1. ICOM's new museum definition, approved in August 2022, reads: ‘A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing.’

the island of Ireland. Over the course of nine months, we met online to discuss readings on different technologies, from the established, such as streaming services and gamification, to the emerging, such as blockchain and the metaverse. Over the course of our discussions, the same themes emerged again and again: concerns about encoded bias, privacy and surveillance; the exclusion of those without digital literacy or access to technology; the importance of environmental sustainability; and the problems of short-term thinking when it comes to the funding of digital projects.

Our discussions also returned to the digital commons and the possibilities for collections that are accessible and inclusive. We talked about the need for strategies that can help use the funding and resources that we have more wisely, such as sectoral collaboration and the sharing of equipment.

Monthly meetings were bolstered by presentations by experts from civil rights organisations, academia, and the tech industry. These speakers illuminated our discussions with wider contexts and histories, pointing to serious concerns as well as exciting potentials. Gracie Mae Bradley, writer and former Director of Liberty, suggested museums ask themselves the following questions:

What is this technology for?
Is the aim illegitimate?
Can you achieve your aim another way?
What else could this money be spent on?
What are the consequences if the technology doesn't work?
Is this normalising technology that harms marginalised groups or civil liberties in other contexts?

These questions undoubtedly raise the bar for the institutional adoption of new technologies but, in doing so, ensure that the potential impact of any investment is carefully considered, and fundamental to museums delivering on their missions.

This document attempts to distil our research and present it in an accessible way. In each of the seven sections, we focus on a different area from our discussions. We explain the terminology, explore how it can be applied in a cultural context, and finally offer some key considerations.

An analysis of the underlying economic and structural shifts in the last 50 years, the rise of Big Tech and platform capitalism, is beyond the scope of this short text, but this wider context has informed our discussions throughout. Indeed, Ireland, the 'Silicon Valley of Europe' — host to numerous technology firms attracted by low corporate tax rates — has provided a fertile base for our discussions.

This primer is principally aimed at those in the cultural sector. We hope it can be worthwhile to the 'technophobic' as well as those with an established interest. Our working group was a space to reflect deeply about new technologies and their place in our cultural life — we hope this text can continue these conversations and spark new ones.

Museums must navigate today's 'brave new digital world' and move beyond a reactive position towards more assertive long-term strategies that actively shape how technology is used in cultural institutions. We must also create space for the public to reflect on these very questions, critical as they are.

Adam Stoneman,
Founder, Muse-Tech Working Group
January 2023

Contributors

Muse-Tech Working Group

Adam Stoneman
SPICE Project Researcher, IMMA (Irish Museum of Modern Art)

Hannah Bloom
Freelance Photographer and Filmmaker; formerly Hunt Museum

Joe Carlin
Project Manager, Nerve Centre

Kathryn Coughlan
Production Manager, Crawford Art Gallery

Stephanie Kennedy
Guide and Education Officer, Office of Public Works

Alan Kirwan
Head of Programmes. UK Association for Art History; formerly Butler Gallery

Judith McCarthy
Curator, Donegal County Museum

Andrew McDowell
Design and Interpretation Manager, National Museums NI

Aisling Murray
Freelance Creative Producer; formerly Science Gallery Dublin

Séamus Nolan
Artist and Researcher, National College of Art and Design (NCAD/UCD)

Laura Patrick
Regimental Heritage Officer / Director Virtual Military Gallery, Royal Irish Regiment

Danielle O'Donovan
Programme Manager / Acting CEO, Nano Nagle Place

Maeve O'Neill
Archives Digitisation, University of Galway; formerly National Library of Ireland

Benedict Schlepper-Connolly
Head of Exhibitions, Digital & Programming, MoLI – Museum of Literature Ireland

Deborah Thorpe
Research Data Steward, University College Cork; formerly Digital Repository of Ireland

Shannon Wilson
Head of Education and Outreach, EPIC The Irish Emigration Museum

Derek Williams
Head of Digital and Information Systems, National Museum of Ireland

Speakers

Fabien Bénétou
WebXR Consultant, European Parliament

Gracie Mae Bradley
Writer, Co-author of *Against Borders*, former Director of Liberty

Jill Cousins
Director and CEO, The Hunt Museum

Daniel Leufer
Senior Policy Analyst, Access Now

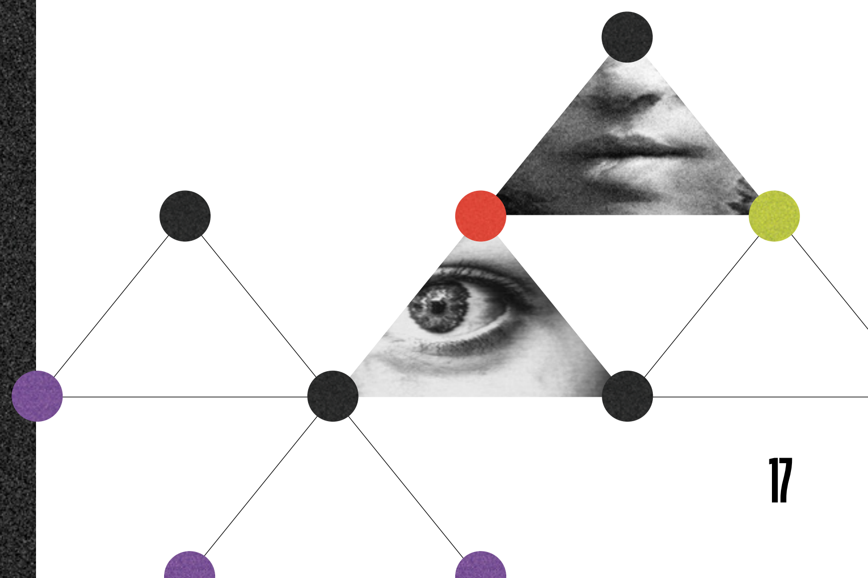
Órla Murphy
Head of Department of Digital Humanities, University College Cork

Jürgen Simpson
Director, Digital Media & Arts Research Centre, University of Limerick

Molly White
Software Engineer, Creator of web3isgoinggreat.com

1

Algorithms and Artificial Intelligence



Hannah Bloom and **Adam Stoneman**
Speaker: **Gracie Mae Bradley**

“It is possible to construct algorithms that are based on well-made, non-discriminatory training data sets – but we have to ask ourselves: are we acclimatising the public to something that in other contexts is harmful?”

