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Working paper on monitoring museum closure and reopening in the UK during the Covid-19 pandemic

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Abstract

Fears of widespread museum closures expressed at the start of the Covid-19 pandemic prompted our research to monitor closures and other museum behaviour in 2021–2022. We wanted to understand how the profile of the UK sector changed in this period. Which museums closed, and what factors were at work in their closure? Did museums that closed have anything in common? Were there any trends or patterns across the sector? To monitor as many museums as possible we employed website scraping and machine learning techniques to perform large-scale data collection and analysis, as well as monitoring news sources. Museums did not close in the numbers expected; on the contrary, closures were reduced from those seen in previous years and few were clearly related to the pandemic. But not all museums reopened once lockdowns were lifted. Many remained closed, and patterns of reopening were unevenly distributed across the sector.

Keywords

Introduction

The Covid-19 pandemic was declared by the World Health Organisation on 11 March 2020 and a nationwide lockdown began in the UK on 26 March. In the months that followed the announcement of lockdown and the consequent closure of many public spaces, surveys of the sector revealed understandable concerns about the future prospects for museums. The International Council of Museums (ICOM) published a survey of 1,600 of its members in May 2020, in which almost 13% of respondents expected that their museum would have to close permanently (ICOM - International Council of Museums 2020, 6). In the UK, Andrew Lovett, Chair of the Association of Independent Museums thought that the impact of the pandemic made it inevitable some museums would 'just run out of cash and go to the wall', with collections potentially being lost (Stokes 2020). Likewise, the director of Arts Council England was concerned that major arts organisations would be put in real jeopardy by the crisis and that some might not survive (Henley 2020). Despite some variance in the anticipated scale of the impact, the widely held view was that many museums were at significant risk of closure. As museums play a significant role in the UK's culture and economy, closures at any scale would entail economic losses and potentially affect the communities that those institutions served.[1]

These concerns were the spur for our project 'Museums in the Pandemic: Risk, closure, and resilience' (MiP), which set out to monitor UK museums during the Covid-19 pandemic. In particular, we wanted to understand how the profile of the UK sector changed as a result. Which museums closed, and what factors were at work in their closure? Did the museums that closed have anything in common? Were there any trends or patterns across the sector? We wanted to work at scale, monitoring as much of the sector as possible. To our knowledge no-one has yet attempted to analyse how the UK museum sector responds to a set of events as they are unfolding, and we wanted to investigate these questions and simultaneously examine how effective our data-driven methods might be for this kind of research.

In addition, until recently there was no long-term or systematic collection of data on closures within the sector, and the best currently available data is from the Mapping Museums database ('Mapping Museums – About the Project' n.d.). Our approach in the MiP project used the Mapping Museums data and also collected (or 'scraped') text from museum websites and social media, using the resulting textual corpus to identify indicators of activities such as closure and reopening, and analysing trends of those indicators during a period of more than a year (Ballatore et al. 2023). In the process we found ourselves having to adapt our methods and develop new systems, and this article is in part a reflection on the effectiveness of our approach.

We also monitored news sources and liaised with sector professionals to gather news of individual museum closures, trying to ascertain whether they were due to the pandemic or had occurred for other reasons. In the process we developed a broad picture of the UK sector that shows a mixed

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[1] For example, museums and galleries in England were estimated to be contributing £1.45bn to economic output in 2015 (TBR Research, Pomegranate LLP, and Scott Dickinson & Partners Ltd 2015).

picture of closure and reopening, and found – against expectations – that permanent museum closures reduced rather than increased when compared to the trend of previous years.

This article focusses on data collected from websites and on individual museums, while our work with social media data will be described in a separate article (Larkin, Ballatore, and Mityurova 2023). The technical details of the data collection and the design of machine learning techniques to analyse the data and to identify indicators of museum activity are described in a further article (Ballatore et al. 2023).

Here we outline the methods we adopted and discuss initial results from the analysis of data scraped from museums' websites relating to museum reopening and closure after lockdown restrictions were lifted. We also discuss how those results prompted further investigation of the data and our methods. Lastly, we detail which individual museums closed, the likely reasons for those closures, and speculate upon the reasons why the scale of closures did not match the expectations initially expressed by some in the sector.

Literature on museums responding to the pandemic – and closure

The majority of studies on museum activity in the pandemic are small-scale, and many of them focus on the so-called 'turn to the digital', the shift to digital communications which was one of the main ways that museums responded to lockdowns and the consequent loss of visitors to their buildings. This digital turn took different forms. One study by King et. al. focussed on temporary exhibitions that had been due to open in the period of the first lockdown in the UK and what, if anything, museums did to replace them (King et al. 2021). Using a selection of museum websites, the authors identified temporary exhibitions that would have opened during the lockdown and analysed the online exhibitions that were put in place as a substitute. Another study sought to understand how so-called 'memory institutions', mainly museums, developed their digital capabilities during the pandemic, using a sample of 83 institutions of which 48 were in the UK and the remainder in the USA (Samaroudi, Echavarria, and Perry 2020).

Burke et. al. conducted a brief survey of digital offerings from a small sample of museums during the pandemic, including virtual tours, exhibitions moved online that would otherwise have opened physically, and crowdsourcing (Burke, Jørgensen, and Jørgensen 2020). A larger study examined how Chinese museums used live streaming to connect with audiences during pandemic lockdowns, assessing the effects of streams on engagement including comments and new fans gained (Jin and Min 2021). At the other end of the scale, a study of just three Italian museums used mixed methods including website reviews to assess what effect the pandemic had on digitisation processes that were already underway (Raimo et al. 2021).

