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Understanding levels of online participation in the U.K. museum sector

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ABSTRACT

COVID-19 has undeniably affected museums' online content, yet attempts to identify or understand sector trends have been hampered by a lack of data. This paper uses a representative sample of 315 U.K. museums to create a much-needed benchmark against which museum practitioners can evaluate and contextualise prior studies and their own experiences. Gathering data from museum websites and five social media platforms, this paper is one of the largest studies of its kind in the European museum sector and the first of such scale in the U.K. Beginning with an overview of social media adoption, the paper then investigates museums' use of YouTube to identify sector trends. Crucially, this paper demonstrates a scalable methodology that enables a broader analysis of European and North American museums using TripAdvisor. This method has applications beyond the heritage sector and is pertinent to the study of any public facing attraction.

Introduction

During the COVID-19 lockdowns in March 2020, a narrative emerged that digital content was able to reach beyond museums' traditional audiences to engage communities under-represented in museums on-site visitors (Samaroudi, Echavarria, and Perry 2020). In a survey of ten sector experts, Lukas Noehrer et al. (2021) found that digital resources were seen as an opportunity to diversify audiences in the face of the pandemic, a belief which was supported by early surveys measuring digital engagement (Mantell and Turpin 2020).[1] Yet the publication of the first large-scale studies has challenged this common account of the early pandemic. The findings of the Centre for Cultural Value's 18-month-long COVID-19 research project, highlighted that 'digital distribution is not the great equaliser or diversifier that much of the sector was hoping it was and even claiming it to be' (Walmsley et al. 2022, 68). The profiles of online audiences

during the pandemic were discovered to be similar to in-person visitors in 2019, with only 17% of online audiences coming from demographic groups with a low average levels of engagement, compared with 20% of physical visitors (The Audience Agency 2021).

The discrepancy between museum practitioners' accounts of the pandemic and the audience data reaffirms the need for 'a sound metric to benchmark online visits' (NEMO 2020, 3). Leading sector experts noticed that over the pandemic 'senior leadership teams became significantly more metric aware', yet a lack of expertise has hampered digital data collection – an issue that was more acute in smaller organisations without existing digital resources (Noehrer et al. 2021, 6; Newman, Beetham, and Church 2020; UNESCO 2020; Travkina and Sacco 2020).

With limited options and already overstretched digital teams, digital surveys have proven a popular and inexpensive way for museums to measure engagement online. However, they have limitations as a method to understand the sector as a whole; privacy and commercial considerations restrict what museums can share, while a self-selection bias in respondents skews our understanding of online audiences (Nuccio and Bertacchini 2021; Gran et al. 2019; Bethlehem 2010). A large-scale quantitative analysis of the sector is desperately needed to provide an overarching view of how COVID-19 has affected the production and reception of online content, creating a benchmark against which museum practitioners can evaluate their own experiences.

Our paper contributes to this ambitious undertaking, focusing on the U.K. museum sector through a representative sample of 315 museums. It explores their online presence across five social media platforms – Facebook, Twitter, Instagram, YouTube, and TikTok – and museum websites, combining this new data with pre-existing efforts to identify trends in online offerings and audience reception. The results of our paper will be divided into two parts: it will begin by exploring the current web presence of museums in the U.K.; and then investigate the impact of COVID-19 through an in-depth analysis of museums' uploads to YouTube. The perceived popularity of video content in surveys of museum practitioners made YouTube a likely site of change during the pandemic, and will be used as both as an indicator of wider trends and as a demonstration of our methodology (NEMO 2020). As arguably the largest study of its kind in the European museum sector and the first to focus on the U.K. institutions, our paper offers three key contributions to the sector:

(1) The creation of a representative dataset recording U.K. museums' use of social media channels – with a focus on YouTube – that can act as a benchmark for evaluation.
(2) To supplement existing qualitative data gathered during the pandemic with quantitative evidence, identifying sector-wide trends that contextualise the accounts of museum practitioners.
(3) A scalable methodology that can be used to conduct large-scale studies across Europe and North America, and has broader applications in the tourism sector.

Related literature

Social media adoption

Museums use of social media in the last fifteen years – part of a wider adoption of digital technologies dubbed the 'digital turn' – has transformed the relationship between the

institutions and their audiences. The accessibility and conversational nature of social media became, as Alanna Bayer writes, a 'potential method for diluting the art institution's authority, aiding in the incorporation of both large and small voices into artistic conversation' (2014, 82). Matthew Fisher and Bill Adair noted that this technological development created an opportunity to improve accessibility and social media held 'enormous potential for museum to effectively realise their objectives online' (2011, 44). These benefits make social media an attractive prospect for many museums, yet there is remarkably little data on how many actively use social media platforms.

There are multiple barriers that prevent museums from participating online: they need the ability to digitise items in their collections; maintain IT infrastructure such as cameras, computers, and stable internet access; and have skilled staff (François 2019, 57). Many museums struggle to meet these criteria, an issue that has been exacerbated by the pandemic (Noehrer et al. 2021; UNESCO 2020; Murphy 2014;). Inhibited by the Europe-wide lockdowns, museums had to halt ongoing digitisation efforts and only those with pre-existing digital resources were able to capitalise on the perceived demand for online content. This has exacerbated digital inequality in the sector, making it more important than ever to understand what types of museums are online – and crucially, what types of museums are not.

Sampling museums' online output

Discussions of museums' online offerings usually focus on 'major institutions', or the innovative projects of 'superstar' museums (Gombault and Allal-Chérif 2021; Samaroudi, Echavarria, and Perry 2020; Gladysheva, Verboom, and Arora 2014). Heralded as sites of innovation, large museums disproportionately shape the perception of online museum experiences in academia both in the U.K. and across Europe (Camarero, Garrido, and José 2016; Zafiropoulos, Vrana, and Antoniadis 2015). Although small organisations made up 54% of U.K. accredited museums in 2017 and 85% of the estimated number of unaccredited institutions, this majority is largely ignored in discussions of sector trends (Candlin et al. 2019, 58).[2]

This is primarily due to a lack of data. Giuseppe Vito et al. argued that the 'main obstacle to pursuing such research is in the data', and the lack of a benchmark hampered their attempts to analyse the performance of 10 small and medium sized Italian institutions (2017, 1075). This issue became increasingly prominent during the COVID-19 crisis, as researchers had no benchmark from before the pandemic to compare against current online engagement (NEMO 2020). In a study of social media use over the early pandemic, Agostino, Arnaboldi, and Lampis (2020, 365) focused on the top 100 most visited Italian museums specifically because they were already being monitored by the Ministry for Cultural Heritage and Tourism. While choosing samples that align with pre-existing datasets enables researchers to contextualise and understand the new data more easily, replicating previous sampling choices perpetuates existing biases. In using a sample that is representative of the wider sector, it is possible to discuss the sector as a whole and to create a benchmark.