What is it?

An algorithm is a complex set of rules based on a mathematical model that is used to solve a problem and to make or inform a decision.

Artificial intelligence (AI) is a family of algorithms that claims to mimic human intelligence. In plain terms we can think of it as ‘complex information processing’ derived from optimised statistical models. AI systems are often built to learn from ongoing interactions, facilitating the incorporation of new information into its decision making; it is iterative. One might set up an AI tool or a model and might not know how it is making its decisions in a year’s time because it has evolved as time has gone on. This can range from the software on our computers to machine learning, a type of artificial intelligence which gathers and observes statistical data to improve its accuracy.

What is it typically used for?

AI and algorithmic tools and decision making are increasingly embedded in everyday life, governing all kinds of processes from the assessment of financial credit scores to catching a cab across town or suggesting what to watch next on a streaming service.

How is it being used in museums?

It might surprise you to learn how many daily operations within the museum already rely on AI functionality; it is present in our social media apps, emails, databases, and security systems. AI can be used to measure and forecast visitor behaviours, and predict the number of no-shows to ticketed events. What these AI systems have in common is the reliance on large datasets, data gleaned from our staff and visitors. Algorithmic processes are employed in all the technologies explored in the sections that follow.

There is a long history of artists and curators experimenting with AI systems in their work. In the 1970s British-born artist Harold Cohen created AARON, a computer programme designed to produce art autonomously. More recently, Swedish artist Jonas Lund created an algorithm to analyse famous artworks. The outcome was a set of instructions on how to make the most successful works of art. He followed these instructions and created an exhibition from the resulting works.

The Museum of Digital Art in Switzerland has deployed an algorithm called Hal 101 to select artists for an exhibition. Hal 101 bases its choices on data streams available through the internet. However, AI curation such as this should not be understood as neutral, unmediated, or uninfluenced by human bias.

Key considerations

Bias

Algorithms can be applied in ways that can be helpful to society or exploitative. They are used to deploy our data to create specific outcomes to our questions. In this sense, algorithms can manipulate people by using their own personal data. This is a serious concern for our privacy and our ability to communicate securely. Algorithms can be helpful when applied in medical settings, such as Apgar scoring, used to assess the health of new-born babies and identify those that might need additional medical support. They can also be destructive, for example, in situations where they prompt disturbing or violent content on YouTube or social media.

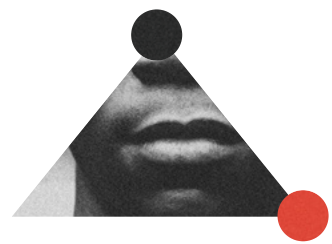
It is important to recognise that the ground on which these tools are being deployed is not neutral.

These algorithms are being deployed in imperfect societies, where profit-motivation, ableism, sexism, transphobia, racism exist. Algorithms can function to codify and legitimise existing patterns of unfairness in society. In many cases we may not be aware that algorithms are being deployed, and rarely are we asked to consent in an informed way.

Algorithms are set up in such a way that they must assume the future will be like the past. They work on the basis that past assumptions made by decision-makers were correct and that past decisions were good decisions. They are only as good as the data they are trained on or the person who creates them. In-built biases in areas such as gender, race, disability, or religion can become embedded and invisible, and amplified over time. A society that is striving for equality will be battling forces that it cannot see and that cannot easily be removed.

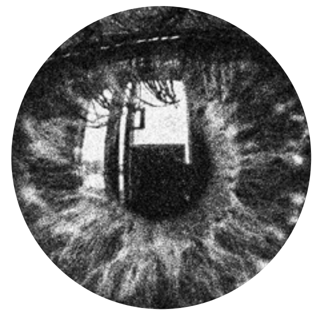
Normalisation

Algorithms, like their human creators, are always imperfect and will always exhibit bias. It is possible to construct algorithms that are based on well-made, non-discriminatory training data sets, and which can, therefore, be appropriate in the museum context — but we have to ask ourselves: are we acclimatising the public to something that in other contexts is harmful?



2

Biometrics



Hannah Bloom and **Aisling Murray**
Speaker: **Daniel Leufer**

“There is a relationship between facial expressions and emotions, but the correlation is not that simple. Phrenology and physiognomy serve as reminders of the danger in looking to physical features to explain our inner characteristics.”

What is it?

EU General Data Protection Regulations (GDPR) defines biometric data as ‘personal data resulting from specific technical processing relating to the physical, physiological or behavioural characteristics of a natural person, which allow or confirm the unique identification of that natural person’. An example is the use of facial recognition technology or fingerprint scanners to unlock mobile phones. Developers have taken facial recognition technology a step further, not only to recognise faces but also the emotions they express.

Facial Emotion Recognition technology can be defined as technology that analyses facial expressions from both static images and videos in order to reveal information on one’s emotional state. Typically, it analyses facial actions such as furrowed brows, curled lips, eyebrow raises, and eye movements to determine key emotions such as joy, anger, fear, disgust, sadness, and surprise.

What is it typically used for?

Biometrics and Emotion Recognition Technology is used in a variety of contexts and industries including healthcare, marketing, manufacturing, and security. In healthcare, Google Glass has developed an app designed to help children with autism read the facial expressions of others. Companies such as the Boston-based Affectiva, provide biometric emotion recognition services to businesses who wish to see the emotional impact their advertisements are having on consumers. In manufacturing, cars are increasingly incorporating this technology to recognise various states such as fatigue, intoxication, and stress.