Those studies predominantly examined museum activity via their websites, but other studies focussed on museums' use of social media. A study of the hundred most-visited Italian state museums analysed data provided by the Ministry for Cultural Heritage and Tourism and found that museums more than doubled their use of social media during lockdown (Agostino, Arnaboldi, and

Lampis 2020). Another study examined how museums in the USA had produced digital content, and the effect of that production on engagement with the museums' social media accounts (Ryder, Zhang, and Hua 2021). A questionnaire-based survey of museums in the Attica Prefecture area of Greece found that during the pandemic, most of the museums that responded had increased the time they spent managing social media (Kyprianos and Kontou 2022). Magliacani and Sorrentino surveyed Italian University museums about the first phase of the pandemic (until May 2020) to ascertain to what extent and how they tried to maintain a museum experience during lockdown using a variety of online approaches (Magliacani and Sorrentino 2022).

A further study took a blended approach by examining theoretical models of crisis management and surveying around 1500 Italian museums to understand whether they activated new digital channels as a response to lockdown and what other activities they initiated to maintain a connection with their audiences (Marzano and Castellini 2022).

In the main, these studies were relatively small-scale in relation to the size of the museum sectors in question, sampling selections of museums rather than attempting to gain an overview of a country's entire sector during the pandemic. A different approach was evident in an article that summarised the surveys conducted by the major museum bodies such as ICOM and NEMO, offering an impressionistic overview of trends in museum behaviour during the pandemic using a small selection of examples from across the world (Raved and Yahel 2022); however, this attempt to develop a broader picture is uncommon in the academic literature.

Research on museum closures is mainly limited to individual case studies (for example: Bottoms 2007; Kam 2004). Furthermore, there has been little in the way of systematic data collection on closure. Until the release of the Mapping Museums database in 2020 the most recent museum database was DOMUS, which ran between 1994 and 1999 ('Museums and Galleries Commission: Digest of Museum Statistics (DOMUS): Datasets' 1994), but DOMUS did not keep longitudinal data and publications based on it did not list closures. Some editions of *Museums Yearbook* listed museums that had closed since the previous edition, although that was restricted to members of the Museums Association (For example: Museums Association 1995). The Association also published an undated online map of museum closures since 2005, including 76 institutions (Museums Association n.d.), but the list is not actively maintained and does not include museums that closed from 2019 onwards. The Mapping Museums database is the only resource that systematically records closures.

Methods

Our research in the MiP project began in January 2021 and was therefore underway in a period that included the third national lockdown in England and contemporary lockdowns in the other UK nations. We wanted to monitor as much of the UK sector as possible but with over 3,300 museums recorded as being open in the Mapping Museums database when we began the project, the scale of the task of assessing how the sector responded to the pandemic was considerable.
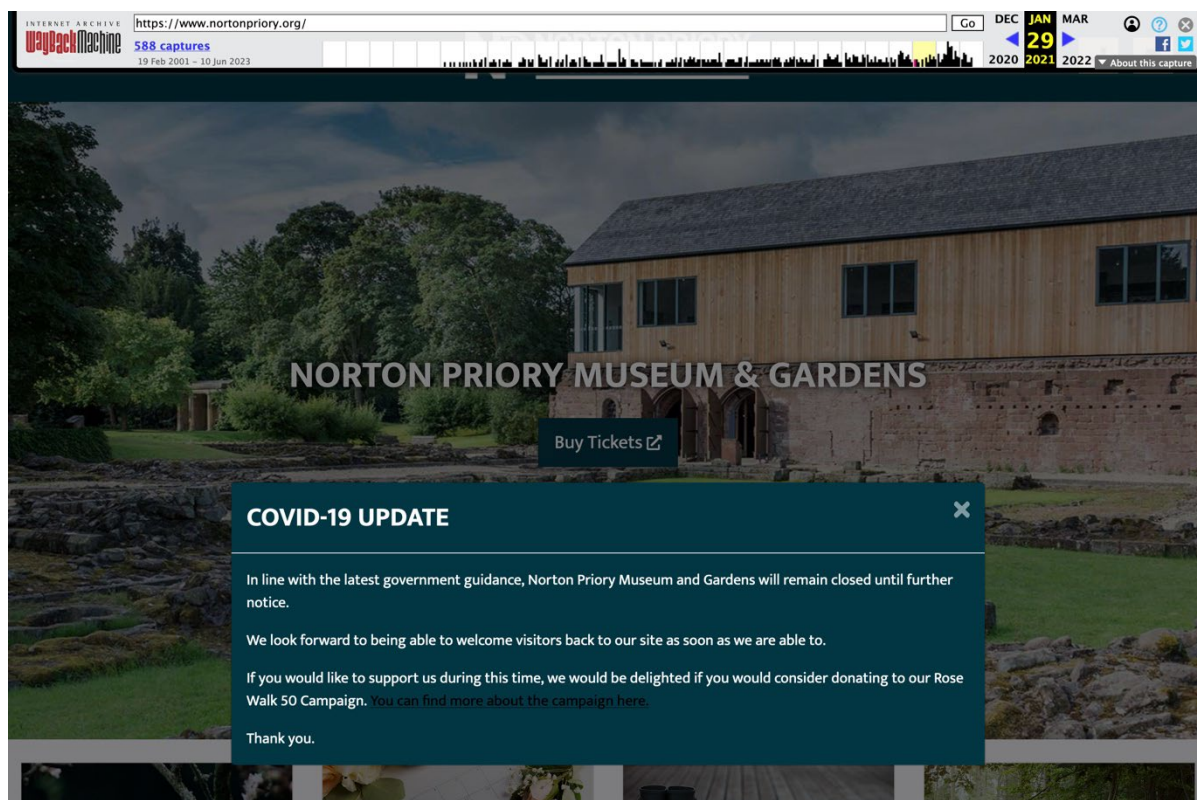
Figure 1. Norton Priory Museum & Gardens website on 29 January 2021, via archive.org.
(https://web.archive.org/web/20210129091338/https://www.nortonpriory.org/)