Website and social media data

The primary difficulty in creating such a benchmark is automating the data collection process. Across museum websites, it is possible for researchers to extract data using

web scraping: firstly, the webpage is fetched and downloaded; and then the information is extracted. The fetching process is usually carried out by web crawlers, autonomous computer programs that systematically search the web and download the desired pages. Once downloaded, these can be searched and the information, included the website's metadata and the text visible to browser visitors, can be extracted. While this is approach is fast and provides researchers flexibility, it requires site-specific programming and must be updated every time there is a change to the underlying format or layout of the website (Dongo et al. 2021; Glez-Peña et al. 2014).

Researchers are also limited by the terms of service of websites and must consider the legal ramifications of extracting this information to avoid copyright infringement (Dongo et al. 2021; Topaz et al. 2019). This is especially pertinent in the wake of the Clearview AI scandal, which saw 20 billion images scraped from public social media profiles to create a facial recognition database (Hart 2022; Sobel 2020). Large social media platforms expressly forbid unauthorised scraping, even of publicly available data (Twitter 2022). Instead, platforms encourage the use of their Application Programming Interfaces (APIs). Researchers can send requests, or queries, to the API, which acts as an interface for the platform's database.

There are disadvantages to using APIs. There is a limit both the number of queries that can be made in a day, and the types of data available. While researchers are able to request special permissions through academic research applications, ultimately, the data available through these APIs is entirely governed by the corporations that own them (Twitter Developers 2022; Facebook Developers 2022a; 2022c). This results in their utility varying by platform. The Facebook Graph API is the most inaccessible and requires special permissions to access even public page information (Facebook Developers 2022b). Daniel Thiele notes that 'accessing the Facebook API has become more and more difficult for researchers in the past few years' and criticised the lack of transparency, identifying that 'the data returned sometimes exhibits gaps or skewness for unclear reasons' (Thiele 2022, 193). For our paper, the difficulty in using Facebook data was such that museums' page likes and follower counts were verified manually. The reduction in data available since the Cambridge Analytica controversy means that to conduct a larger study including Facebook would require our paper's methodology to be adapted (Venturini and Rogers 2019). Fortunately for the purposes of scaling our study, both the Twitter and Instagram APIs provided useful data that reliably reproduce result that mirrored those of scraping (Dongo et al. 2021).

YouTube data

In a recent study of interactive behaviours on Facebook, Gillian Moran et al. discovered that video content was particularly effective at encouraging 'clicks', 'likes', 'comments', and 'shares' (2019, 534). Any understanding of engagement with online content is mediated by – and limited to – measures of these interactive behaviours. Combined with the perceived popularity of video content in surveys of museum practitioners and the widespread use of YouTube in the museum sector, the platform was chosen for in-depth study as a likely site of change over the pandemic (NEMO 2020).

The functionality of the YouTube Data API allows researchers efficient access to video metrics and made it an attractive choice of platform (Google Developers 2022; Malik and

Tian 2017). While the API limits the number of queries researchers can make per day, it is the most accessible of any major social media site and does not restrict researchers' ability to generate large data sets through the use of authentication tokens (Henry 2021; Chatzopoulou, Sheng, and Faloutsos 2010).

Although the capabilities of the YouTube Data API provide ample tools for this research, it has its limitations. Previous studies have been limited to a snapshot of a video's popularity over a short period of time – at best providing a few months of comprehensive data (Figueiredo, Benevenuto, and Almeida 2011; Chatzopoulou, Sheng, and Faloutsos 2010; Cha et al. 2009). As the API attribute 'viewcount' only gives the number of views a video has received at the time the API is accessed, charting the popularity of a video through time requires accessing the API repeatedly over a given period. This makes it impossible to chart a video's changing popularity in retrospect, as measuring the popularity of a large number of videos – especially without the benefit of hindsight to inform a project's focus – is costly in both time and API requests, increasing the necessary financial outlay.

The authors accessed the API between 23 and 30 June 2022, taking a snapshot of videos' popularity two years after the first lockdown measures eased. Yet, while the initial reception of the videos may not be reliably reflected in the 'viewcount', it is still a valuable measure. YouTube videos most commonly hit a peak in popularity within days of being uploaded, and over the years there is evidence to suggest that the 'lifespan' of YouTube videos is getting shorter (Jiang et al. 2014; Pinto, Almeida, and Gonçalves 2013). A recent study by Noriaki Kamiyama and Masayuki Muratahas found videos' daily view count, 'dramatically decreased over several days just after their upload day and decreased moderately after this initial period' (2019, 1103). Therefore, even two years after an upload, the number of views is still likely to reflect a video's initial reception. It should also be noted that the view count can only increase over time, which could lead to an optimistic assessment of the sector. Being aware of these limitations and bias, the number of views remains a valuable metric in the dataset.

Supplementary data

The use of the YouTube Data API in isolation would be of limited use in understanding museums' video content during the pandemic. Nancy Baym (2013) detailed the shortcomings of decontextualised statistics as a way to understand audiences' behaviour in a systematic literature review. By only having 'audience' data, the group of individuals interacting with a video are misleadingly flattened into a monolithic entity. Our paper hopes to minimise this effect by exploring museums' actions – for which far more contextualising data is available – alongside the audience reception. Unlike individual audience members, museum data is not anonymised, and it is possible to supplement a museum's YouTube data with the existing database of the Mapping Museums Project. Compiled over four years between 2016 and 2020, the project collated and validated information on 4,191 museums spanning from 1960 to the present day. The resulting data is open access and is the largest and most comprehensive data set on U.K. museums to date (Ballatore and Candlin 2022; Birkbeck Knowledge Lab 2021). The research addressed inequalities in data collection and combines and expands on many existing data sets to documented museums' opening and closing dates, size, subject matter, and location.

This contextualising data can be used to identify regional disparities and – combined with policy and economic trends – point at underlying causes of museum closure. In this paper, that same information is added to the social media data, enabling us to explore the digital disparities between regions and types of organisations identified in the earlier UNESCO and NEMO sector surveys (NEMO 2020; UNESCO 2020).