Biometric technologies are commonly used in surveillance, policing, and security — this has led to concerns about their impact on civil liberties and the potential for the misuse of biometric data.

How is it being used in museums?

While biometric technology is increasingly employed in museum security systems, this technology is being used experimentally in other ways. In 2021, Istituzione Bologna Musei installed 14 small cameras next to artworks that use AI to study the facial expressions and emotional responses of visitors. They were seeking to understand how visitors engaged with individual works of art. On the one hand, it can be argued that this captures a wealth of qualitative data, including visitor dwell time, eye-tracking, and emotional responses to artworks. On the other hand, there is the intrusion of the cameras making visitors feel surveilled and disrupting the intimate relationship between a viewer and an artwork.

Key considerations

GDPR

Biometric data is protected under GDPR law and is considered a 'special category' of personal data. In the case of a data breach, it is easy to replace other forms of personal data, such as your credit card details, but it is not possible to replace your face. For this reason, it is generally not permitted to process biometric data except in the limited circumstances, as outlined in Article 9 of GDPR. These circumstances must be a legal and ethical consideration in the usage of this technology. Similarly, consent is an important consideration when it comes to the gathering and processing of biometric data. Explicit consent, given by the subject to the processing of their data for a specific purpose, is one of the cases where the use of biometric data may be permitted.

Accuracy

The accuracy of these technologies in recognising human emotion is contentious and unreliable at best. While it is true that there is a relationship between facial expressions and emotions, the correlation is not that simple. The debunked practices of phrenology and physiognomy serve as reminders of the danger in looking to physical features to explain personality or inner characteristics. The human face can move its muscles into countless different expressions. However, this does not mean that we always express our emotions clearly and reliably. Emotional recognition software is based on the premise that we are powerless to hide our emotions, but certain emotions, such as shame and guilt, do not have clear facial signifiers. People have rich emotional experiences which cannot always be easily categorised. An artwork may have an emotional impact on an individual that may not be realised for some time and this may be unclear or ineffable. Similarly, the context of emotional responses is significant: museums and galleries are social and public spaces, and so an emotional response to an artwork may be influenced by other factors.

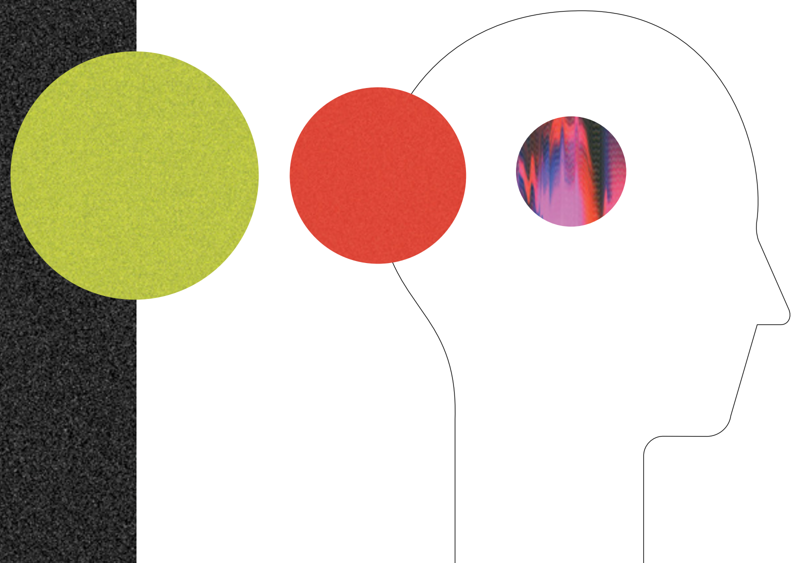
Bias

Biometric emotion recognition data faces issues with bias. While there are some common facial expressions that can be recognised universally, facial expressions and emotional signifiers vary significantly between cultures. This racial bias has notably led to the misreading of emotion, resulting in inhumane and unjust consequences. An example of this is the emotion recognition technology used by airport security in the USA in an attempt to identify terrorists, leading to racial profiling. The issue of cultural or racial bias, the broader issue of accuracy, and the potential consequences must be a consideration in the planning and use of this technology.

Given these issues, the reasons for using this technology in a cultural context must be carefully considered. The interests of the public should be represented in the museum, along with their reasonable assumptions of privacy. Breaching GDPR mandates risks fines and embarrassment. Is there a more ethical and accurate way to obtain the information you are looking for? If you are interested in emotional response to an artwork, will a qualitative survey or workshop be able to provide you with the same or better quality data?

3

XR and the Metaverse



Judith McCarthy and **Séamus Nolan**
Speaker: **Fabien Bénétou**

“To be successful in the digital space, museums must look to develop hybrid physical/virtual environments and, in doing this, pioneer new forms of communication and experience that do not exist anywhere else.”

What is it?

XR, also known as cross reality or extended reality, is an overall term for several different but related technologies that modify the human-to-computer interface, either by immersing you in the virtual environment (Virtual Reality - VR), by adding to, or augmenting, your surroundings (Augmented Reality - AR), or by doing both (Mixed Reality - MR).

Popularly conceived, the metaverse is a virtual world, or collection of virtual worlds, that exists in tandem with the physical world. One where users can socialise and engage in an unlimited variety of virtual experiences, such as working, gaming and shopping — all supported with its own digital economy based on blockchain technologies (see section 6).

There is no one metaverse — yet. There are many of them, owned by different companies or individuals. To date, a universal metaverse has not been realised.

The anthropologist Genevieve Bell has traced the metaverse back to a museological antecedent: the Great Exhibition of 1851, in which immersion and spectacle were used to assert a powerful vision of the future for Victorian Britain. However, not everyone was impressed; the artist William Morris was said to be appalled by its rampant materialism.

What is it typically used for?

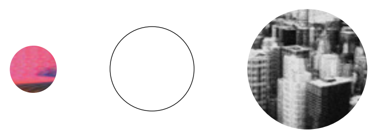
VR and AR technologies have seen significant advances in recent years, driven by their applications in gaming. To see the metaverse in action, you can look at popular and vast multiplayer VR games — such as Rec Room or Horizon Worlds — where participants use avatars to interact with each other and manipulate their environment.