It was already apparent that many museums were using their websites and social media to communicate whether they were open or closed, as well as using them to fundraise, announce online events, and more besides (Figure 1). Collecting data about what was happening at museums from text displayed on their websites and social media accounts therefore seemed a promising approach to monitoring the sector at scale. However, there were a number of potential difficulties in adopting this approach. Although we had a database of museums (the Mapping Museums database), we did not possess a list of their website URLs or of their social media accounts. Moreover, even a small sample of museums' websites made it clear that museums described what was happening in very different ways. If we were to summarise museums' responses to the pandemic across thousands of museums, we would need to find ways of analysing the data collected to provide evidence of behaviours across the sector..

Another potential problem with using museum websites to monitor changes in behaviour is that the success of that approach is dependent upon those websites being updated to reflect current circumstances. In the course of our research, it became evident that some museum websites were not updated regularly, with a handful appearing to be years out of date. So, while we are confident that the sector-wide trends we describe here are broadly accurate, our results are dependent on websites that may not always accurately portray a museum's actual status.

From the beginning, we did not intend to rely solely on digital data collection and analysis. Our team's experience during a previous project had shown us that local knowledge was invaluable for understanding what was happening at individual museums. We therefore maintained communication with existing professional networks to understand whether the fears of widespread closures were playing out as anticipated. Altogether, this work provides the broadest overview to date of how the UK museum sector reacted to the pandemic.

Our website data collection work proceeded in stages. As we lacked a comprehensive list of museum website addresses (URLs) we began by identifying them, using a combination of automated Google searches, machine learning, and hundreds of manual checks. We started to collect data from those websites in March 2021, a time when many museums were closed due to lockdowns, and repeated that data collection at regular intervals until the end of May 2022. This gave us over a year's worth of data that began with a lockdown and ended in a period when, in principle, all museums would have been able to open without any Covid-related restrictions.

At the same time as identifying websites and acquiring data, we developed a set of textual indicators that would enable large-scale analysis by grouping words and phrases into categories, such as those that indicated that a museum was currently closed. Using a sample of websites we compiled a list of 278 phrases that indicated how museums were responding to the pandemic, which was refined to a set of twenty two indicators that we deemed the most relevant for our research and likely to reveal signals within the data when examined at scale.

However, that list of indicators had to be refined when many of the indicators that had seemed clear in the small sample were not detected within the larger dataset, and after several iterations of the process we arrived at a final list of just six indicators that could be detected at scale. This process also entailed hundreds of manual checks to train and refine the machine learning process. The six indicators included:

- signs of online engagement, such as mentions of events or online exhibitions
- whether additional pandemic-related funding had been received
- whether staff were working despite the museum being closed to visitors
- if the museum was open
- if the museum was closed
- whether it was intending to reopen later on

Those indicators were mapped against the text corpus scraped from thousands of museum websites, using machine learning techniques that search text for linguistically similar phrases. The result is a set of statistical analyses of those indicators across the whole sector. Using the categories already assigned to museums in the Mapping Museums database, we analysed those indicators against variables including museum size, governance, and accreditation.

In parallel, we developed software (the MIP Search App) that allowed us to search the entire text corpus. As we examined the statistical results of our analysis, we often found ourselves wanting to examine the underlying data, either to check results or to understand in more detail some of the trends that we were seeing. The new software showed search results in context and allowed us to filter the results for subgroups of museums using the Mapping Museums database categories.

In addition to this data-driven work, we continued to monitor the sector for developments at individual museums. We used a range of news sources including sector email newsletters and custom Google news alerts to track reports of museum closures and openings. We also liaised with the Museum Development Network and other sector-wide bodies to check our findings and to obtain further information where possible about openings and closings. We followed up reports of openings and closings with further online research and dialogue with sector colleagues, in order to develop as detailed an account as possible of each new and closed museum. It is striking that it is not always possible to determine why a museum has closed, or indeed when the closure took place. Even those working in local museum development networks may not be able to obtain information from the relevant parties about the reasons for closure. Nonetheless, when this micro-level analysis of individual museums is combined with the macro-level statistical analyses of sectoral trends, the result is a picture of the sector at an extraordinary time.