Museum websites are another valuable source of data, providing links to social media profiles, and helping determine the museums' relationship to an umbrella or host organisation. Before the discontinuation of alexa.com on 1 May 2022, museum URLs were regularly used to retrieve website's Alexa traffic ranking. These rankings were an inverse indicator calculated using the number of unique visitors and the total number of pageviews – the lower the Alexa traffic ranking the more the site was frequented (Alexa and Amazon 2022). The rankings have been widely used in the previous studies as a measure of websites' popularity, and their discontinuation poses a problem to researchers (Camarero, Garrido, and José 2016; Enhuber 2015; Zafiropoulos, Vrana, and Antoniadis 2015). In an analysis of a preliminary dataset conducted in anticipation of this paper, we found a statistically significant relationship between museums' Twitter following and Alexa traffic rankings – indicating that museums which perform well on social media are also likely to have popular websites. Therefore, although Alexa traffic rankings could not be incorporated into this data set, our paper will compensate by exploring the correlations between popularity across multiple social media platforms to achieve a holistic understanding of museums' online popularity.

Methodology

A stratified random sampling method was used to select a sample from the Arts Council Accredited Museums by dividing them into strata based on the types of museums – either independent, university, local authority,[3] national, National Trust, English Heritage, National Trust for Scotland, or Historic Environment Scotland – and then randomly selecting a number of museums from each group that is proportional to their presence in the population (Arts Council England 2021). The 1731 Arts Council accredited museums were sampled using Cochran's formula corrected for small populations, where n is the sample size, N is the population size, e is the desired level of precision, p is the estimated proportion of the population with the desired attribute (if unknown 0.5 is the maximum), q is $(1 - p)$, and Z is the area under the normal curve with the tails cut based on the desired confidence level (Cochran 1977).

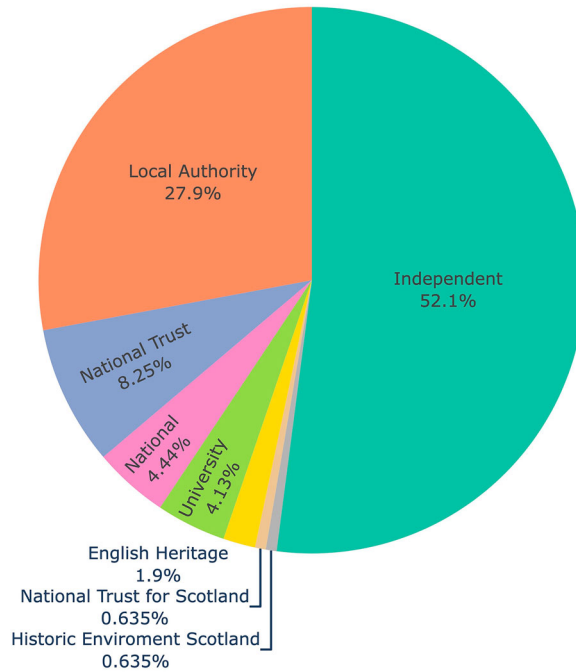$$n_0 = \frac{Z^2 pq}{e^2} \tag{1}$$

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} \tag{2}$$

As applied to the English accredited museums, to achieve a 95% confidence level and margin of error of 5% required a sample size of 315.

The distribution of museums' type in the sample thus reflects those of the accredited U.K. museums and is shown in Figure 1. However, basing the strata on museum type risks

Types of Museums

Figure 1. Distribution of types of museums in the sample dataset.

the sample being skewed in other ways, as types of museums are not distributed evenly – National Trust for Scotland and Historic Environment Scotland are only found in Scotland. The largest discrepancy between the population and sample is found in the South East of England which is underrepresented by 4.3% in the sample, however, Table 1 indicates that when broken down by both type and country, the sample is an accurate to 0.6% in its representation of the U.K. museum sector.

Creating a representative sample has meant that the null data collected can be used to estimate the percent of U.K. museums that do not have a website or presence on social media. With digital inequality in the sector rising, this is a valuable metric that allows us to identify the types of museums unable, or disinclined, to overcome the obstacles to participation. However, there are limitations to a representative sample. As shown in Table 1, the relatively small number of museums in the Channel Islands and Island of Man makes abstractions or comparisons based on that grouping impossible due to the high variability in the data; the results of a single atypical museum would affect our understanding of purportedly sector-wide trends. This effect is also seen when breaking the sample down by size. There was only one 'huge' museum, the British Museum, necessitating its removal from some graphs. However, the other size categories each contained a good number of museums: 120 small, 103 medium, and 88 large (see endnote 2).

Once the sample museums were selected, the names were taken from the Arts Council accredited list and used to scrape the URLs from TripAdvisor – a travel comparison and

Table 1. Discrepancies in the distribution of ONS regions and countries in the accredited museum dataset and sample dataset.

Country	No. in population	% of population	No. in sample	% of sample	(% of sample − % in population)
England	1312	75.8	237	75.2	−0.6
Scotland	255	14.7	47	14.9	0.2
Wales	101	5.8	19	6.0	0.2
Northern Ireland	43	2.5	8	2.5	0
Channel Islands	10	0.6	2	0.6	0
Isle of Man	10	0.6	2	0.6	0
Total	1731	100	315	100	

review site. The process was automated through Selenium, a tool to automate web browsers, and the web scraping library Beautiful Soup (Richardson 2022; Selenium Developers 2022).

The URLs for each of the 315 museums was then checked manually to identify errors. With 4912 U.K. museums listed on TripAdvisor – 721 more than the Mapping Museums Project – the site had a URL listed for almost every museum in the sample. As the world's largest travel website, its large community of contributors was able to validate the links, producing highly accurate results even when the museum itself had an outdated or confusing web presence. Museum websites are frequently not optimised for search engines and prove difficult to find without a direct link or contextual knowledge. This became evident running the names through third part tools such as Clearbit – which returns the domain with the highest web traffic for a given company name – or Crunchbase (Clearbit 2020; Crunchbase Data 2022). These tools only returned results for a third of the sample and illustrate the limitations of web scraping with limited human validation.

The museums' websites were then scraped for links to social media channels, which once again were checked individually. Some form of official website was found for every museum, with 42.5% of museums being hosted by a larger organisation – most frequently by a local authority – while the remaining 57.5% had their own website. Many museums did not provide links to their social media on their website, and a manual check on each social media platform was used to consolidate these results. It is notable that accounts with less than 10 followers were difficult to find even using the search tools of each social media platform.