Musicians and entertainment labels have been experimenting with hosting concerts in the metaverse. The sports industry is also trialling XR, with top franchises like Manchester City building virtual stadiums so fans can watch games. In November 2021, Seoul, South Korea, announced a plan to make a variety of public services and cultural events available in the metaverse.

How is it being used in museums?

The potential to overlay multiple, even contested, narratives is part of the appeal of XR for museums. Beyond the large-scale sensory event-based immersive initiatives such as the popular Van Gogh experiences, cultural institutions and museums have been engaging with VR technologies for decades by developing AR apps for visitors and, increasingly, to create online exhibitions and virtual spaces where collections can be curated and viewed. In heritage museums, immersive technologies are being used to provide access to objects, places, and people that is otherwise impossible. For example, reconstructing fragmented artefacts or environments (Gates of Hell tour in Wicklow's Historic Gaol); recreating buildings that no longer exist (Rome Reborn); having David Attenborough give you a face-to-face guide to the collections in the Natural History Museum in London (Hold the World).

Artists, cultural activists, and digital museums have also been overlaying virtual exhibitions within the physical space of many museums and cultural centres. Artist, co-founder, and curator of MoMAR, Damjanski describes this as the democratisation of the museum; with MoMAR he has been curating unauthorised exhibitions of digital or crypto art in various leading art museums across the world.



Key considerations

Access and exclusion

The metaverse is claimed to be the ultimate in immersive experiences. However, full immersion comes with a health warning. Immersion does not necessarily allow space for reflection or contemplation which is one of the many ways in which culture plays an important role in facilitating the understanding of our world. A visit to a museum or gallery engages our imaginations, while also allowing us to be together with others — to share a cultural experience. XR and the metaverse should not replace communal forms of culture.

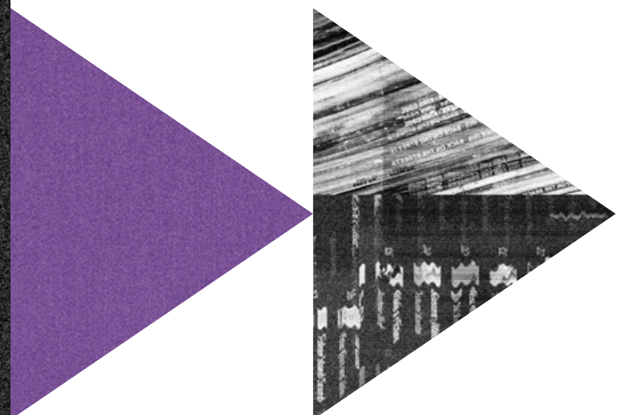
Extended realities offer the possibility of multivalent knowing, the ability to know or experience objects or ideas from a variety of perspectives and to test out different ways of understanding those items in different contexts. The ethical issues of how the user is safeguarded from the problems of such new and commercially driven technologies places a huge responsibility of care on museums towards their audiences when entering hybrid spaces. For example, cyber insecurity, data harvesting, and the acceleration of problematic or traumatic histories may cause issues. Access to digital devices, digital literacy, sensory or neurodivergence — indeed any physical or cultural barriers to the digital as well as the physical space of the museum — are necessary considerations for augmentation and immersion.

Real world experience

Museums, however, are unique spaces which provide special experiences for their visitors, not least of which is enabling access to rare, 'real-world' artefacts, archives, and artworks. In navigating the world of VR, AR, and the metaverse, museums need to ensure that they can translate their distinctiveness online. One way to do this is to connect public digital content to the physical spaces, the layouts of exhibitions, and experiences of visitors to the museum. This does not mean making 3D copies of museums a digital user can navigate which may lose some of the uniqueness of a real-life visit. To be successful in the digital space, museums should look to develop hybrid physical/virtual environments and, in doing this, pioneer new forms of communication and experience that do not exist elsewhere. The physical, experiential, and incidental encounter within the museum, and the unique haptic and tacit experience with the physical artwork or cultural object, cannot be dismissed lightly.

4

Streaming Platforms



Benedict Schlepper-Connolly and **Adam Stoneman**
Speaker: **Jürgen Simpson**

“We can have billions of hours of music, videos, podcasts, and films at our fingertips at a relatively low price. Now that consumers have come to expect this instantaneous access, is there any going back?”

What is it?

Streaming services offer digital media such as films, television, music, or video games, delivered and consumed in a continuous manner from a website or app with little or no intermediate storage in network elements. This is, therefore, different from downloading files digitally or watching a live broadcast. Popular platforms such as YouTube, Netflix, Apple TV, (for video, films and TV); Spotify, Soundcloud, Bandcamp (for music and audio); and Twitch (for video games) have hundreds of millions of subscribers.

Streaming is big business: Netflix is now worth more than oil giant ExxonMobil. Most of these commercial streaming platforms generate income through paid subscriptions and advertising, though it should be noted that some of these companies are run at a substantial loss to gain market share. Spotify, for example, has been operating at a loss since it was founded in 2006.

What is it typically used for?

Streaming services are increasingly dominating how culture is consumed. Before the advent of streaming, if you wanted to experience film or music you might go to the cinema or concert, watch or listen to a television or radio broadcast, or a play a record or DVD. What is distinct about streaming is its ‘on-demand’ relationship to cultural content — that culture can be accessed on a phone or personal screen anywhere and at any time, instantly.

How is it being used in museums?

While the cultural sector has always competed, to some extent, with the commercial entertainment industry for audiences, this intensified during the pandemic, leaving the screen as a main stage for culture and entertainment. Video-streaming projects from the Hammer Museum, the Louisiana Museum of Modern Art, and Art21 borrow design and search features from major streaming platforms to host their collections of artist talks, films, and documentaries.