Initial results and variations of closure

Our initial statistical analyses of the sector during this period used the six indicators that we had selected early in the research process. Some of the indicators showed trends clearly, while others did not produce interpretable signals.
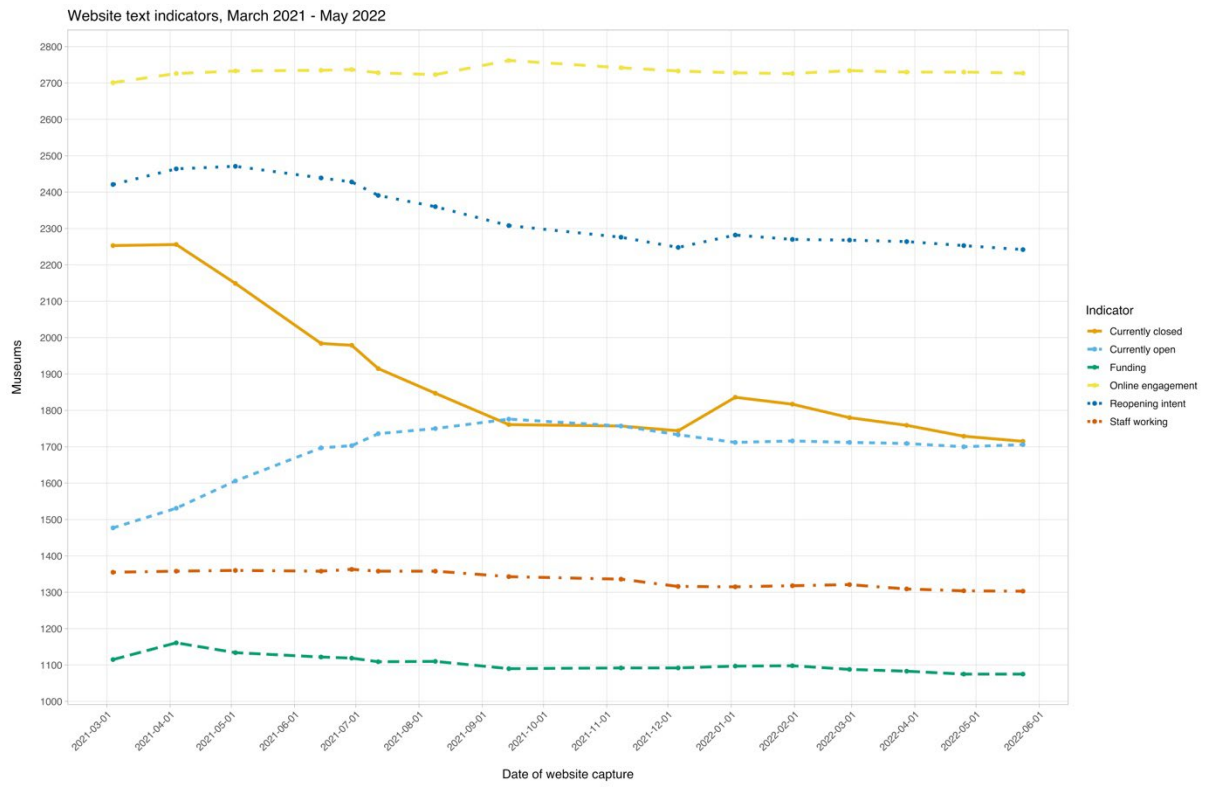
Figure 2. Website text indicators, March 2021 – May 2022
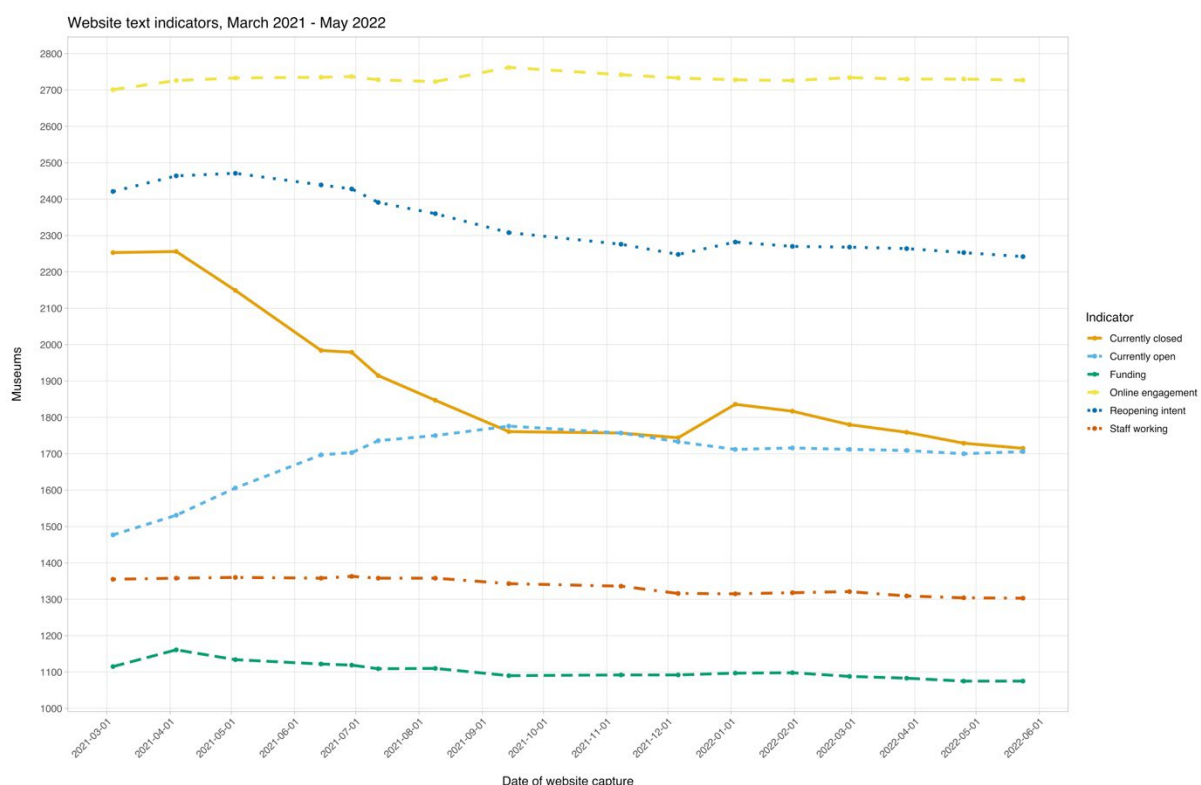
Website text indicators, March 2021 - May 2022

Figure 2 shows the results of data collected between March and November 2021, with lines showing the number of museums for each of the six indicators. There are noticeable trends for currently closed (third from top), and currently open (fourth from top), while reopening intent (second from top) also shows fairly distinct change, albeit on a smaller scale. Slight variation is evident for online engagement (top line), and funding (bottom line), but the indicator of whether staff were working is very flat. The lack of variation in three of the indicators meant that it would be difficult to draw any meaningful conclusions from them.[2] For the remainder of our research we therefore focussed on the indicators that showed the clearest signals, which related directly to opening and closing.