Using the scraped social media links from the websites, the Twitter and Instagram data were both accessed by generating authentication tokens using the relevant APIs and then using the tweepy and instaloader python libraries respectively to query the data (Roesslein 2022; Graf 2022). As YouTube will be explored in-depth, in addition to the channel information, data from individual videos, such as the upload date and 'viewcount', were also gathered.[4]

Once the data was gathered, it was tested for gaussian distribution visually using quantile-quantile plots and checked against the Shapiro–Wilk test (Das and Imon 2016). With predominantly non-normal distributions, non-parametric methods were used for hypothesis testing (Parab and Bhalerao 2010). Different tests were chosen based on the attributes of the variables and used to identify areas of the data to explore further (Nussbaum 2014). Due to both the small sample size, and the desire of our paper is to understand the relationships between variables, outliers have not been excluded from the figures and

tables without comment but have been highlighted and explained (Rousseeuw and Hubert 2011). Although features of museums' online popularity – followers, subscribers, number of videos – are all integers, they have been treated as continuous variables and simple linear regression was used to model the relationships between them for some visualisations in an attempt to prioritise clarity and utility to museum practitioners.

Results

A reliance on umbrella organisations

Of the 315 sampled museums, 134 (42.5%) of the museums' webpages were hosted by a larger umbrella organisation; in 38.8% of cases, this was by a local authority. A third of museums acknowledged the support of a local authority on their website, which exceeds the number of museums identified as 'local authority' by the Arts Council; notably a third of those who credited a local authority were classed as independent museums. A similar number of museums were exclusively represented by an umbrella organisation on at least one social media platform, while 12.0% of museums had no social media presence of their own on any of the platforms studied. This figure drops to 10.8% for those that also did not have their own website – a disproportionately high number of which are run by a local authority (50%). Across the U.K. there is a discrepancy between countries, and museums that shared a domain are disproportionately likely to be Scottish, Welsh, or Northern Irish; this difference grows for museums with no web presence of their own (Table 2).

The prevalence of platforms

Facebook proved the most popular platform and 85.7% of museums had their own Facebook page, even in the absence of their own website (Table 3). Alternative social media platforms proved surprisingly rare, with only 22 museums (7.0%) appearing to have a presence on TikTok. LinkedIn and Pinterest, were used by less than 2% of museums. These platforms have therefore been excluded from visualisations as subdividing that data by museum size or subject matter would result in high variability.

Unsurprisingly, museums that were not hosted by a larger umbrella organisation were more likely to have their own social media channels, although there is difference between platforms; museums are significantly more likely to have a YouTube account if they are not part of a larger organisation. Continuing the trend identified in Table 2, there is a

Table 2. The reliance on umbrella organisations for domains and social media channels compared by country.

Country	% of sample	% with shared domain	(% with shared domain – % of sample)	% without own web presence	(% without own web presence – % of sample)
England	75.2	66.4	−9.4	47.4	−27.8
Scotland	14.9	20.9	+6.2	31.6	+16.7
Wales	6.0	5.2	+0.6	10.5	+4.5
Northern Ireland	2.5	4.5	+2.0	10.5	+8.0

Table 3. Overview of museums' use of social media platforms, including comparisons between the use of social media platforms between museums hosted by a larger umbrella organisation and those with their own online presence.

	% with Facebook	% with Twitter	% with Instagram	% with YouTube	% with TikTok
Hosted museums	70.9	53.7	36.6	20.1	0
Independent museums	96.7	89.0	74.0	63.0	12.2
All museums	85.7	74.0	58.1	45.7	7.0

higher uptake of social media platforms in England than the rest of the U.K., with the most notable difference found in the use of Twitter (Table 4).

Attributes of popular museums

The relationship between popularity on different platforms was visualised using simple linear regression, and the best fitting line was calculated using the least squares method (Figure 2). Popularity across different social media channels is highly correlated, especially on Instagram and Twitter, and the same trends are found across multiple social media platforms. As there is only one 'huge' museum, the British Museum, it has been excluded from the visualisations in Figures 3-5. With the largest social media following on every platform, it significantly raised the average number of followers on each platform to the extent that it was the only datapoint above the mean, obscuring trends in the data. Three museums for which the size data was unavailable have also been excluded.

With the exclusion of the British Museum, it becomes clear that across all social media platforms, larger museums tend to have larger followings (Figure 3).
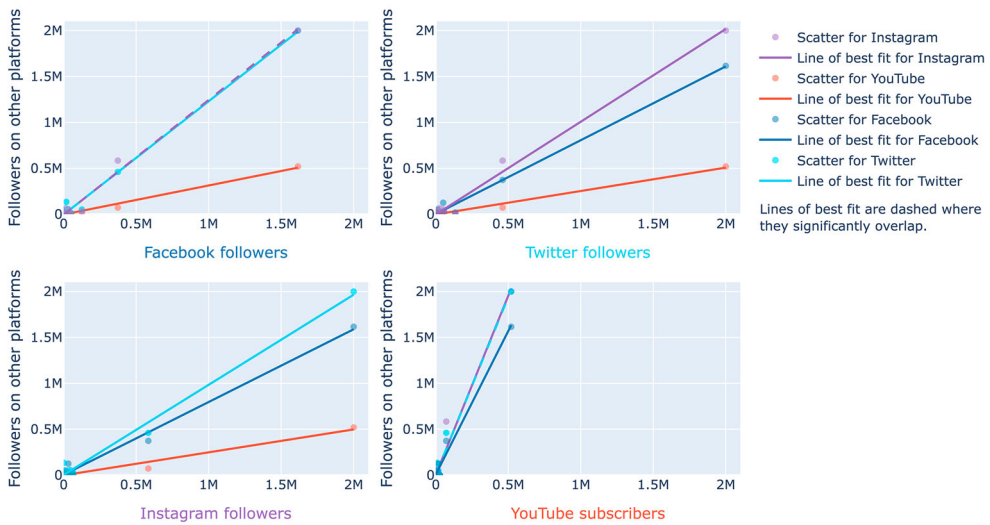
YouTube

By focusing on a single platform, in this case YouTube, it is possible to investigate these trends in much greater depth. 144 of the 315 museums had dedicated YouTube channels, while a further 90 were represented by the YouTube channel of an umbrella organisation or group. Of the individual museums that use YouTube, the popularity of their channels varied dramatically. While the mean number of subscribers to a museum's channel is 4,890, the median is a mere 46, a discrepancy that is also evident between the overall channel views (Table 5). The vast majority of both channels and videos have a small number of views with a few exceptionally well preforming outliers. This is also true when the number of subscribers is broken down by museum size, and there is a relatively

Table 4. Museums' use of social media platforms separated by country.