In 2021, Italy launched an innovative streaming platform called ITsART, billed as the ‘Netflix of Italian culture’, offering access to virtual tours, museum exhibitions, operas, and other forms of art. Commissioned by the Italian ministry of culture, ITsART has teamed up with more than 100 cultural institutions in Italy, including the Uffizi Gallery, Galleria Borghese, Peggy Guggenheim Foundation and Fondazione Prada. With these initiatives, museums are adopting the popular streaming model to increase access to their digital collections for the general public and researchers. By creating their own platforms, these museums retain control over how users explore their content, encouraging users to go deeper into the archive, and providing a space to develop digital collections.

Key considerations

New cultural paradigm

Besides directly competing with streaming platforms, it is worth reflecting on the ways in which streaming is influencing the broader cultural environment — including cultural production and popular taste. Whether it is a reduction of our attention spans, visual literacy (the prominence of image over text), or expectations of high production values for video content, there are many ways in which streaming culture can be seen as a new cultural paradigm from which museums are not exempt.

From the consumer's viewpoint, streaming services have opened up a whole new world. We can have billions of hours of music, videos, podcasts, and films at our fingertips at a relatively low price. Now that consumers have come to expect this instantaneous access, is there any going back?

Economic model

Some argue that the music streaming model is an inherently unfair and unsustainable model of payment for musicians and composers as the actual fees received by all but the most popular are extremely small. Musicians need thousands of streams to earn the same as the sale of a single album (the exact rate is adjusted for each stream according to an undisclosed algorithm). Rather than rewarding artists for their work or nurturing new talent, these platforms are designed to build subscribers to the platform, attract speculative capital, and create value for shareholders. Streaming platforms such as Spotify can be seen as breaking from the traditional music industry in their detached and disinterested relationship to music as *culture*. Rather, as composer and academic Jürgen Simpson puts it, for these companies, music is 'oil to be mined'.

Netflix and Chill

The commercial logic of streaming services privilege certain forms of culture to the detriment of others. Streaming is predicated on high consumption 'bingeing' and repeated playbacks, favouring quantity over quality of content. Our listening and watching habits produce data, and the more time we spend on these platforms the more data can be sold to advertisers. This dynamic works better for culture that creates certain moods and vibes (affect) than more complex or intellectually demanding culture.

5

Laura Patrick and **Shannon Wilson**
Speaker: **Órla Murphy**

Gamification

“Gamification should build upon a foundation of information and data literacy and awareness, encouraging and integrating digital citizenship so that informed users have the choice in how to interact, and control their data.”

What is it?

Gamification in the museum context is a method of exhibiting that utilises elements of game, play, competition, puzzle solving, and sensory engagement and — most importantly — achievement and goal-setting, to ‘bring to life’ social, cultural, and historical elements and make them digital, physical, embodied, sensory, and intellectual experiences.

What is it typically used for?

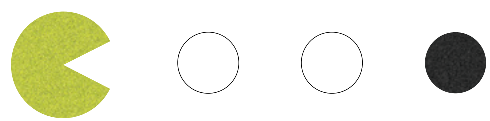
Gamification is an incentivised engagement with a task or subject. It is used to engender a more experiential, atmospheric, and phenomenological visit by engaging visitors more readily in their environment. It enables immersion of participants in learning, making the experience more lifelike and lived, and therefore more memorable and relatable. Gamification can enable a multiplicity of access points for visitors, particularly those of different cultures, age ranges, and needs, alongside virtual audiences. It can provide further context to exhibits and enable participants to have the chance to actively rather than passively engage, using the past to ask questions about how we move forward in areas such as climate change modelling. Through active skills-based learning, gamification can have real practical learning or skills outcomes which can align with the curriculum.

How is it being used in museums?

Gamification is not a new concept in museums. There is a long history of interactive exhibits that utilise puzzles and board games or ask visitors to turn knobs and press buttons to achieve outcomes. However, the technological element is new, and its application is constantly evolving. Developments such as motion sensors and virtual and augmented reality place visitors in new sensory environments. Gamification is not just about what we put in the museum, but what we do in the museum.

Gamification is increasingly used to capture the ‘digital native’ generation, who are often the most difficult segment to interest in more traditional museum experiences. Carrickfergus Museum created a virtual gallery trail which can be used for groups of young people. Based on the artefacts in the museum, it guides the user through the space and compels them to engage with the exhibit in order to get to the next stage.

It is important to note that the term ‘gamification’ can also denote ways in which the museum space is utilised in terms of the architecture and visitor flow. For example, biometric and sensory technologies utilised at the MIT Museum in Boston and the Kalitosis project between King’s College London and the Wellcome Trust, where an artery fills the entire double height gallery space visitors can stand inside.



Key considerations

Gamification can be effective and elevate the museum experience if done with due consideration and careful implementation. Three core things should be considered: purpose-oriented, people-oriented, and data-oriented principles.

Purpose

Children and adults have been learning through games, such as role-play, sport, song, and storytelling for many centuries. Research shows that people have multiple ways of processing information, which includes visual, auditory, kinaesthetic (movement), smell, and taste, as well as a wide variety of accessibility and neuro-diverse needs. More complex information may be communicated and understood more easily through gamification. There are less barriers to engagement than with more traditional museum exhibits, which may rely on more academic forms of understanding. With gamification, visitors play a more active role in their learning. Gamification also taps into reward-based learning, where the brain releases a hit of dopamine when an action leads to a desired result. Studies have shown that this type of learning engages adolescents best, traditionally one of the more difficult-to-reach segments of museum visitors, though it can also be very addictive.

The immersive nature of gamification can bridge the gap between learning history and experiencing it. Research by organisations such as Narrative 4 shows that, by getting someone to retell a story as if it were their own, we can increase empathy and understanding. Role-playing games can offer visitors a chance to step into the shoes of those from the past, enabling them to imagine what life must have been like for them.

