

# The impact of COVID-19 on digital data practices in museums and art galleries in the UK and the US

Lukas Noehrer (✉ [lukas.noehrer@manchester.ac.uk](mailto:lukas.noehrer@manchester.ac.uk))

The University of Manchester <https://orcid.org/0000-0002-9167-0397>

Abigail Gilmore

The University of Manchester

Caroline Jay

The University of Manchester

Yo Yehudi

The University of Manchester <https://orcid.org/0000-0003-2705-1724>

---

## Article

**Keywords:** COVID-19, data, digital technology, museums, art galleries

**Posted Date:** June 15th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-535272/v1>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

---

**Version of Record:** A version of this preprint was published at Humanities & Social Sciences Communications on October 15th, 2021. See the published version at <https://doi.org/10.1057/s41599-021-00921-8>.

## Abstract

In the first quarter of 2020, the doors of museums around the world shut and their operations at physical sites were reduced in line with necessary security measures. This heralded the beginning of an uncertain future for museums and galleries as the COVID-19 pandemic hit and the only means to stay 'open' was to turn towards the digital. In this paper, we investigate how the physical closure of museum buildings due to lockdown restrictions caused shockwaves within their digital strategies and changed their data practices potentially for good. The methodology of the research involves a review of the impact of COVID-19 on the museum sector, based on literature and desk research, with a focus on the implications for three museums and art galleries in the United Kingdom and the United States, and their mission, objectives, and digital data practices. We also present analysis of ten qualitative interviews with expert witnesses working in the sector, representing different roles and types of institutions, undertaken between April and October 2020. Our research finds that digital engagement with museum content and practices around data in institutions have changed and that digital methods for organising and accessing collections for both staff and the general public have become more important. We present evidence that strategic preparedness influenced how well institutions were able to transition during closure and that metrics data became pivotal in understanding this novel situation. Increased engagement online changed traditional audience profiles, challenging museums to find ways of accommodating new forms of engagement in order to survive and thrive in the post-pandemic environment. Our findings point to a longer term shift in the operating models for museums and the need to realise economic value and diversify income streams through digital means, which have not yet been clearly established. The research suggests that the unprecedented situation brought on by the pandemic will shape future museum audiences and their interactions with institutions virtually and physically, posing challenges to museums and their constituents that require structural changes and adaptations, but also present opportunities to successfully survive in an ever-more connected world.

## Introduction

At the beginning of 2020 the COVID-19 pandemic plunged museums<sup>1</sup> into uncharted territory. Museums around the world had to close their doors overnight, rendering their physical collections and gallery spaces inaccessible, and creating a mass exodus to the digital as the only means to stay present in their constituents' lives. This sudden rupture has prompted museums to rethink their strategies, address questions of relevance, and find ways forward that rely on virtual rather than physical interactions. Some institutions accelerated digital strategies that were already in place or made agile changes to their programming, others could not keep up with the race to provide online content (Creative Industries Policy and Evidence Centre, 2020; Art Fund, 2020). A lack of digital skills and appropriate access to training and devices (Newman et al., 2020) in the sector was laid bare by the pandemic, exacerbating persistent problems around new technologies (Merritt, 2021). Institutions were confronted with multiple challenges that permeated their institutional infrastructures, from how to get data to staff working from home, to digital access for audiences and the monetisation of online assets, accompanied by the persistent lack of digital skills in the sector. Rifts opened up by the pandemic showed fundamental shortfalls not only in digital capacity (Knight Foundation, 2020; Newman et al., 2020) and income streams (ICOM, 2020a), but also in aggravating inequalities of access and inclusion (Merritt, 2021; UNESCO, 2020).

Addressing these issues required rapid planning for what was quickly termed the 'new normal' (Johnson, 2020) as suddenly the only presence was a *datafied* one. After a year of closure (at the time of writing), vaccination programmes and governmental determination to prevent a return to lockdown prompt the need to reflect on the implications this pandemic has for museums. The novel coronavirus has presented a new context for museum strategies and the potential for an on-demand lifestyle requires not just the rethinking of business models but possibly the reimagining of the museum in a post-pandemic world.

In this paper we investigate the impact of the pandemic on the data practices of public museums during 2020 and consider the implications for future digital strategies to drive and deliver museum missions and values. We explore how the pandemic has changed the ways museums provide access to public collections, consider the early and ongoing challenges they face, and the impacts these are having on organisational strategy, audience engagement, and business development. The research focuses on three museums each with publicly-owned collections, but contrasting governance and business models: Manchester Art Gallery and The National Gallery in the UK and the Smithsonian Institution, US. Our analysis examines the mission statements, policy contexts, and digital presence of these museums, and draws on ten in-depth expert interviews with museum professionals ranging from directors to staff in digital capacities, which took place between April and October 2020. It is supported by a desk-based literature and evidence review of the impact of COVID-19 on international collecting institutions.

The first section of the article introduces the context and rationale for the research, setting out briefly the timeline of rapid closure of public museum spaces globally and the background and context of the three institutions, before presenting thematic analysis of the interviews. We conclude with a discussion of key findings and their implications for museums, pointing to a longer term shift in the operating models of museums and the need for further investment and innovation in digital strategies in order to realise public value.

## Background And Institutional Context

SARS-CoV-2, the virus causing the COVID-19 disease, started its relentless journey across the globe in 2019, resulting in severe restrictions on behaviour and movement including locking down public space with a subsequent negative economic impact. The museum sector was not spared and by April 2020 about 90% of institutions (ICOM, 2020a; UNESCO, 2020) around the world were closed, putting extreme strain on the cultural sector and its constituent communities, leading to economic hardship and considerable social consequences (UNESCO, 2020). As a result there was an increased online presence of museums (Finnis & Kennedy, 2020) catering to a significantly increased consumption of cultural content online (Creative Industries Policy and Evidence Centre, 2020).

This novel situation has created shockwaves on several levels from operational management, programming, and resource development to longer term strategic planning. Whilst most staff have been able to work from home and the situation for employed staff has been relatively stable, many temporary contracts have been terminated or not renewed, leaving a high number of UK museum employees worrying about their job security or the future of their organisation (Art Fund, 2020) and a quarter of international freelance museum professionals reporting they have not had their contracts renewed (ICOM, 2020a). Seven out of ten European museums expect budget cuts over the subsequent years (NEMO, 2021), putting institutions that were struggling financially pre-pandemic at particular risk, with the prospect of severe operational and strategic changes being necessary for survival, to the detriment of their workforce and missions.