Social media platforms	% of museums using each platform separated by country			
	England	Scotland	Wales	Northern Ireland
Facebook	89.5	74.5	78.9	62.5
Twitter	79.7	55.3	63.2	50.0
Instagram	61.6	44.7	57.9	62.5
YouTube	49.8	34.0	42.1	25.0
TikTok	7.6	6.4	5.3	0

Figure 2. Simple linear regression showing the correlation between museums' popularity across different platforms.

small difference between the worst preforming 50% of each group, and it is predominantly the top preforming quartile of each size category that contributes to the effect in Figure 3.

The relative proportions of the different size groups on YouTube are similar – within 3% – of the overall sample. Like the sample, the small size group includes marginally more museums than the larger sizes. It is therefore notable that Figure 4, which explores the total number of uploads per size group, indicates a significant increase in the number of videos uploaded by medium-sized museums in March, and they appear to have been the most responsive to the closure of museum sites in mid-March of 2020 (Adams 2022). Large museums also substantially increased their uploads in April, and both groups maintained this increased output over the first lockdown period. However, the output of small museums is unclear from this figure due to the limitations of the small sample size. A close examination of individual channel uploads revealed that the July peak for small museums is largely accounted for by Barnsley Museums. The spike in uploads coincides with them publishing a collection of writing tips which consisted of multiple short videos a day. With their contribution removed (Figure 5) it is clear

Table 5. Distribution of number of channel subscribers and overall channel views for museums' YouTube channels, alongside the mean and standard deviation.

	Minimum	Q1	Median	Q3	Maximum
Channel views	10	1,175.8	6,136.5	62,761.5	55,600,610
Channel subscribers	0	10.8	46.0	409.3	521,000
	Mean	S.D.			
Channel views	644,972.8	4,811,481.2			
Channel subscribers	4,890.5	44,403.5			

The effect of museum size on mean number of followers/subscribers
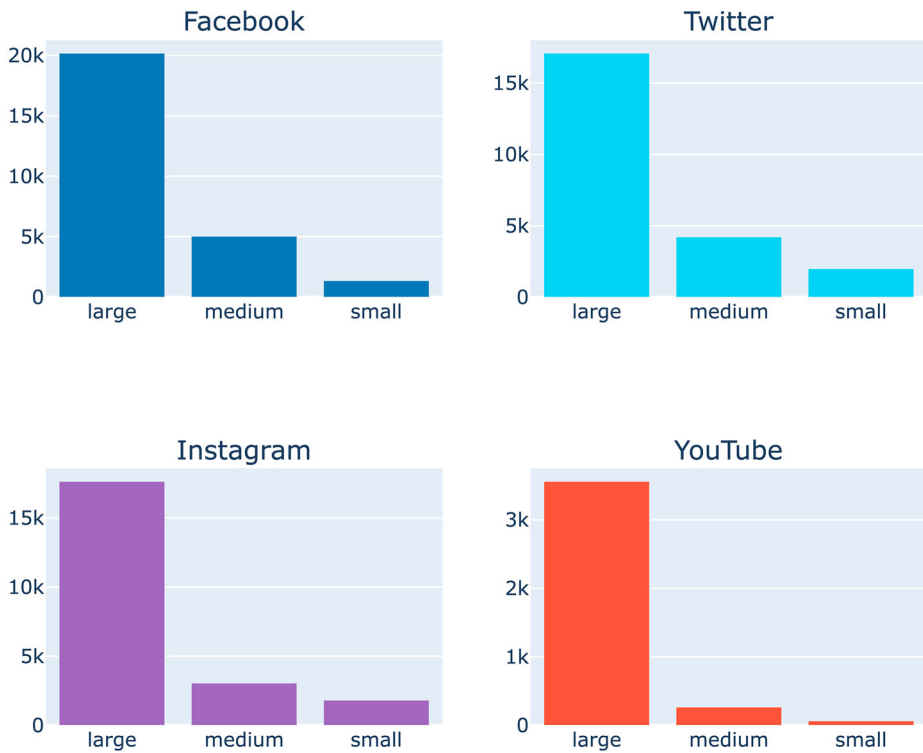
Figure 3. The average social media followings of different museum sizes, separated by social media platform (excluding the single huge museum).
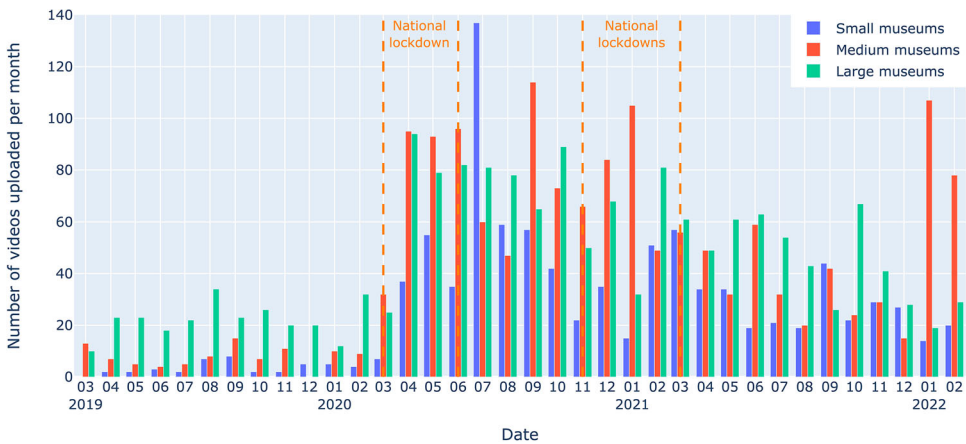
Figure 4. Number of monthly video uploads separated by museum size.

Figure 5. Number of monthly video uploads separated by museum size (excluding Barnsley Museums and Hastings Museum and Art Gallery).

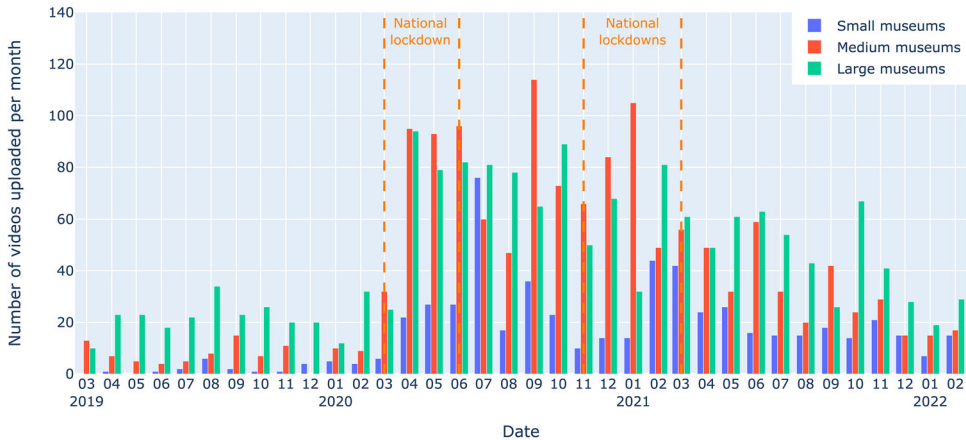small museums' uploads rose, but to a lesser extent than larger organisations, despite the fact that small museums were the most prevalent group in the sample. Similarly, the uptick in medium sized museum in uploads in 2022 evident in Figure 4 was caused by the Hastings Museum and Art Gallery posting 153 short videos over a three-month period and was also excluded in Figure 5.