There are currently no best practice guidelines or policies for the use of gamification in museums. Projects are often funding-led, with little or no experience of gamification amongst museum staff, and — without consulting educational specialists or those with a background in pedagogy — they may result in rushed or poor quality learning experiences. Approached cynically, gamification can come across as a gimmick, encouraging superficial engagement — 'sugaring the medicine' with badges and points, rather than understanding the value of the medicine in the first place. In some instances, gaming might be seen to trivialise sensitive historical events or artefacts.

People

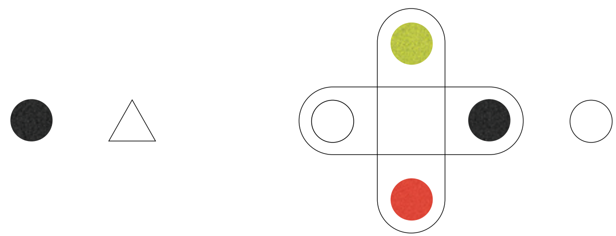
Gamification does not just affect how visitors engage with the space and exhibits but also how they interact with each other. While traditional text-heavy exhibition panels engage visitors on a more individual level, gamification can encourage teamwork or competition as players work either collectively or against one another to complete tasks. By encouraging visitors to work together, gamification creates shared experiences, in effect changing the understanding of museums as solitary and academic spaces to spaces which are social, vibrant, and immersive.

It is more difficult to control what a visitor is exposed to in a gamified environment, risking user safety and triggering negative memories and experiences. Where the interactions are not optional, this presents issues in terms of choice and accessibility. We might assume that people want to engage with technology in the museum space. This is not always true. Furthermore, gamification that utilises the visitor's own technology can exclude and create barriers to access.

Data

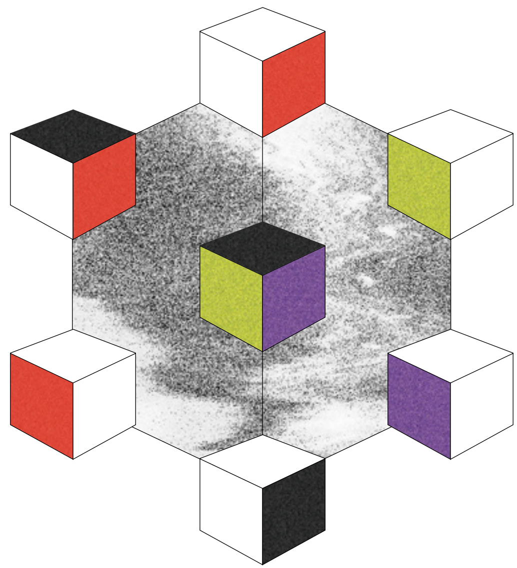
With the rise in the use of digital technology, there are increasing concerns about the tracking and collecting of personal data. With gamification, this is easier to control if the museum is managing the platform itself. However, without a coherent infrastructure, most museums do not have the capacity to support this. Museums generally use a third-party platform, which raises issues around data aggregation and privacy. Gamification should build upon a foundation of information and data literacy and awareness, encouraging and integrating digital citizenship so that informed users have the choice in how to interact and control their data.

Getting the balance between knowledge sharing and data governance is key. We should aim for unique and persistent global identifiers, and ensure that it is created open source so that it can be shared and scaled. We need to work towards putting a set of robust management procedures in place for our digital agenda, aspiring to the same standards as those for health and safety in our public spaces. We should prioritise service level agreements for providers of software. Those utilising data in any form must ensure transparency and place data governance as a core value — management of data should be of paramount importance.



6

Blockchain, NFTs, Web3



Stephanie Kennedy and **Adam Stoneman**
Speaker: **Molly White**

> “There is enormous pressure on individuals and institutions to buy into cryptocurrency. But given the high risks and extreme fluctuations of the crypto market, it is worth approaching this area with extreme caution.”

What is it?

Blockchains are decentralised digital ledgers that keep track of data, such as financial transactions. Information is stored on a network of linked computers in such a way that the data is spread across many servers. Once data is added to a blockchain it is very difficult to alter it or remove it due to the governance structure that exists between these computers. This is both its strength and weakness. It is more secure than other digital storage systems, but it is extremely difficult to correct errors or remove incorrect information.

NFTs or ‘non-fungible tokens’ are signposts to digital assets, constituting a digital certificate of ownership. The details of ownership of the assets are stored on the blockchain, while the asset itself is stored elsewhere on the internet. It is often thought of as owning a limited-edition print. The NFT is the signature and edition number but not the artwork itself. By introducing digital scarcity, so the argument goes, artists have more opportunities to make a living from their work. Similarly, NFTs are seen as a way for museums to claim ownership of their objects in the metaverse (see section 3).

Web3 is the idea that all activity on the internet will be based around blockchain in the future. Everything we do such as online shopping or video gaming will take place in a virtual world in which all transactions will take place in cryptocurrency. Everyone will be obliged to buy into cryptocurrency to interact in this new metaverse. All the data generated by our activity online will be stored on the blockchain.

What are they typically used for?

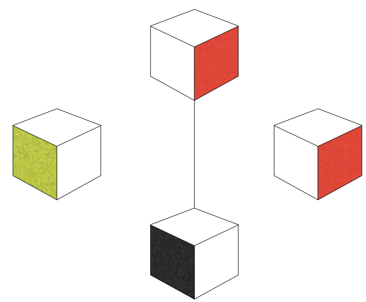
Blockchains are a vital element of cryptocurrency financial markets and Web3. They are used to support data required to facilitate cryptocurrency transactions.

NFTs have provided one way for digital artists to monetise their art. The NFT is a reference to a unique version of the asset. With an NFT, you do not own the rights to the image, but your image has been claimed as authentic.

PFP stands for picture for proof or profile picture, constituting a subset of NFTs. People typically use these digital avatars as their profile picture on social media. Bored Apes are a large series of PFPs based on procedurally generated images of a cartoon monkey. People have paid large sums for

these NFTs in the hope that they will become part of an exclusive club of owners and speculate that these assets will rise in value. Due to the inherent instability of the crypto market however, this has not always been the case.