In addition, there has been an acceleration of digital processes, including online content production, republishing, and repackaging content (Finnis & Kennedy, 2020). This has necessitated changes in internal processes, increasing focus on data cleaning, cataloguing, or getting collections online (Art Fund, 2020). There has been a rapid assessment of the rationale and purpose for digital engagement not as an enhancement of usual delivery but as its core, not solely for entertainment, but to provide other societal benefits and public services, such as research and knowledge centres (Agostino et al., 2020; Samaroudi et al., 2020) and as resources to promote wellbeing and combat anxiety, mental health issues, and loneliness (Creative Industries Policy and Evidence Centre, 2020). Whilst being valuable contributors to society, museums are facing uncertainty and frustration over whether they will be able to deliver their services in the future. An ICOM survey (2020a) in May 2020 found a reduction in projects and programmes in at least 80% of museums, a number that rises to 93% and 87% in the regions of Africa and the Pacific respectively. Almost all museums around the world reduced their activities as a consequence of the COVID-19 pandemic: nearly one third of respondents predicted that they would downsize and more than one in ten may be forced to close permanently. ICOM's follow-up survey (2020b) conducted in November 2020 also found that planned investment into digital was on the horizon, with 75% of museums aiming to increase their digital offering in the future and 77% wanting to rethink their digital strategies.

The ramping up of digital engagement and access has revealed issues that in many cases existed prior to COVID-19. The Knight Foundation (2020) surveyed 480 museums across the US and found that about half have either no or just one person in a digital capacity role, and just 9% of senior leadership teams (SLT) have digital experience. This conclusion was also drawn by Finnis and Kennedy (2020) and Merritt (2021), with both finding substantial gaps in digital skills and a lack of strategic investment or positioning, with digital departments and capabilities often appearing somewhere on the organisational chart without a clear purpose or goal. Making the move to digital requires a mind shift in organisational culture and an evaluation of the status-quo to address the prevalent gaps in skills and knowledge, where it is not the technology itself, but rather the training and hire of digital skilled staff that is the expensive part (Finnis & Kennedy, 2020).

The exposure of these weaknesses is combined with the complex challenges of continuing uncertainty, personal grief and loss, and the frustrations of not seeing work colleagues, visitors, and other stakeholder constituents except in the digital space. It has also had unexpected consequences in scaffolding innovation where previously old practices sufficed, rendering what Galani and Kidd (2020) discuss as "hybrid materialities" (p. 298). These require technological strategies that can mediate between digital and analogue materials, in ways which summon imagined materialities in their remote audiences in sometimes creative and relational ways, for example, engaging new audiences who were previously unable or unwilling to physically visit museums in participatory workshops, and opening up gallery space through virtual technologies. Working outside the walls of the institution via digital and social media has provided energy to these initiatives and proof of principle in many cases, allowing educational and social missions that highlight the strategic opportunities within this strange "isolation as collective experience" (Kist, 2020, p. 346).

It is evident that the pandemic will have a long-lasting impact on the sector, prompting institutions to revisit their strategies (Samaroudi et al., 2020), address the lack of staff and digital skills training (Newman et al., 2020), and appreciate the digital as a helpful tool to re-emerge and successfully sustain in the future (Merritt, 2021). In the next section we present three case studies of museums, considering how their background, institutional missions, and digital presence have shaped their preparedness for coping with the pandemic and the shift to digital.

### Manchester Art Gallery

Manchester Art Gallery (MAG) is a local authority owned museum, operated by Manchester City Council since 1882. It is part of a consortium of museums named the Manchester Museum Partnership, which shares administrative and research capacities and offers a network of support and practice for its three member organisations. These comprise MAG, the Manchester Museum and The Whitworth art gallery, the latter two being University museums.

Articulated on its website, MAG's current vision statement reflects on these historical foundations and outlines its contemporary civic and social mission, which is to position the museum as a "Civic Think Tank; creating a convening space for voices across the city, providing creative education for all classes and cultures" (Manchester Art Gallery, n.d.). This ambition corresponds with the interests in "diffusion of useful knowledge" held by the eponymous 19th century Society for the Diffusion of Useful Knowledge, which influenced the foundation of Mechanics Institutes and Lyceums and led to similar movements in the US (Portolano, 1999). It also reflects the interests of the gallery's current leadership in Ruskinian theories of 'useful art', connected to the broader international 'Arte Util' network, and, as the website acknowledges, corresponds with the strategic priorities of local government (Manchester City Council, n.d.) and those of key funders, Arts Council England, to produce social impact through investment in arts and culture, to promote inclusion and education for the residents of Manchester, and also to attract visitor economies to the city centre.

The articulation of the mission therefore focuses not on digital as a means to diffuse knowledge, but on attracting and welcoming diverse audiences into the gallery spaces for the purposes of civic dialogue and education, with an emphasis on arts for health and well-being. There is little if any reference to digital or technological strategies for achieving these aims within the webpages and although the 'Learn' pages signpost engagement activities to particular demographics and contain some curated digital content for self-guided exploration for schools and colleges, the majority of content is oriented towards encouraging visitors to the physical gallery spaces. There is a collections search interface which allows for simple term searches of text and images relating to over 25,000 objects, although many of these have not been digitised. Personal use of the images is available for browsing and viewing only, however for further use of more than a single copy user need to enquire via a licensing enquiry form. During lockdown there was some further content developed on the site to allow users to access 'The Gallery at Home', including online talks and creative activities, however the emphasis remains on temporary activities which are stop-gaps for during the time of COVID restrictions, rather than new strategies to be integrated into the gallery's future.

#### The National Gallery

Directly grant-in-aid funded by the Department for Digital, Culture, Media and Sport (DCMS), the National Gallery in London has charitable status and is constituted as a Non-Departmental Public Body. The Gallery dates to the same year as the foundation of MAG, although by contrast its origins were ostensibly supply rather than demand-led, when in 1823 first the collector John Julius Angerstein and then landscape painter and collector Sir George Beaumont gifted their collections of paintings to the nation, necessitating a new national institution with suitable buildings for conservation and display.