Audience reception

Figure 6 further explores the increase in uploads in 2020 by comparing the number of uploads with the average number of views in a given month. A peak in the number of views in February 2020 again highlights the limitations of both the sample and the metric, as this outlier is the result of one video uploaded by the Royal Academy of Arts that received 6.6 million views. There is a smaller second spike in May that is due to a video published by the British Museum that had 7.3 million views, but its impact is partially offset by the increase in uploads. Due to the lack of data on when these videos reached their peak popularity, it is likely although not conclusive, that their success was partially bolstered by the introduction of the lockdowns. Once those two channels were removed, it becomes clear that the remaining museums only saw a small increase in views during the early pandemic.

As the number of uploads had risen, it might be assumed that the increased quantity of video content had caused the average number of views per video to drop, while the total number of views had risen. Figure 7 shows that the views did in fact rise for museums over this period, yet considered in the wider context of the last five years (Figure 8), it becomes evident that this growth within the bounds of usual fluctuations and is not necessarily caused by the pandemic. Notably, the rise in views during the pandemic is a return to levels seen in 2017 and was preceded by a significant drop in the number of views between 2018 and 2020.

The number of monthly videos uploaded shown against the average number of views, 2017-2022
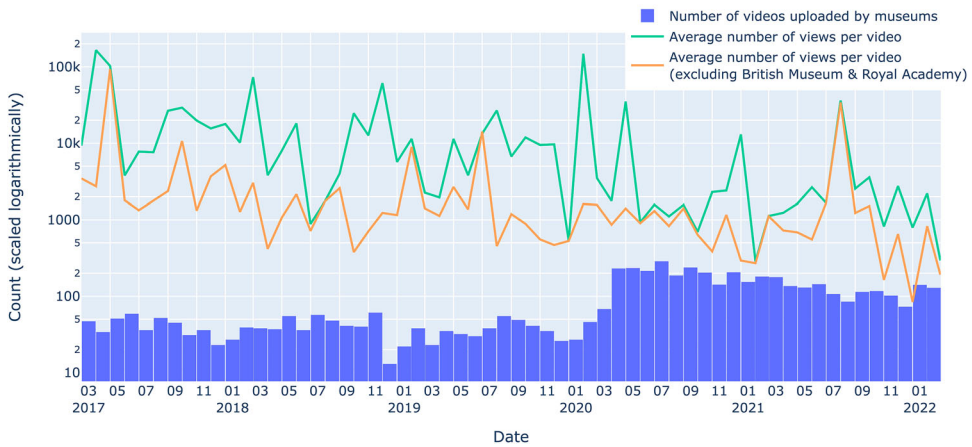
Figure 6. The number of monthly uploads across all museum channels shown against the average number of views for those videos.

Museum output

In this broader context, the more remarkable aspect of the pandemic is not the audience reception, but museums' responses. Looking at the number of uploads over a decade (Figure 9), it is evident that the lockdown had an enormous impact on how museums use YouTube. In addition to changes in the how often museums were uploading videos, the type of content produced also shifted over the course of the pandemic. Table 6 highlights that the proportion of 'People & blogs' content uploaded between March 2020 to March 2021 increased significantly in comparison to the previous year.

Total number of views per month, 2019-2021
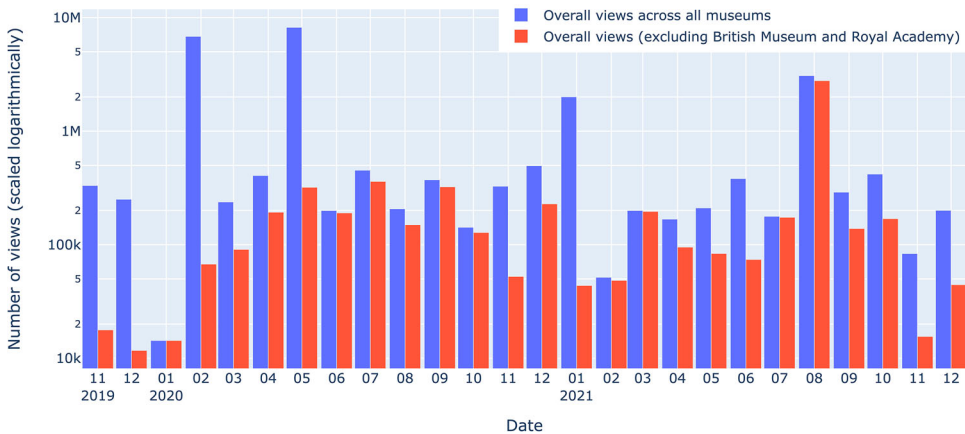
Figure 7. The number of views each month across all museum channels over the past 2 years.

Total number of views per month, 2017-2021
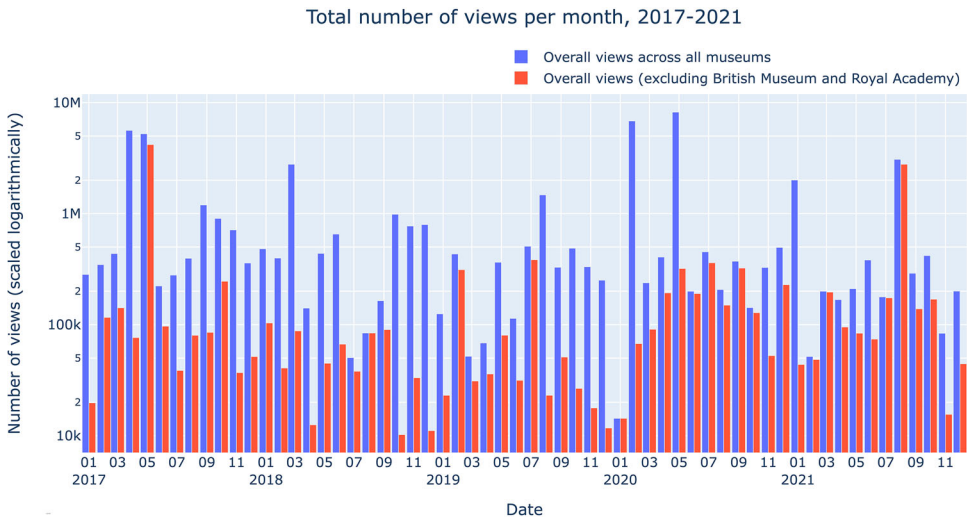
Figure 8. The number of views each month across all museum channels over the past 5 years.