Initial concerns about the future of museums had focussed on the loss of visitors due to enforced closures, and the consequent loss of income. With that in mind, it might have been expected that museums would reopen in line with the lifting of restrictions in their areas, thereby maximising the possibility of income. Our data analysis suggested that this was not always the case (Figure 3).

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[2] By contrast, indicators for social media data were much clearer (Larkin, Ballatore, and Mityurova 2023).
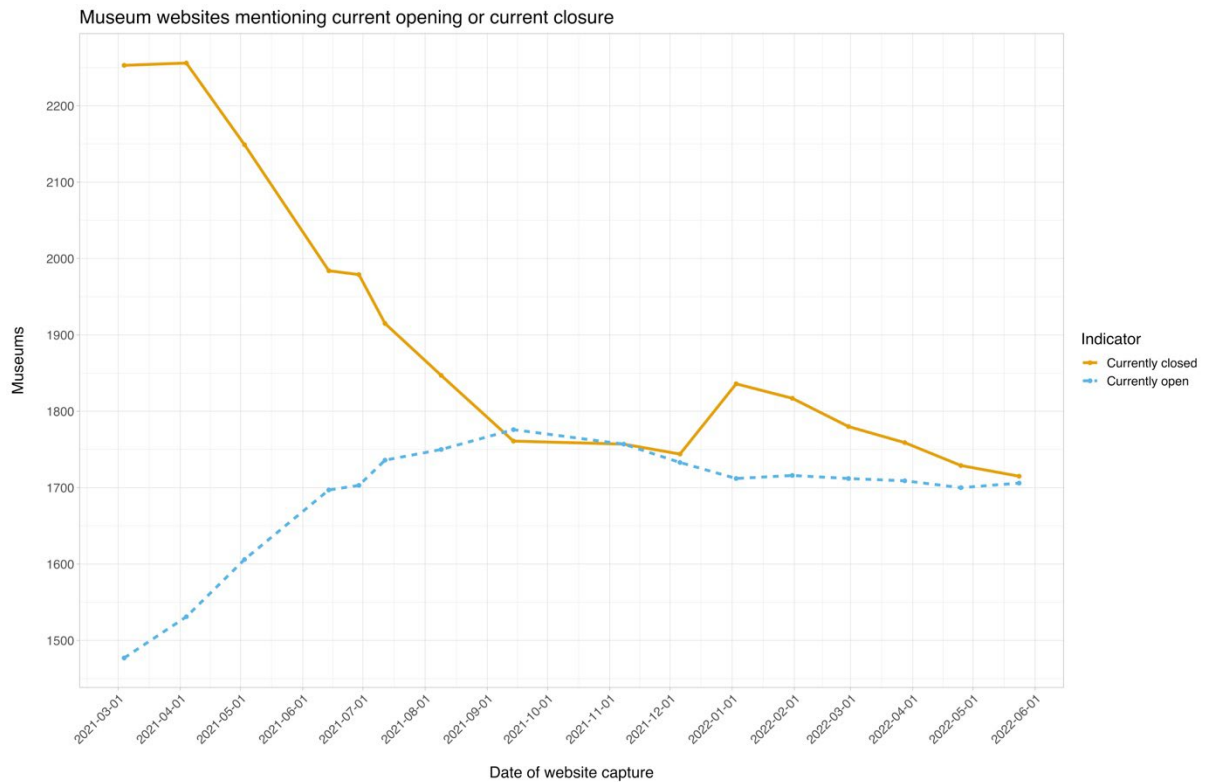
Figure 3. Indicators of opening and closing 2021–2022

In April 2021 we recorded around 2,250 museums stating that they were closed. Museums could reopen in Scotland in April, followed by the other UK nations in stages during May. Those reopenings are mirrored in the downward trend of the 'currently closed' line. However, by September this trend stabilised temporarily at a level much higher than expected. This suggested that many museums remained closed despite being able in principle to reopen, and conversations with museum sector staff confirmed that many museums had decided to remain closed in 2021. But despite that anecdotal confirmation, our figures suggested that over 1700 museums remained closed. As this was more than half of the museums recorded in the Mapping Museums data, this figure seemed very high.

We therefore used our MIP Search App to check those trends against the underlying data (Ballatore et al. 2023). This revealed ambiguities and variations in the way museums describe parts of their site or activities. For example, the language of 'open' and 'closed' was used to describe a wide range of events. Museums announced that they were 'closed for Christmas' or that certain parts of the museum complex were closed, such as the café or galleries. 'Open' was used in a similar way, such as for online exhibitions. So although our machine learning process had correctly identified these terms, the linguistic signals were weak or ambiguous. This made them a challenge for software to identify with precision and may account for some of the attributions of closed status.