The national collection now has over 2,300 paintings, representing classical western traditions from the 13th to the 20th century, acquired via a mixed economy of donation, fundraising via public appeal, grant-in-aid, trusts and foundations and private donors, and primarily displayed at the iconic building in Trafalgar Square. There is a discrete access policy which articulates the Gallery's commitment to "free access for all" (National Gallery, n.d.), although some temporary and special exhibitions have admissions charges and income is also generated through loans, touring exhibitions, licensing of image rights, publications, and merchandise. The Gallery has the power to raise capital via investment under the Museums and Galleries Act 1992 and maintains a carefully worded financial policy which stipulates the principles through which works of art are capitalised and appear on their balance sheet, to the concern of the Trustees, as an arbitrary valuation on their date of acquisition (HMSO, 2020), reflecting the tensions between the fluctuations of the art market, the governance of a Non-Departmental Public Body, and the need for transparency over public funds.

Following a Strategic Review of DCMS-sponsored museums (2017), the Gallery launched a new Strategic Plan which outlined some significant ambitions for its business model and its use of digital technology. These included seven strategic objectives which, alongside continuation of the acquisition and conservation of major paintings, signalled an ambition to engage further within their programmes with contemporary artists and museum learning, and notably to "create a National Gallery with digital at its heart, to reflect a more digital world" (National Gallery, 2018). This pre-pandemic shift in strategy aims to embed digital technology and data capabilities across programmes to support visitor experience and audience research within the Gallery, as well as to present new opportunities for public engagement and digital display and consumption. Furthermore, digital is also noted as a key lever for the strategic objective to raise levels of self-generated income to match the Grant-in-aid and become 50% self-funded.

As the Annual Report for 2019/20 states, the pandemic has put strain on the ambition to achieve sustained self-funding within the next few years. However, investment in digital capacity has furthered the Gallery's mission to provide public access to its collections, not least in supporting digital engagement during lockdown. A first stage in this was the Collections Information Project which required the complete rewriting of collection data entries, as well as investment into ticketing and customer relation management systems. New partnerships with technology and academic partners, including the Alan Turing Institute, King's College London, and Google Arts and Culture are supporting experimentation with virtual and augmented technology and an innovation lab, National Gallery X, a move which will presumably further research ambitions in technical art history as well as provide the means to take the collection out of the Gallery, and may mitigate the plans for an expanded national programme which have been curtailed by loss of funds due to the pandemic (HMSO, 2020).

## The Smithsonian Institution

The bequest of James Smithson, in 1835 and via his heir-less nephew, to “the United States of America, to found at Washington, under the name of the Smithsonian institution, an establishment for the increase & diffusion of Knowledge among men (sic)” (Portolano, 1999, p. 65) led to a protracted political debate within Congress about how to interpret this vision. One group held that the institution should pursue discovery of new knowledge through the funding of empirical scientific research for the benefit and progress of society, following the Baconian philosophical traditions established by the British Royal Society popular amongst nineteenth century US scientists and their supporters. The other group favoured the governmental reform of public education via ‘common-school’ educationalism in useful arts and sciences, which echoed the moral improvement and settlement agendas found elsewhere, including in Victorian Manchester. This debate was eventually resolved through the founding of the Smithsonian Library and Museum in 1846, to exhibit and promote the products of scientific enquiry, including entire government collections of art, material sciences and natural history research. These were housed in the National Mall, maintained by resident scientists, complemented by research grants programmes and extremely popular public lectures. The latter were carefully regulated in an attempt on the part of the Organizing Committee to maintain the ‘neutral ground of science’ and keep the Institution’s knowledge diffusion free from politics, a task near impossible to achieve during the rampant partisanship of mass democratic politics in mid-19th century, civil war-torn America, until a fire put an end to the public lecture hall in 1865 (Adcock, 2014).

The Smithsonian Institution currently operates nineteen museums, eight research centres, gardens, and the National Zoo. Writing well before the advance of digitisation and digital museology, Portolano (1999) points out by establishing a museum-dominated complex, the Smithsonian Institution retained its mission to diffuse knowledge to the common man, although it “does so primarily through the medium of exhibition of material objects” (Portolano, 1999, p. 79). Twinned with the mission to advance scientific enquiry, digital technology and strategy now have a notably central place in the Smithsonian’s mission. Its current strategic plan (2017–2022) identifies seven goals to achieve the vision to “build on its unique strengths to engage and to inspire more people, where they are, with greater impact, while catalyzing critical conversation on issues affecting our nation and the world” (Smithsonian Institution, 2017). Two of these goals - to reach 1 billion people a year, and to drive “large, visionary, interdisciplinary research and scholarly projects” - combine to articulate the Institution’s continuing commitment to increasing and diffusing knowledge, and are clearly predicated on digital technology, innovation and data science. The “digital-first strategy” is supported by a Digital Access Agenda which was incorporated into its strategic plans as early as 2014, and which emphasises technology use for enhancing visitor experience within the museums, as well as full digitization of the collections with easy, accessible, and low/no cost access to extend engagement and participation “among learners everywhere” (Smithsonian Institution, 2014). This has led to metadata, 3D objects, datasets, and a huge stock of images being released into the public domain as Creative Commons Zero (CC0) that can be used, manipulated, transformed, and shared without the need for institutional permissions (Smithsonian Institution, n.d.).

These three differently constituted institutions with distinct digital strategies share common objectives of providing public education through increasing access to their collections and positioning the museum as a site of knowledge and innovation. In the following sections we introduce the research methods and discuss our findings.

## Methods

Our research combines in-depth interviews with museum professionals in the United Kingdom and the United States that we position theoretically within the context of the institutions presented above.

We conducted ten semi-structured interviews between April and October 2020 via the video conferencing software Zoom (Zoom Video Communications, Inc., 2020). The design of the study was informed by the Standards for Reporting Qualitative Research (SRQR) to assure sound and rigorous data collection and reporting (O’Brien et al., 2014). The study received ethical approval by xxxxx (Ref: xxxxx).

Participants were purposively sampled (Mason, 2018) on the basis that they had substantial “experiential relevance” (Rudestam & Newton, 2015, p. 124) in terms of strategic and digital knowledge. We invited our interview partners directly via personal email correspondence to take part in a study about COVID-19 and its impact on data and digital practices in their institutions. As we aimed to generate data that establishes a representational account of the interviewees’ professional roles, we refrained from including the names of participants. All participants received a Participant Information Sheet (PIS) prior to the interview and were asked to give written consent (Anonymous, 2021). Interviewees were further given the option of withdrawing data up to 14 days after the date of participation.