'Education' videos were the most frequently uploaded over the three-year period, and also received the highest average number of views (Table 7). Although the average number of views each 'Education' video received in 2020 shows a drop from the previous year, the overperforming video by the Royal Academy of Arts was in the same category, raising the mean for 2019. This single video also affected the yearly average, while the impact of similar outliers in 2020 were mitigated by the large number of videos uploaded. An inspection of the 'Education' uploads by month, and the fact that the category outperforms the overall average in 2020, both suggest that the decrease in average views was due to the outliers rather than

The number of monthly video uploads, 2012-2021
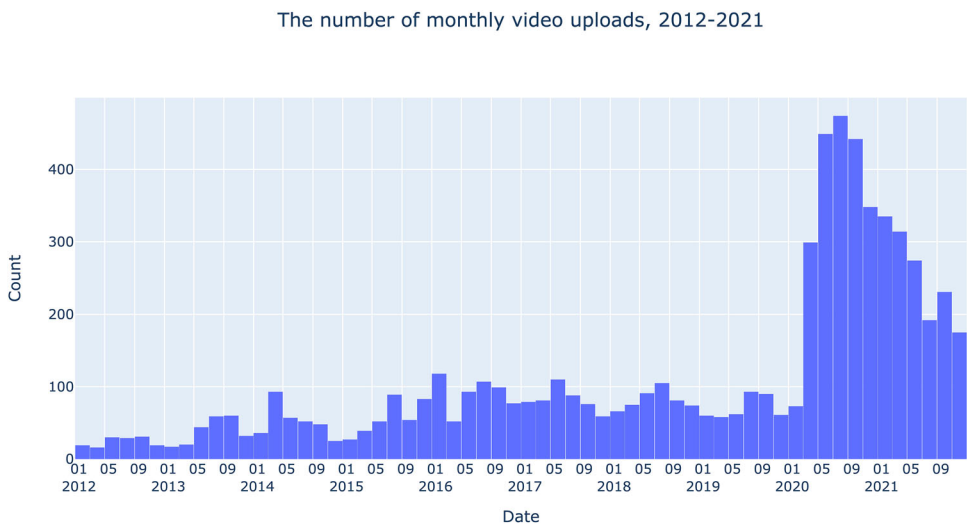
Figure 9. The number of monthly video uploads across all museum channels over the past 10 years.

Table 6. The proportion of different category of uploaded videos compared between 2019, 2020, and 2021 (year beginning 01/03).

|		Year (beginning 01/03)		
		2019–2020	2020–2021	2021–2022
% of the total number of videos uploaded split by video category	Education	32.0	23.5	27.0
	Nonprofits & activism	20.4	18.1	12.1
	People & blogs	18.8	30.3	20.6
	Film & animation	12.6	9.2	11.1
	Entertainment	6.2	5.6	12.0
	Travel & events	6.0	1.8	4.4
	Science & technology	2.3	6.4	4.9
	Autos & vehicles	1.4	1.4	1.3
	Pets & animals	0.2	n/a	0.3
	How to & style	0.2	1.2	1.2
	Music	NA	2.5	4.1
	Sports	NA	NA	0.2
	News & politics	NA	NA	0.8
	TOTAL	100	100	100

indicative of a drop in popularity. 'Education' is also the most common category in the top fifty preforming videos of 2020 (Figure 10).

The same figures show that between 2019 and 2021, 'Entertainment' had the second highest number of average views per video and the highest over the past year. Unlike 'Education', does not correspond with the number of 'Entertainment' videos museums have uploaded; from 2019 to 2022 it was only the 5th, 6th, and 4th most uploaded video category respectively. It is also notable that while more 'People & blogs' videos were produced over the pandemic, they did not perform particularly well. Investigating the statistic further found that 92.8% of those videos were uploaded by medium and small museums, making it difficult to identify why they performed poorly: it may be due to the small audience of the size of the channels uploading them; the inability to gather and respond to channel statistics; or a lack of resources to produce other types of content in lockdown conditions.

Table 7. Mean number of views per video separated by video category compared between 2019, 2020, and 2021 (year beginning 01/03).

		Year (beginning 01/03)		
		2019–2020	2020–2021	2021–2022
Average number of views per video separated by video category	Education	72,060.5	20,087.8	4,289.3
	Entertainment	8802.6	4342.6	14,132.4
	News & politics	NA	102.0	111.7
	Travel & events	422.3	1728.1	4194.7
	Nonprofits & activism	4806.0	1442.5	4683.8
	People & blogs	489.1	751.4	129.8
	Film & animation	244.3	200.6	143.3
	Pets & animals	121.0	NA	96.0
	Gaming	NA	160.0	NA
	Autos & vehicles	288.7	521.8	5,497.5
	Music	NA	1,735.1	505.2
	How to & style	111.0	1,084.3	96.3
	Sports	NA	NA	8.3
	Science & technology	1336.1	419.3	2249.3
	YEARLY AVERAGE	24,791.1	5,586.7	3,853.9

Content categories of the 50 top preforming videos
03/2020 - 03/2021
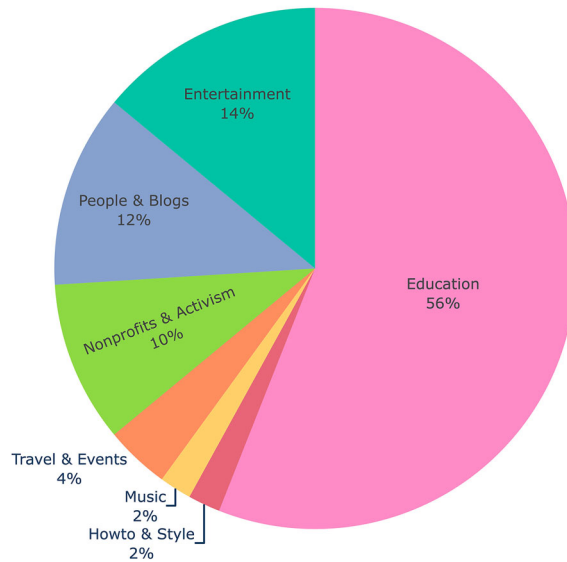
Figure 10. The content categories of the top 50 preforming videos of between March 2020 and March 2021.