These ambiguities of language also serve to highlight variations of partial and temporary closure. Some of these were seasonal closures, which are an annual occurrence for many museums, while

others were variations within a single site where one or more parts were open and other parts were closed. In addition, some museums were temporarily closed for refurbishment. The National Portrait Gallery, for example, closed for refurbishment in early 2020 and is due to reopen in June 2023. Searching the corpus, we found 42 museums similarly closed for this purpose.

The temporary closures of most interest to us were those enforced by national lockdowns. These affected museums in the four UK nations differently, and each nation ran to its own timetable with different criteria for when museums needed to close and could reopen. Scotland, for example, introduced a system of levels in November 2020 that meant museums in some areas, such as Orkney, could remain open while many others were closed due to higher infection levels. In England a tier system was introduced in late 2020 that enacted different restrictions in different parts of the country (Department of Health and Social Care 2020).

This complexity of temporary and partial closure prompted a detailed analysis to check our findings, with particular reference to the accuracy of figures for opening and closing. Using the app to view some of our search terms in their linguistic context, we looked at a random sample of 1200 museum websites (over one third of the total) as they stood in September 2021. In 167 instances searches indicated that the site was closed specifically due to the pandemic (e.g. 'the museum remains closed due to Covid-19'). In a further 212 instances the museum was closed for an unspecified reason, although the majority of those were also likely to be due to the pandemic ('We have taken the decision to remain closed during 2021'). There were a further 12 references to seasonal closure.

We extrapolated from the 167 closures found in our sample to conservatively estimate that some 550 museums, roughly 16% of the sector, remained completely closed as of September 2021, months after the lifting of lockdown restrictions, for reasons connected to the pandemic. Beyond this, other usages of closure referred to specific parts of a site, provided general information on opening and closing times, or less often, references to a museum's history. That information indicates that in addition to museums that were entirely closed, many more were still experiencing some degree of temporary closure. Large numbers of museums did not resume ordinary service.

Trends of reopening and remaining closed

Two indicators mapped to the website data, of current closure and of reopening, showed marked changes as the pandemic progressed, but we found that those changes were not uniform across different types of museum. After lockdowns had lifted, indicators of current opening for the sector as a whole showed a marked increase, but museums did not reopen evenly across the sector. We examined trends of reopening using categories of governance, size, and accreditation status, and found differences in each case.

We examined the three largest groups of museums categorised by governance: local authority, not-for-profit, and private museums (Figure 4). Of those three groups, private museums were the most

likely to remain closed, showing relatively little change between March 2021 and May 2022. Local authority museums and independent not-for-profit museums were far more likely to have reopened, with the largest change evident between April and September 2021 following the lifting of restrictions.
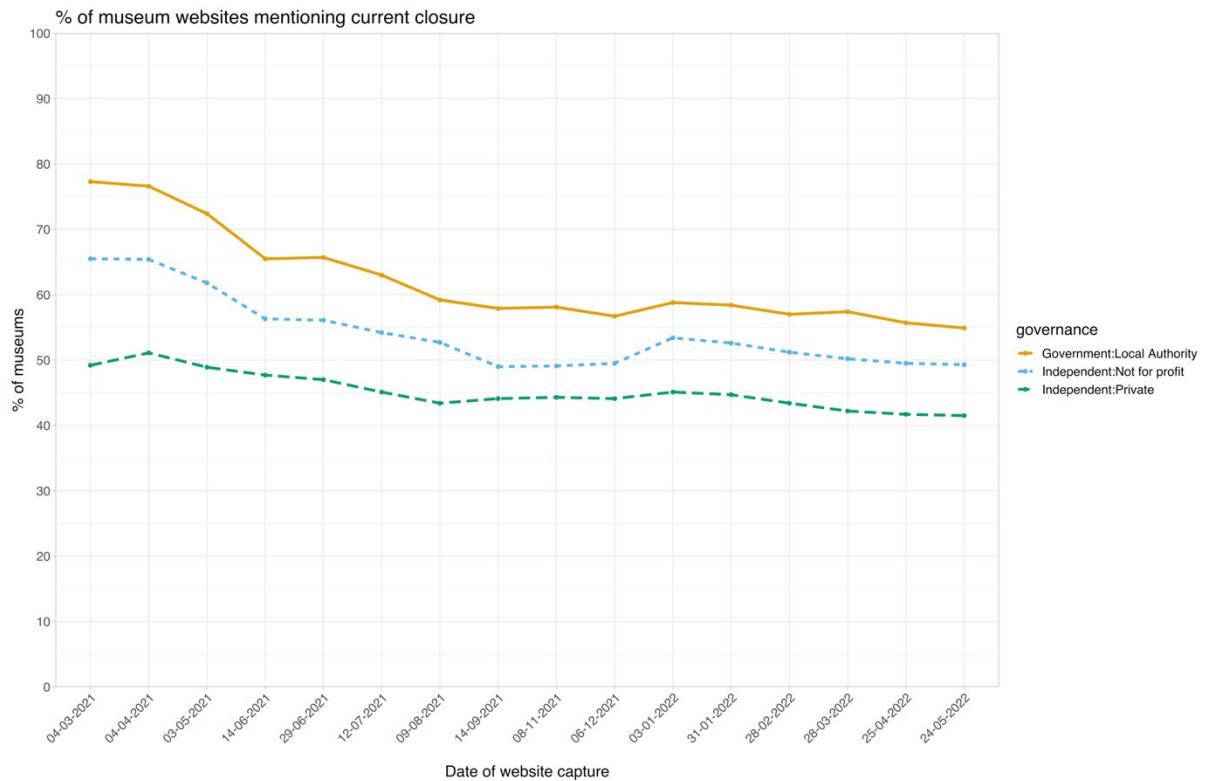

Figure 4. Current closure by governance

We checked those findings using our app to search for whether museum websites in these three governance categories were still mentioning that they were closed due to the pandemic. Comparing the text of websites between April and September 2021, we found that local authority museums were the most likely to have removed such messages from their websites, with not-for-profit independent and private museums slightly more likely to still have a pandemic-related closure message in place.