Table 1  
Interview participants

Participant (P)	Position	Organisation	Location
1	Museum Director	MAG	UK
2	Data Manager	Manchester Museum Partnership	UK
3	Curator of Egypt and Sudan	Manchester Museum	UK
4	Collection Information Manager	The National Gallery	UK
5	Senior Manager Data and Insight	The National Gallery	UK
6	Acting Director, Center for Learning and Digital Access	Smithsonian Institution	US
7	Director, Digitization Program Office	Smithsonian Institution	US
8	Senior Social Science Analyst, Office of Policy and Analysis	Smithsonian Institution	US
9	Associate Director of Program Evaluation, Center for Learning and Digital Access	Smithsonian Institution	US
10	Director, Smithsonian Organization and Audience Research	Smithsonian Institution	US

Interviews followed an interview guide (Lindlof & Taylor, 2017) based on generative questions (Rubin & Rubin, 2005) to encourage extensive replies in an open format. All interviews were transcribed in detail and cross-checked by the authors, to ensure reliability and validity (Kvale, 2007).

Analysis of the interviews was performed by two authors (xxx and xxx) using inductive thematic analysis (Braun & Clarke, 2006) where both authors established their own set of codes at initial coding. Convergent as well as divergent themes were discussed by authors before agreeing on newly emerging themes used to re-code the interviews according to principal themes. Following this step we reached a high level of agreement between the first and the second coder in matching sentences to the primary themes in the interview (98.2%, n = 171) with an unweighted Cohen's Kappa ( $\kappa = 0.95$ ) showing almost perfect agreement (Landis & Koch, 1977). Both authors used the software NVivo (QSR International Pty Ltd., 2020) to analyse and code the interview data.

Analysis was contextualised by a literature review of sector research on the impact of COVID-19 on museums and on the three case study institutions, allowing a comparison of institutional differences in data management, digital capability, and wider policy backgrounds to be incorporated into the results.

## Results

1 Digital attitudes and data perceptions: COVID-19 has changed the understanding of the use and importance of data within the institutions, with the recognition that strategic preparedness significantly influences the ability to realise the shift to digital and remote delivery

All participants stated that COVID-19 significantly affected the way they were working, but when asked about their first reactions, there was evidence that people had different perceptions of how well things transitioned immediately after closure. Interviewees reported that it was quite messy and everything just ground to an halt, causing a situation where “everyone’s just sort of fumbling around and trying to work it out, professional and organised in the lack of clarity” (P1) and that “the priorities for the whole museum have shifted to a kind of like basic needs survival mode” (P2). Others were unable to access sources that are important to fulfil their job role either because they had no access to online systems from their homes or because in many instances the physical assets, such as ledgers and artwork dossiers, had not been digitised. Although digital collections and information were generally seen as a necessity and lifeline during lockdowns, there can be barriers to digitisation when the process goes against the grain of conventional museum practices: for example, one participant remarked that these ledgers are often the only source of metadata for collections, so it is an issue of trust to hand them over to vendors for remote digitisation, and whilst many museums perform this leap of faith, some refuse to lend them out. Interviewees were critical of a general institutional reluctance to embrace the concept of digitising and concerned that colleagues needed a pandemic to realise that analogue material could be rendered inaccessible or, worse, destroyed, making digitisation as crucial to conservation as it is for reaching online audiences.

One participant was frustrated that digital leaders in museums had been advocating for years to adopt a digital-first approach and that the previous resistance had completely reversed:

*"[We were] really fighting leadership and fighting curators and fighting other decision makers at the museum that digital should be prioritised and is important. Suddenly, everybody's like: can you make everything I'm doing digital? Can you do all my programmes? Make them all digital! So there's been a shift in sort of mindset, I think around of, you know, how we do things." (P6)*

This shift in mindset was common across most of the interviewees and almost all reported that data was seen as more important to their work and valuable to their institutions than it was pre-COVID. Interviewees claimed that the way data and digital are understood has changed. For example, online collections were identified as "the core" (P4) of operations and "suddenly it is a sharper focus on [their] importance and role" (P2). Participants highlighted digital assets as the sole means for staying present to the public during lockdown and institutions were "starting to realise the capacity of data and digital in a way they didn't before" (P1), ending the "analogue digital stand-off" (P3).

The Smithsonian Institution acknowledged the capacity of data and digital before the pandemic, noted as a "digital first strategy" (Smithsonian Institution, 2017) within the 2017–2022 strategic plan, and presenting a clear advantage in preparedness. This was also raised by one of our interview partners:

*"COVID sped up a lot of thinking that began at least two years ago when the just prior Secretary did his new strategic plan. And one of the goals was to reach 1 billion people. And you know, that would have to be virtually, would have to be digitally and moving away from the on-site visits emphasis and the emphasis on the physical buildings. And then when our new Secretary came in and one of his three major plans is the virtual Smithsonian. So, this was before any of this happened. So, the thinking was already moving in that direction." (P8)*

This direction was established before the pandemic and contributed to developing digital programmes on "speed drive" (P8) when COVID-19 hit the globe, but also enabled the museums of the Institution to repackage and purposefully reuse existing content. This readiness combined with the support of the new leadership, which has similar visions of digital for the public good in the service of the Smithsonian's communities.

As a local authority museum, with a highly localised strategy to conserve and promote collections for the city and its citizens, MAG had not yet fully embraced a digital strategy when the pandemic struck. The immediate response of the museum was to stop its operations and reflect on the development of an online body rather than to spend a disproportionate amount of energy in joining museums around the world in "racing to produce endless content in an attention economy" (P1). The closure of the gallery was seen as a time to recalibrate the institution in terms of thinking about digital activities and to learn about digital content in a way "to stop seeing digital as being the signpost to a visitor experience and it being a form of collective thinking" (P1). P1 remarked that institutions and people working in them will start to realise the capacity of data and the digital in a world that is going to be markedly different once opened up again and the lessons learnt after the pandemic will be reflected in the data around the collections. They argued that this could enable the use of collections in more interesting ways, referring to a complete reset of all collection data to zero "where nothing has any meaning or date and you would rebuild its meaning, connectivity, and networks or derive understanding from the network" (P1).