Web3 is used to describe all the metaverses that will be created. Proponents of Web3 see blockchain technologies as a solution to the problems of 'Web2', the internet we currently have, which is characterised as monopolised by large technology companies primarily interested in advertising and mining user data for private profit. By storing data on the blockchain rather than on centralised servers, a user — in theory — would not be bound to a single application, and could switch between any number of them, taking their data with them.



How is it being used in museums?

Blockchains — the building blocks of NFTs and Web3 — are being used experimentally by contemporary artists and museums. Artists Ai Weiwei and Kevin Abosch used the blockchain to spark a conversation around the value of human life and how we assign value to art. They collaborated on *PRICELESS*, a complex piece in which two tokens on the blockchain were created. One was rendered inaccessible but sold as digital wallet addresses printed on paper as a long line of numbers in a series of 12 physical works, the other divided into quintillion digital pieces and given away for free.

Larger museums are using NFTs to raise funds and to engage with younger audiences interested in cryptocurrency. The British Museum, in collaboration with French NFT platform LaCollection, have begun to sell NFTs of artworks from their collection, limiting the editions on offer to create scarcity and increase value. LaCollection also sells primarily to investors in NFTs that typically are under the age of 35 years. They hope this will introduce new younger audiences to the collections held by the British Museum.

Web3 is still mostly speculative and unrealised but even in this mode there are interesting propositions for museums. Looty was set up in response to the growing agitation for the return of African art stolen by European colonial powers. African artworks are scanned without permission and converted into NFTs. The works appear in a digital museum in the metaverse. Sales from the NFTs go towards supporting young African artists. Chidi Nwaubani, the founder of Looty, said 'Imagine a world where these items were never looted. We're just trying to reimagine that world and bring that world into the digital form.'

Key considerations

Libertarian dream / nightmare

For its advocates, blockchain technology promises to democratise the web, with users participating on a level and decentralised playing field in which they can be rewarded in crypto tokens for playing, posting, or creating content. In this, Web3 would entail a complete financialisation of our online interactions, requiring users to buy-in to gain access.

This free-market libertarian dream is for others a dangerous, unregulated nightmare. Some aspects of Web3 and cryptocurrency (the relative ease of hiding your identity, irreversible transactions and lack of legal regulations) make it extremely susceptible to fraud. Cryptocurrency and assets valued at over two billion dollars was lost to hacks and fraud in 2022.

Crypto pressure

There is enormous pressure on individuals and institutions to buy into cryptocurrency; as with pyramid schemes, we are told that these are investments that could be a ticket to financial freedom or getting rich quick. For museums and cultural institutions, there is the fear of being left behind. But given the high risks and extreme fluctuations of the crypto market and the prevalence of scams and fraud, it is worth approaching this area with extreme caution.

Environmental impact

One growing criticism of blockchain technology is the enormous amount of energy it uses. Blockchain is, by design, enormously energy inefficient. The demand for energy is due to an algorithm called Proof of Work, involved in 'mining' bitcoin, which requires enormous amounts of computing power. Bitcoin alone currently uses roughly the same amount of electricity per year as Thailand. In Ireland, this raises questions about the sustainability of data centres, and their strain on the national grid. At a time when museums are moving towards sustainable practices, the environmental impact of blockchain can be a deterrent.

7

Kathryn Coughlan and **Laura Patrick**
Speaker: **Jill Cousins**

Digitisation

"Development of digital collections, exhibitions, and resources must be ingrained with the principles of cultural democracy. In what ways can the public engage with the process of digitisation, not just the end result?"

What is it?

Digitisation is the process of transforming analog information into a digital format that can be understood by a computer system or electronic device, for example, oral and written histories. It also describes the capture by digital sensors of the real world, such as scanning artefacts, visual artworks, and even physical spaces.

The output can include image files, virtual reality spaces and maps. In general, in the cultural sector, it is understood as the creation of imagery for collections — archival, archaeological, or visual art. It is most often discussed in relation to Collection Management Systems and Online Collections. Metadata encompasses the secondary information, for example, location, date, depositor, condition, etc. This opens opportunities for interoperability and verification, and the simplified sharing of information using computer systems. Creation of a standard vocabulary also enhances the potential for collaboration.

Production of digital content must also take licensing into consideration in terms of the institution, the artist, and digital licences separate to a physical licence. Creative commons licensing is advised wherever possible to allow researchers and the general public ease of access, supporting their use for editing, reproduction and collaboration.

What is it typically used for?

- Archives (text and image scans)
- Library Catalogues, OLC, etc.
- Museum recording, e.g., Modes
- Professional Records; Medical; Legal; Government
- Journals/Online Publications, e.g., JSTOR
- Research
- Income generation
- Visualisation of analogue data across the public and private sector.
- Cultural Monument Digitisation (notably for at risk heritage sites or grave sites)
- Mapping; Geographical Information Systems for mapping sites and monuments; geographical and botanical crowd-sourcing digitisation efforts
- 3D printing

How is it being used in museums?

The pandemic rapidly accelerated the pace of digitisation of cultural heritage, and online collections are increasingly a priority for museums and archives. On an individual basis, institution by institution, grant by grant, we see the acquisition of software and the purchasing of middleware systems to facilitate this. However, an alternative approach utilises shared cloud systems which service multiple organisations, at both national (The Digital Repository of Ireland or The Ogilby Muster — Army Museums Ogilby Trust) and international (European Collaborative Cloud for Cultural Heritage or Europeana) levels.

During the pandemic, digitisation allowed audiences to access and engage with museum collections through online exhibitions, virtual tours, talks, geographical information systems (GIS) and interactive maps and learning resources. The pandemic also pushed many institutions to reconsider their web and social media presence and question how they can best serve their audiences. Post-pandemic, many of these activities have become normalised as part of regular museum practices.

As well as their public-facing collections, many museums, libraries, galleries, and archives are going 'paperless' by digitising their institutional records and switching newly created governance documents to ‘soft copy’ for ease of access and to reduce paper waste.