There were also differences between accredited and unaccredited museums, with the latter showing a much smaller change in status and therefore being more likely to have remained closed (Figure 5). A similar pattern was evident from searching the text of websites for these two groups, with accredited museums more likely to have indicated that they were now open by removing pandemic-related closure messages from their sites.
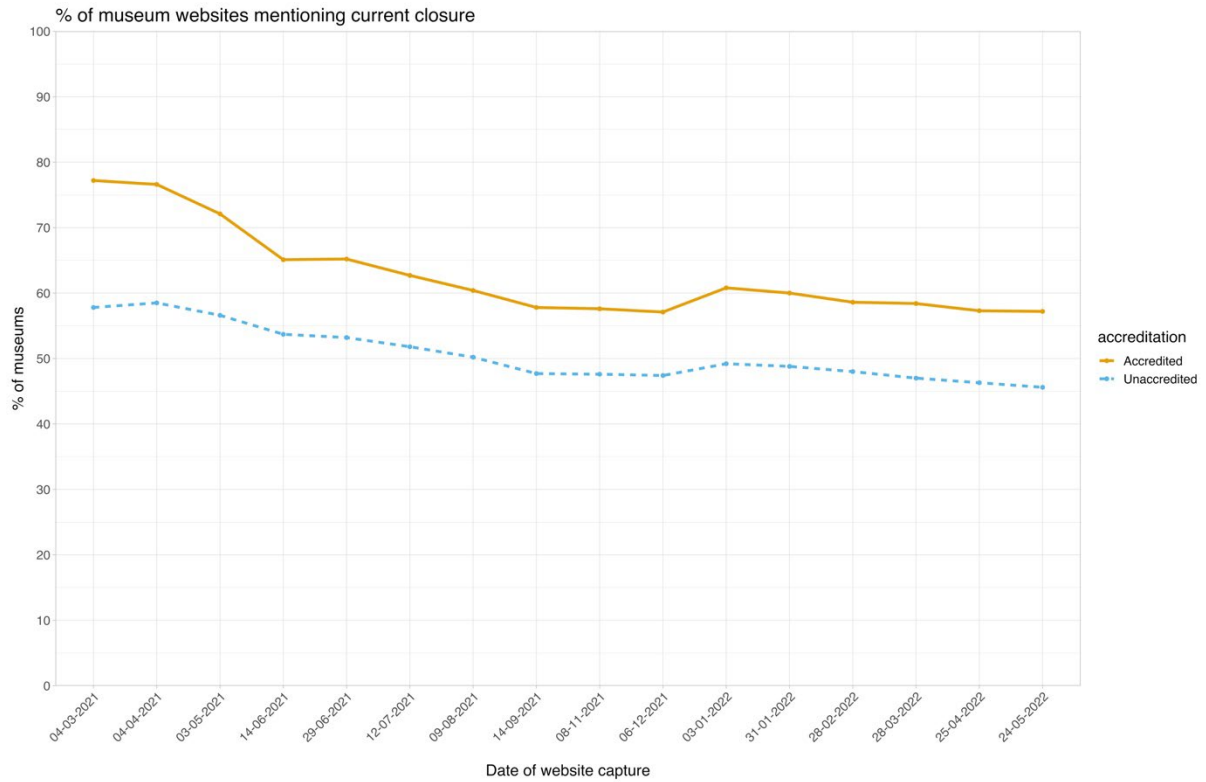
% of museum websites mentioning current closure