As discussed above, the National Gallery's key objective within its new corporate plan is "a National Gallery with digital at its heart, to reflect a more digital world" (National Gallery, 2018). The plan sets out interest in digital to fulfil a public mission for education, to provide outreach of the collections, to facilitate new research partnerships, and to generate income diversification. This meant that the intention if not the culture for digital delivery was in place when the museum buildings closed. When asked about the perception of the physical closure, P5 stated that

*"it's been really, really useful to have just one team looking at digital and physical. It helped us to really transition quite quickly to focusing on who is the digital visitor." (P5)*

This was seconded by P4, who saw the impact as lessened by the fact that people were used to collaborating digitally and a working from home policy was already in place before COVID-19. Outside their team, they claimed that people started to realise the usefulness of putting analogue information online, however, they identified a general tendency towards replicating curatorial content online rather than trying to optimise the data side of collections, such as indexing, classifying, and bringing catalogues as interoperable texts online. They said that this is a question of commitment and that "the notion of taking the sort of curatorial presentation of the collection and just doing it digitally rather than physically is probably not the best use of resources" (P4). This sentiment was also expressed by other participants. Some observed that institutions were "reverting to a more curator driven than user or visitor driven approach" (P8) and a more "uptight" (P1) use of online collections, with "people just throwing digital programming out there and there is no system in place to know what's working and what isn't" (P10).

All participants perceived increased demand for digital content since the first lockdown, but institutions varied in the choice and the amount of content that they felt they should offer in response. Whilst some museums spent a "disproportionate amount of energy trying to provide online entertainment" (P1), others emphasised that their pre-pandemic set-up enabled them to tailor content according to interest through user tracking and real time evaluation, delivering the content people were searching for, and avoiding users "being flooded" (P10).

Overall, participants recognised the power of the internet to reach out to people and acknowledged that the pandemic led to a digital awakening and a “mind shift to the digital” (P6). They admitted that the often feared enemy of the physical space can be a useful tool to connect, widening reach and producing attendance numbers that far exceed on-site events. Now the potential of a digital offering has been demonstrated, museums seem likely to keep online provisions post-COVID, using digital technologies as a virtual auditorium.

2 Data and decision-making: a newfound focus on numbers in the pandemic is also observed in museums

Metrics and numbers have become a key trope of the pandemic: public health communications through the media and government briefings have been data-driven and expressed graphs, from cases and deaths, to numbers of people vaccinated. This phenomenon is also observable in museum management, as participants reported that SLT were suddenly more metric aware and asking for metrics that either had not been tracked before, or data that was tracked but had not previously been of interest:

*“One interesting thing for me is that I’ve gone from reporting to the Trustees once every six weeks to every week.” (P5)*

There was a sense that data was driving decision-making, with one participant wondering “whether the way we think about data as institutions will change almost in a sort of pre-emptive way” (P1).

The operational set-up of institutions and the general ‘metric-awareness’ of people in leadership positions influenced the perception and usage of metrics. Institutions with a focus on digital provisions were able to quickly adapt their dashboards and tracking tools, whereas others struggled to cope with the new demand to reflect the museum’s operations in numbers. Data was used more directly and more often for decision making than before COVID-19.

For example, data gathered through user research supported decisions about digital tool development and allowed online programming to be adjusted to demand. These metrics were highlighted as important during interviews, but their use also led to discussions in institutions and the wider sector about the terminology of measurement, laying bare discrepancies in understanding, most notably in relation to issues of reach, engagement, and impact and how to successfully and consistently analyse and measure them. The pandemic has provided the motivation to (re)think current systems that are not fit for purpose, exposing where traditional metrics were no longer applicable or lack compliance with systems for tracking new digital analytics data. For example, one participant reflected on the “challenge for data to understand progress in relation to inclusion” (P2) and another one identified that “this whole evolution toward more digital has definitely produced, you know, the need for different kinds of metrics and different kinds of data” (P8).

This new reliance on metrics also raised issues regarding the interpretation of data. One interviewee pointed out that data driven decisions are often made under the assumption that having numbers reduces uncertainty, but the reality is that a lot of decisions are based on intuition and prior knowledge, and that numbers need contextualisation to be useful. Most participants therefore saw having a data scientist or staff with skills to interpret data as very useful and recognised it as a disadvantage for institutions who do not have such staff.

Another source of the new appetite for data was the management of re-openings, which was severely impacted by social distancing measures. The National Gallery was able to forecast and plan by using visitor tracking obtained by Wi-Fi data to predict dwell times and journeys through the gallery with graphs and machine learning models, “where tracking the most common journeys is now helping us to look at [...] what would be the best way” (P5). The application of these systems was mentioned not just regarding crowd control, but also recognised as useful to future exhibition planning, visitor management and exhibition design when placing objects in the physical museum space, for example when displaying paintings that tend to be audience magnets.

3 Audiences and engagement: COVID-19 radically reshaped audiences and engagement and generated innovation for public good

Reviewing the three museums’ mission statements and strategy documents it is evident that their identified audiences vary significantly in terms of reach and impact. Whereas the Smithsonian and the National Gallery define their audiences as “global” (Smithsonian Institution, 2017) and “worldwide” (National Gallery, 2018), MAG’s operational reach is highly localised, as “for and of the people of Manchester” (Manchester Art Gallery, n.d.). These distinctions can be found in relation to the means through which institutions plan to reach their audiences, with the Smithsonian striving to become “not only digital first, but mobile first” (Smithsonian Institution, 2017) and the National Gallery seeing digital as an “enormous opportunity” (National Gallery, 2018), whilst MAG does not make any specific reference towards online audiences or digital engagement.

Nevertheless, participants from all museums said that COVID-19 sent them back to the drawing board, re-addressing questions of audience segmentation, motivation, and interaction. There were concerns that in a (post-)pandemic environment traditional visitor profiles may no longer apply and institutions may be looking at completely new and emerging audiences which sit outside of current visitor profiling. For example, the pandemic has elicited engagement with audiences beyond the classic visitor spectrum, including people who have never been to a gallery in-person before. It is important to think about the expectations of these groups when becoming first time physical visitors, foreshadowing a



potentially significant change where “opening our doors, mandating how they experience the gallery” (P5) will not suffice. This concern was revealed by several participants, who remarked that most understanding of public engagement was focussed on on-site visitors, and existing data therefore cannot be used to build effective online marketing as it is based on face to face experiences.