Discussion

The dominant narrative over the course of the pandemic was that uploading virtual tours and online exhibitions to a platform such as YouTube offers several advantages to small museums: they offer hosting infrastructure for free; are relatively easy to use; and give museums access to large 'built-in' audiences (UNESCO 2020). Yet, our research has highlighted that it is large museums that predominantly benefit from using social media platforms. While the same museums tend to have large followings across multiple platforms, it is unclear if this is because popularity on one platform makes it easier to establish a larger following on another, or if it is merely that the same museums have the resources, expertise, and content to reach a wider audience.

The resources available to larger museums were perhaps most evident in their response to site closures compared to small museums. A UNESCO report found that at the start of the pandemic 'a large number of institutions have also put digital productions, applications and games from previous exhibitions back online to give them a new lease on life'(2020, 15–16). The use of previously digitised resources enabled museums with existing digital assets and infrastructure to adapt quickly, exacerbating the already prevalent digital inequality (François 2019). Although most museums were able to increase the number of videos uploaded by May 2020, this did not correlate with a rise in the number of views for the majority of museums. This supports the initial findings of a NEMO survey published during the first months of the pandemic suggested that '4 out of 5' museums had increased their digital services, but only '2 out of 5' had seen an increase in online visits (2020, 2–3). The same NEMO survey also highlights the prevalence of educational

content, with museums reporting that 'both educational and collections related materials, including video and film content, were most popular with online audiences' (NEMO 2020, 3).

Considering the cultural context, it is possible that some museums prioritised the services they were providing to their existing visitors over the need to expand their audience. This may explain why 'Education' was the most frequently uploaded category, but 'Entertainment' – which had a high average number of views – was less frequent. With many museums facing permanent closure and seeking financial aid, the 'essential part' museums play in communities and their ability to provide cultural services online became a matter of urgency (International Council of Museums (ICOM) 2020; Samaroudi, Echavarria, and Perry 2020). The conditions of the pandemic, combined with the rise in prominence of the Black Lives Matter movement and the discussions surrounding the toppling of the Edward Colston statue in June 2020, saw many museums actively engaged with their local communities (Frost 2021; Siddique and Skopeliti 2020).

The reasoning behind what museums have uploaded would be an interesting avenue of further research, and our paper's data orientated approach would benefit from follow up interviews with museum practitioners who could contextualise the dataset. It would also be valuable to situate the responses of U.K. museums within the wider museum sector. While we have focused on creating a human-validated comprehensive dataset, using our method, it would be possible to scrape the 48,479 European museums or 24,906 North American museums listed on TripAdvisor without encountering any data limits or fees. As TripAdvisor is predominantly an English-language platform, it is unsurprisingly that the review coverage in Europe and North America is more comprehensive. Studies investigating other continents would benefit from additional data to validate their findings: the site only has 5,668 museums listed in South America; 2,520 in Australia; 1,657 in Africa; and the entirety of Asia has a total of 20,112 listings.

On any continent, the contextual data would be inconsistent between countries, however, such a large dataset would be invaluable in understanding trends in social media content. International data would also clearly show the effect of COVID-19, as lockdown restrictions were enforced at different times in each country.

Conclusion

With a representative sample of 315 museums, our paper is the largest and most comprehensive exploration of U.K. museums' online presence. It has found a significant digital disparity amongst museums, supporting the findings of NEMO and UNESCO surveys conducted during the pandemic (NEMO 2020; UNESCO 2020). It further builds on this research, using a representative sample to address the disproportionate focus on larger museums (Camarero, Garrido, and José 2016). As such, it has emphasised the extent and likely predictors of this inequality; one in ten U.K. museums have no independent online presence, with neither a dedicated website nor social media account on any platform. Local authorities facilitate online participation for many museums with the lowest levels of digital participation – a disproportionate number of which are Scottish, Welsh, and Northern Irish.

Popularity across social media platforms is highly correlated, and a larger museum size correlates with a larger following on every platform. This trend was investigated in greater

depth on YouTube, which found that for the majority of museums, uploading videos had failed to expand their audience reach. With half of the sampled channels having less than 46 subscribers, our paper has made clear that a 'built-in' audience does not guarantee a large one. Most significantly, our research indicates that – contrary to museum practitioners' accounts and prior expectations – the outbreak of COVID-19 did not result in an increase in views for the vast majority of museum YouTube channels. This discrepancy highlights the value of quantitative benchmarks and suggests that a sector-wide retrospective analysis of the other platforms will be crucial in understanding the impact of the pandemic on museums and their audiences. In its investigation of museums' YouTube content, our paper has identified a number of trends:

- The pandemic and consequent lockdowns resulted in a large increase in the number of videos uploaded to YouTube.
- Large- and medium-sized museums were able to response faster to the perceived demand for content, uploading more videos in a shorter time frame than small museums.
- The content uploaded the YouTube changed over the course of the pandemic, with museums producing more 'People & blogs' video content – although this category did not perform well.
- Only the two largest museums in the sample saw an increase in the number of views during the first lockdown. For other museums, their increased uploads to YouTube did not result in an increase in the number of views their channels received.
- Museum channels saw a drop in the number of views between 2018 and 2020 but rose to 2017 levels again in 2021.

This dataset has corroborated much of the survey and interview data gathered over the course of the pandemic and has provided quantitative evidence of trends already identified by museum practitioners. Yet, it is in the discrepancies between museums' perception of audience demand and the data that provides the most interesting avenues for further research.

Notes

1. The data describing high levels of online participation of audiences from Black, Asian and Mixed ethnic backgrounds was gathered in October and November of 2020, and likely reflects an increase in online engagement following the murder of George Floyd and the ongoing work of the Black Lives Matter movement (Mantell and Turpin 2020, 24; BBC 2020).
2. Fiona Candlin et al. (2019, 57) classified museums into four categories based on the annual number of visits: 'small (0–10,000 visits); medium (10,001–50,000 visits); large (50,001 to one million visits); and huge (over one million visits)'.
3. In the U.K., local authorities – most commonly local councils – are responsible for delivering a range of services including social care, housing, and waste collection in a specific region. They predominantly receive funding through council tax, business rates, and government grants (Local Government Association 2022).
4. Authentication tokens were not needed for the YouTube Data API, and the API was queried with get requests.

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Data availability statement

The data that support the findings of this study are openly available in Zenodo at http://doi.org/10.5281/zenodo.7786326.

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