The licensing of products for commercial sale and photographic reproductions is increasingly considered as both a revenue source and a form of public engagement, with a significant push for unlimited digital access to images and information on collections. With their doors closed during the pandemic, online shops became an increasingly important source of revenue, turning digital collections into merchandise.

Key considerations

Cost, equipment, and expertise

Digitisation opens new possibilities for sharing and experiencing cultural heritage, but a coherent infrastructure and collaborative approach is needed. With the majority of museums and heritage organisations now digitising in one manner or another, there is much duplication of resources in terms of equipment and fund-raising.

Shared use of digitisation equipment and partnerships minimises the resources expended by individual institutions and drain on funding bodies. Sharing digital infrastructure and ensuring interoperability between the information systems and datasets of all national museums, archives and libraries would, in

the longer term, bring down costs while increasing the visibility and usability of contents and services in education, culture, science and public administration. By reducing energy consumption, there is also a strong environmental motive for sharing of equipment, software, and data storage.

Democracy of expertise is another important consideration. Often in-house staff are carrying out digitisation projects without training, due to time and budgetary constraints. Often specialist expertise is not locally available and can be prohibitively expensive for smaller organisations to access. Larger institutions can take the lead on establishing guidelines, providing training, and knowledge-sharing.

Collaboration

In Ireland, all island collaboration is encouraged. Cross border projects are vital: while drawing on different professional standards (e.g., MSPI vs Spectrum) can be challenging, they provide valuable opportunities for learning.

Standardisation of process and vocabulary within the museum sector could be a good way to make cross-border collaboration more effective and is an EU wide issue. A good comparison is ISADg and MARC21 standards in archives and libraries respectively. Standardised vocabulary facilitates collaboration in many areas: cross-institutional, with community groups, private sectors and international partners. However, we must be mindful of data sharing issues with for-profit organisations — the risk of ransomware attacks and the volatility of data storage, requiring competent strategies for data backup. Project objectives across partners must align to institutional, civic, and project values.

Currently, there is also a lack of standardisation for digitisation and capture of metadata across the wider heritage sector. The recommendations of networks like ICOM CIDOC are slow to filter into day-to-day practice in many cultural institutions. Should a standard be set and incorporated into, for example, accreditation standards, it needs to be developed in a way that allows smaller organisations, with stretched resources, to meet the conditions required.

Access and public engagement

Development of digital collections, exhibitions, and resources must be ingrained with the principles of cultural democracy and create opportunities for community participation. In what ways can the public engage with the process of digitisation, not just the end result? Many local museums undertook 'pandemic collecting', however, some of the participants were not ready for their stories to be shared immediately. Around certain issues, there needs to be consideration of timing and how the information is collected and presented.

Sustainability and obsolescence

Consideration must be given to the choice of storage and hosting platforms, software lifespan and maintenance, and the cost of long-term investment to achieve sustainability, both in terms of project and digital collection lifespan and environmental sustainability. Without funding or an income stream, how can platforms be maintained and updated as technology progresses? To reduce risk, contingency plans need to be in place should a provider stop offering a service or hardware becomes obsolete.

Values of digitisation

To achieve meaningful digitisation, all work should be aligned to the values of the organisation rather than digitisation for the sake of it. Digitisation should be built into the organisational principles, from the practitioner or funder, collection management policy or strategy. These policies should include best practice for data collection, management, and disbursement. In this, government collaboration can lead the way by reviewing the methods by which digitisation projects are funded, particularly in light of our commitment to Public Sector Information open data frameworks.

We must consider, how do we build on the best practice that has been undertaken and ratify it in our work going forward?.

Further Reading

Benjamin, Ruha.
Race After Technology: Abolitionist Tools for the New Jim Code. Cambridge: Polity, 2019.

Bridle, James.
New Dark Age: Technology and the End of the Future. London: Verso, 2018.

Browne, Simone.
Dark Matters: On the Surveillance of Blackness. Durham: Duke University Press, 2015.

Crawford, Kate.
Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence. New Haven and London: Yale University Press, 2022.

Eubanks, Virginia.
Automating Inequality: How High-tech Tools Profile, Police, and Punish the Poor. New York: Picador, 2018.

Lessig, Lawrence.
The Future of Ideas: The Fate of the Commons in a Connected World, New York: Random House, 2001.

O'Neil, Cathy.
Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. New York: Crown, 2016.

Postman, Neil.
Technopoly: The Surrender of Culture to Technology. New York: Vintage, 1992.

Seymour, Richard.
The Twittering Machine: How Capitalism Stole Our Social Life. London: Verso, 2019.

Taylor, Astra.
The People's Platform: Taking Back Power and Culture in the Digital Age. New York: Picador, 2014.

Turkle, Sherry.
Reclaiming Conversation: The Power of Talk in a Digital Age. London: Penguin, 2016.

Winesmith, Keir, and Susie Anderson.
The Digital Future of Museums: Conversations and Provocations. London and New York: Routledge, 2020.

Zuboff, Shoshana.
The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power. New York: Profile Books, 2019.

This research was made possible with funding from The **Irish Museum of Modern Art (IMMA)** and the **Irish Museums Association (IMA)**, as well as support from each of the institutions represented by members of the working group. We would like to thank each of the speakers for generously sharing their insights and expertise. The primer document was additionally supported by the Small Grant Award 2021 operated by the **Irish Museums Trust** and the **IMA**.

IMMA ÁRAS NUA-EALAÍNI NA hÉIREANN IRISH MUSEUM OF MODERN ART

IRISH MUSEUMS ASSOCIATION

IRISH MUSEUMS TRUST

The Muse-Tech Working Group was formed by museum workers in Ireland in 2021 to interrogate the popular conception of technology as a 'neutral tool' and consider its moral and ethical implications.

This Primer distils the research of the working group and presents it in an accessible way. Focussing on seven relevant technologies, it explains the terminology, explores how they can be applied in a cultural context, and finally offers some key considerations.

9 781234 567897