COVID-19 has not only affected the audience spectrum of institutions; participants also reported a significant increase in traffic to online portals for various reasons. When asked about the most sought-after content, interviewees unequivocally said the highest demand was for educational and inspiring content, mostly driven by parents home-schooling their children, teachers (re-)using content designed for pedagogical use, and people who sought inspiration and intellectually stimulating content:

*“[T]hey were looking for things that were coming from a trusted source and so they didn’t want just anything they could find online, they didn’t necessarily want something from more of an entertainment source, they really want, they were looking for things that they assumed would have some educational value, because they were from a museum institution.” (P6)*

Our review identifies education as one of the core missions of all three institutions, but closer scrutiny of their online offer during the pandemic reveals that institutions who were digitally prepared had an advantage in putting content online and serving education communities. Those who have a wider reach also seem to have been more able to fulfil their missions during the pandemic, whereas those without digital strategies were offering very limited content, making them unable to sustain their service and deliver online.

The ability to track engagement is a valuable asset, enabling staff to adjust content according to data, to evaluate demand and to package material according to user feedback. This supports teachers in giving students agency when choosing what activity they want to work on, presenting a noticeable shift in approach to curriculum facilitation and learning, since digital not only attributes agency of choice beyond classic curriculum content but also breaks with the often linear narratives of ‘normal’ museum learning in physical space, enabling a different kind of experience. Participants also recognised home-schooling as a driver of website traffic and potential museum visitors: P5 considered how parents home-schooling their children using museum content might eradicate the barrier to engaging with museums and galleries in the future as it might make them feel more confident having had the digital as their first touch point.

The reality of new audiences and surge in demand for online educational content prompted interviewees to advocate for more nuanced sets of data around audience research that ask specific questions around reach, engagement, and accessibility. They asserted that to answer those questions requires different methodologies and forms of interpretation compared with on-site metrics, as well as the need for inclusive programming to stop “an erasing of cultural specificity and cultural sensitivity of digital offerings” (P9).

There were issues of accessibility, some under the direct influence of institutions, others not. Participants felt that one positive outcome of the pandemic might be that institutions were forced to tackle issues that had been overlooked by museums before the pandemic. One participant reflected on their engagement with care home residents and that “such thoughts were provoked through experimenting with social media and digital interfaces out of the need to stay connected during lockdowns, enabling us to have discussions and conversations that may have not been possible without technology” (P3).

The Smithsonian saw an increased demand for bilingual content, mostly due to parents home-schooling their children, prompting the Smithsonian’s Learning Lab to develop content tailored to Spanish speakers; due to the pandemic, the Lab saw an increase in website traffic of up to 400% compared with 2019. Both P6 and P10 saw a greater demand for low-tech products, where a device is used to access the material, but it does not necessarily require a high bandwidth or content to be printer-friendly. One participant highlighted that some people have either no device at all to access museums online or not enough bandwidth to use content involving significant data. This prompted the Smithsonian to think of ways to reach people ‘beyond device’, handing out educational materials at school lunch drop-off locations where families could still come to get food although schools were closed.

The digital divide further exists as a rift between institutions themselves, separating those who have data from those who do not. One participant further extended this to institutions who have data accessible from home and those who do not, as those museums that have digitised data accessible collections have been able to continue to work, engage, and research whereas others are only now realising how important it is to have digitised assets.

4 Future-proofing the museum: museums plan for a new paradigm after COVID-19, acknowledging that the pandemic will have a long-lasting impact

We asked participants to make predictions about the future of institutions and how they are preparing not just in terms of reopening their physical facilities, but also for the long term. All participants agreed that the future will look different and that the pandemic will have a long-lasting effect. Interviewees raised concerns about the allocation of resources and the economic impact of the pandemic both in commercial income and in longer term public funding and had fears about lessons not learnt and a possible lost momentum for institutions. However, they also saw COVID-19 as an opportunity to disrupt old habits and address issues that were affecting their sector, but which had not been

previously brought to the top of the agenda. Whereas the pandemic itself was not perceived as positive, some participants acknowledged that positive outcomes may come from it.

One of the themes that emerged was the monetisation of digital content. Participants stated that this was mostly motivated by trying to match self-generated income goals, combined with the struggle to charge for cultural content “because people tend to not attribute any monetary value to it” (P2), because it was seen as something that had already been paid for through public taxation, or because of an assumption that institutions should offer everything for free. Participants remarked that museums are on one hand operating as revenue-driven enterprises and on the other hand as institutions whose mission is to educate and diffuse knowledge as widely as possible, causing a dilemma that needs careful consideration, especially with the ongoing digital divide.

One participant feared that current digital programmes cannot be sustained after re-opening the physical sites due to insufficient funds to run both at the same scale and that the public, but also leadership teams, will have higher expectations that institutions would fail to deliver. The problem of successfully monetising digital content was also related to the establishment of relevant performance indicators for museums, a task not yet fully achieved according to participants. If in place, these would enable museums to fundraise for digital programmes, allowing them to quantify the success of digital provision to attract patrons, sponsors, and donors.

In addition to funding, our interviewees showed a concern about how future-proofed the sector was more broadly, in terms of longer term sustainability and leadership, with the greatest worries about smaller, less financially secure institutions. Participants felt that the pandemic had put leadership teams into the unique position of steering the digital future of museums, not just in regard to their strategies, but also in terms of finding a new equilibrium between onsite and digital. The pandemic was seen as “an opportunity to really rethink everything” (P10) from streamlining operations and establishing partnerships, to including new audiences and changing organisational culture. Participants feared that it will be a lost opportunity in some cases, as institutions either revert to former operating modes in a form of risk aversion, are afraid of changing organisational structures, or lack understanding of their audiences and the content they require: “[a]lthough money is always a constraint, one of the bigger constraints is the culture, the organisational culture” (P7). They predicted a future that brings a new paradigm for institutions in a world that has changed considerably and acknowledged that it is the right time to address societal issues, disrupt past patterns, and use the time post-COVID to integrate the progression of digital strategy and infrastructure.

## Discussion

With closures, and museums unable to attract visitors to their physical spaces, institutions and their audiences were thrown into the “digital deep end” (Finnis & Kennedy, 2020, p. 11), making the internet the default form of engagement. Our research finds that institutional approaches to digital and data-driven operations were a considerable factor in how well museums were prepared for a global pandemic. Attitudes towards digital and perceptions of data were significantly influenced and shaped by COVID-19, creating a new paradigm that institutions have yet to fully understand.

In many instances digital strategies were acknowledged as part of a fundamental digital turn before COVID-19, but not all museums have anchored these strategies in their planning, which had knock-on effects on their preparedness both to cope with a surge in demand for digital access, and also to perform basic operations. Our interviewees confirmed the findings of the literature research: that institutions with digital strategies in place reported a smoother transition into lockdowns than those without, and were better able to accommodate the digital surge (Art Fund, 2020) and the pressure to perform and deliver online in ‘pandemic-mode’. This caused problems for museums that were not adequately equipped (Finnis & Kennedy, 2020) and reinforced persistent issues for institutions who had struggled to successfully incorporate digital products into their operations or keep pace with rapid technological developments before COVID-19 (Merritt, 2021). Specifically, we identified that institutions benefit from data insight and tracking, enabling them to tailor content to audiences and evaluate their interactions in (near) real-time. This was more prevalent in larger institutions, leaving smaller organisations hit harder than their bigger counterparts with fewer resources and capacities to serve their constituents (Travkina & Sacco, 2020).

The shift to digital-only participation has brought potential for new and diversified audiences to encounter museums, but not all audiences have equal access to digital technologies and COVID-19 has contributed to worsening the digital divide (Holmes & Burgess, 2020); exacerbating inequalities in a society that is ever more reliant on data infrastructures (Baker et al., 2020). Participants in our interviews highlighted the need for inclusive programming and gave consideration to low-tech or no-tech material in order to bridge the digital divide and engage those struggling or unable to access digital devices. Our research also indicates that COVID-19 prompted professionals to reach out to people that tend to get neglected in our society. This is further supported by UK and US surveys (The Audience Agency, 2020; Samaroudi et al. 2020), which saw a rise in engagement with less traditional and vulnerable audiences, possibly due to their needs being more aligned with broader societal developments in terms of self-isolation, shielding, or being under lockdown. It will be imperative to continue to provide digital engagement for such audiences to stay connected once buildings are open again.

The pandemic has brought a new heightened interest in the monetisation of digital content, and with it the need to balance the principles of charging for content (Art Fund, 2020) with the risks of new income models and issues of accessibility and inclusion. However, participants were highly supportive of online specific metrics and KPIs to prove success of digital products and therefore attract funders. The research found that whilst financial investment in skills and capacity is important, organisational culture can be a greater barrier to digital development, with success dependent on leadership teams adopting future-facing strategies and encouraging more embedded digital cultures within their institutions.

Our participants remarked that institutions need to use this momentum to not just achieve their digital goals, but also to stay relevant in the time ahead, generally perceived as an opportunity for development and evolution. This echoed other research findings on the importance of organisational digital culture and capacity (Newman et al., 2020) to bounce back faster post-COVID with “strategic foresight” (Merritt, 2021) and by learning to “speak machine” (Maeda, 2020).

The notion of the future after the pandemic was portrayed as one noticeably different to the time before, requiring museums to embrace change and adapt to a model where “the physical space of the museum is no longer dominant” (Art Fund, 2021, p. 5). On opening up again, museums will have to accommodate a different operating environment that poses new challenges, but also offers opportunities to incorporate even-handed approaches to both onsite and digital operations which mediate between online and on-site spaces to address “online audiences as key agents in the production of digitally-mediated material encounters” (Galani & Kidd, 2020, p. 300).

## Conclusion

Our research finds that not only has COVID-19 impacted institutions in the short-term during lockdowns, but that it has profoundly changed the future course of museums around the globe. Whilst some museums will not be able to open their doors again, most institutions have shown great resilience and will re-emerge from this situation and adjusting their strategies and modes of operation to a new paradigm. It will be an awakening to a society that has profoundly changed too; drastic measures led to almost complete restrictions on public life, where the only means to stay connected socially and to the world beyond one’s walls was a digital one.

Our research offers an in-depth account of the situation of museums during 2020 witnessed through the lens of professional practice within variously sized institutions, contextualised by a broader evidence review, which forms the basis for further research in this area. The findings suggest confidence in the museum sector to adapt and support further investment in the development of organisational digital culture, to ensure the sustainability of museums and their capacity to deliver social mission and public benefit on-site and online in the future.

## Notes

<sup>1</sup> The terms ‘museum’, ‘art gallery’, and ‘institution’ are used inter-changeably throughout the article.

## Declarations

### Data availability

Data generated and analysed during the current study is not publicly available due to data sharing restrictions but is available from the corresponding author on reasonable request.

### Acknowledgements

This work was supported by the UK Engineering and Physical Sciences Research Council (EPSRC) grant XXXXX for the XXXXX.

We would also like to thank our participants for their time in participating in this study.

### Ethics declarations

Competing Interests

The authors declare no competing interests.

## References

1. Adcock R (2014) ‘The Increase and Diffusion of Knowledge’: Constructing the Relation of the Smithsonian Institution to Politics, 1835–1866. Paper presented at the Annual Meeting of the American Political Science Association, Washington D.C., 28–31 August 2014. <https://doi.org/10.13140/2.1.3178.5922>

2. Agostino D, Arnaboldi M, & Lema MD (2020) New development: COVID-19 as an accelerator of digital transformation in public service delivery. *Public Money & Management* 41(1):69–72. <https://doi.org/10.1080/09540962.2020.1764206>
3. Anonymous (2021) Details omitted for double-blind reviewing
4. Art Fund (2020) COVID-19 Impact. Museum Sector Research Findings. Summary Report. Available from <https://www.artfund.org/assets/downloads/art-fund-covid19-research-report-final.pdf>
5. Art Fund (2021) Looking ahead. Museum Sector Research May 2021. Summary Report. Available from <https://www.artfund.org/assets/downloads/looking-ahead-sector-research-report-2021.pdf>
6. Baker C, Hutton G, Christie L, Wright S (2020) COVID-19 and the digital divide. UK Parliament POST, London. <https://post.parliament.uk/covid-19-and-the-digital-divide/>. Accessed 09 Apr 2021
7. Braun V, Clarke V (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2):77–101. <https://doi.org/10.1191/1478088706qp063oa>
8. Creative Industries Policy and Evidence Centre (2020) Digital Culture: Consumption in Lockdown. Insights from the Consumer Tracking Study. Thematic Report. Available from <https://www.pec.ac.uk/assets/images/The-PEC-and-the-IPO-cultural-consumption-study-insights-from-the-six-week-study.pdf>
9. DCMS (2017) Strategic review of DCMS-sponsored museums. Strategic review. Available from [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/673938/Strategic\\_review\\_of\\_DCMS-sponsored\\_museums.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673938/Strategic_review_of_DCMS-sponsored_museums.pdf)
10. Finnis J, Kennedy A (2020) The Digital Transformation Agenda and GLAMs. A Quick Scan Report for Europeana. <https://pro.europeana.eu/post/the-digital-transformation-agenda-and-glams-culture24-findings-and-outcomes>. Accessed 20 Feb 2021
11. Galani A, Kidd J (2020) Hybrid Material Encounters – Expanding the Continuum of Museum Materialities in the Wake of a Pandemic. *Museum and Society*, 18(3):298–301. <https://doi.org/10.29311/mas.v18i3.3565>
12. HMSO (2020) The National Gallery Annual Report and Accounts for the year ended 31 March 2020. Annual Report. Available from <https://www.nationalgallery.org.uk/media/35604/the-national-gallery-annual-report-and-accounts-19-20-web-version.pdf>
13. Holmes H, Burgess G (2020) Opinion: Coronavirus has intensified the UK's digital divide. <https://www.cam.ac.uk/stories/digitaldivide>. Accessed 09 Apr 2021
14. ICOM (2020a) Museums, museum professionals and COVID-19. Available from <https://icom.museum/wpcontent/uploads/2020/05/ReportMuseums-and-COVID-19.pdf>
15. ICOM (2020b) Museums, museum professionals and COVID-19: Follow-up survey. Available from <https://icom.museum/wp-content/uploads/2020/11/FINAL-EN-Follow-up-survey.pdf>
16. Johnson H (2020) Arts and culture in a 'new normal'. *The Psychologist*, 33:98–99.
17. Kist C (2020) Museums, Challenging Heritage and Social Media During COVID-19. *Museum and Society*, 18(3):345–348. <https://doi.org/10.29311/mas.v18i3.3539>
18. Knight Foundation (2020) Digital Readiness and Innovation in Museums. A Baseline National Survey. Available from <https://knightfoundation.org/wp-content/uploads/2020/10/Digital-Readiness-and-Innovation-in-Museums-Report.pdf>
19. Kvale S (2007) *Doing Interviews*. SAGE, London
20. Landis JR, Koch GG (1977) The Measurement of Observer Agreement for Categorical Data. *Biometrics*, 33(1):159–174. <https://doi.org/10.2307/2529310>
21. Lindlof TR, Taylor BC (2017) *Qualitative Communication Research Methods*, 7th edn. SAGE, London
22. Maeda J (2020) 2020 CX Report. <https://cx.report/2020-cxreport/>. Accessed 14 Mar 2021
23. Manchester Art Gallery (n.d.) Our mission and vision. <https://manchesterartgallery.org/visit/about-us/our-vision-and-mission/>. Accessed 21 April 2021
24. Mason J (2018) *Qualitative Researching*, 3rd edn. SAGE, London
25. Merritt E (2021) TrendsWatch. Navigating a Disrupted Future. Report, American Alliance of Museums. <https://www.aamus.org/programs/center-for-the-future-of-museums/trendswatch-navigating-a-disrupted-future/>. Accessed 12 Mar 2021
26. National Gallery (n.d.) Access Policy. <https://www.nationalgallery.org.uk/about-us/organisation/policies/access-policy>. Accessed 22 April 2021
27. National Gallery. (2018). Strategic Plan 2018–2023. Available from [https://www.nationalgallery.org.uk/media/25328/strategic-plan\\_2018-2023.pdf](https://www.nationalgallery.org.uk/media/25328/strategic-plan_2018-2023.pdf)
28. NEMO (2021) Follow-up survey on the impact of the COVID-19 pandemic on museums in Europe. Final Report, NEMO. Available from [https://www.nemo.org/fileadmin/Dateien/public/NEMO\\_documents/NEMO\\_COVID19\\_FollowUpReport\\_11.1.2021.pdf](https://www.nemo.org/fileadmin/Dateien/public/NEMO_documents/NEMO_COVID19_FollowUpReport_11.1.2021.pdf)

29. Newman T, Beetham H, Church, S (2020) DASH Survey Results 2020. Describing the digital attitudes, skills and organisational support of people working across the UK heritage sector. Available from <https://www.heritagefund.org.uk/sites/default/files/media/attachments/DASH%20report%20draft%20v13.1.5.pdf>
30. O'Brien BC, Harris IB, Beckman, TJ, Reed DA, Cook DA (2014) Standards for Reporting Qualitative Research: A Synthesis of Recommendations. *Acad Med.* 89(9):1245–51. <https://doi.org/10.1097/ACM.0000000000000388>
31. Portolano M (1999) Increase and diffusion of knowledge: Ethos of science and education in the Smithsonian's inception. *Rhetoric Review* 18(1):65–81.
32. <https://doi.org/10.1080/07350199909359256>
33. QSR International Pty Ltd (2020) NVivo, Version 12. Computer Software. Available from <https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home>
34. Rubin HJ, Rubin IS (2005) *Qualitative Interviewing: The Art of Hearing Data*, 2nd edn. SAGE, London
35. Rudestam KE, Newton RR (2015) *Surviving Your Dissertation*, 4th edn. SAGE, London
36. Samaroudi M, Echavarría, KR, Perry, L (2020) Heritage in lockdown: Digital provision of memory institutions in the UK and US of America during the COVID-19 pandemic. *Museum Management and Curatorship* 35(4):337–361. <https://doi.org/10.1080/09647775.2020.1810483>
37. Smithsonian Institution (n.d.) Smithsonian Open Access. <https://www.si.edu/openaccess>. Accessed 21 Jan 2021
38. Smithsonian Institution (2014) *Delivering on the promise of the Digital Smithsonian*. Available from <https://www.si.edu/content/pdf/about/SmithsonianDigitalActionAgenda.pdf>
39. Smithsonian Institution (2017) *Strategic Plan: Smithsonian 2022*. Available from <https://www.si.edu/sites/default/files/about/smithsonian-2022-strategic-plan.pdf>
40. The Audience Agency (2020) *The Audience Agency Digital Audience Survey November 2020*. Available from <https://www.theaudienceagency.org/asset/2547>
41. Travkina E, Sacco P (2020) Culture shock: COVID-19 and the cultural and creative sectors. *Tackling Coronavirus (COVID-19): Contributing to a Global Effort*. OECD, Paris.
42. UNESCO (2020) *Museums around the world in the face of COVID-19*. Report. Available from <https://unesdoc.unesco.org/ark:/48223/pf0000373530>. Accessed 27 Oct 2021
43. Zoom Video Communications, Inc. (2020). *ZOOM cloud meetings, Version 5*. Computer software. Available from <https://zoom.us>.