Figure 5. Current closure by accreditation

We also found differences between museum sizes in indications of whether museums had reopened (Figure 6). The smaller the museum, the more likely it was to remain closed. Huge museums showed the biggest change and were therefore much more likely to have reopened, while large museums and medium museums changed by a smaller amount. Small museums showed the smallest change, about half that of medium and large museums, and this group is therefore the least likely to have reopened.
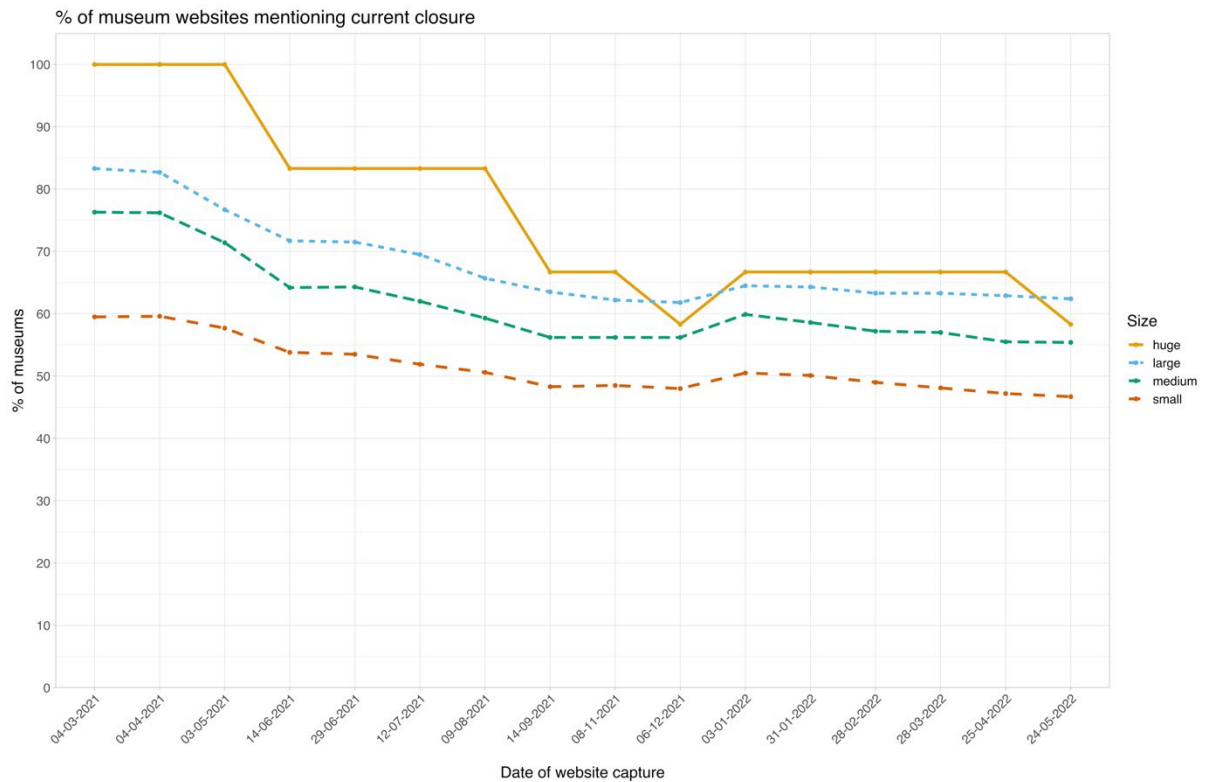
Figure 6. Current closure by size

Our statistical analyses of data collected from museum websites therefore show different patterns of reopening after lockdowns were lifted in April/May 2021. Many museums remained closed despite being able in principle to reopen, and museums which were run privately, unaccredited, or were smaller, appear to have been the least likely to reopen of the groups of museums we examined. One reason for this, in the case of some smaller independent museums, is likely to have been a lack of volunteers (Candlin 2021). The sector-wide trends were broadly confirmed when we checked groups of museum websites for the number of pandemic-related closure notices that were still in place by September 2021. Altogether, reopening was not evenly distributed across the sector.

Individual closures and the role of funding

While our data-driven work was aimed at developing a big picture of what was happening in the sector during the pandemic, we also monitored individual closures. As the pandemic progressed and our analyses developed, we realised that closures were not happening in the numbers initially feared. Through monitoring news sources, collecting information from Museum Development Networks and following up reports with further research, to date we have recorded twelve permanent closures in 2020, three in 2021 and five in 2022. One other closure is of uncertain date and we have assumed that it took place in 2020–21, but this is not confirmed. These figures are significantly less than in previous years. There were 28 closures in 2016, 31 in 2017, and 21 in 2018. The figure fell to 14 in 2019, but the average rate of closures between 2020 and 2022 is far lower than the years prior.

Given the understandable concerns about permanent closures expressed at the start of the pandemic, why might so few museums have closed permanently during the period? One reason is likely to be the extensive funding that was made available by the UK Governments to museums as part of a larger programme to protect cultural and heritage organisations during the pandemic.

The funding arrangements were complex and developed rapidly throughout the first year of the pandemic, although new funding streams were also introduced later. In total, over fifty new funding streams were opened (Candlin and Liebenrood 2021). Some funding was available to museums across the UK, while other streams were particular to individual UK nations or combinations thereof. The grants had different criteria including governance, accreditation status, and the museums' financial position. Museums were also eligible for support schemes that were aimed at businesses more generally. These included the job retention scheme, Statutory Sick Pay rebates, VAT deferral, government-backed loans, and rate relief.

Given the number of funding streams and the variety of their remits, we were unsurprised to learn that some museums struggled to negotiate this complex terrain and that staff from the Museums Development Network had to act as translators and guides for some of the smaller museums. It was also extremely difficult to establish whether particular types of museums were ineligible for some of these funding streams. Yet, despite the complexity of emergency funding, the lack of closures suggests that the schemes were collectively successful in helping museums through this difficult period.

Another unexpected feature of the closures in 2020–22 was that only two of the twenty closures appear to be a direct result of the pandemic. The first was the Jack the Ripper Museum in London. The museum was controversial because its founder originally obtained planning permission for a Museum that focused on women's history, whereas it actually concentrated on the murder of five East End women (Hayward 2017). In a blogpost, Natasha Tidd pointed out that the museum suffered from a lack of local trust, that it had responded to controversy by closing down communication, which would have an impact on its public profile, and that with poorly executed exhibits there was little enticement for visitors to return (Tidd 2020). These were all factors that may have had led to its closure. Given that it was a commercial venue reliant on ticket sales, and (so far as we know) did not receive any emergency funding, it is also likely that its insolvency was linked to the pandemic and the consequent lack of income.

The second closure that can be linked to the pandemic is that of the Hall at Abbey-cwm-Hir in Wales, which closed in July 2020. Unlike the Jack the Ripper museum, the Hall made it clear that it had closed due to the financial impact of the Covid-19 pandemic, with no plans to reopen (Sheehan 2020).

The other eighteen closures were for a variety of reasons. In two cases the museum closed when the owner retired. In September 2020, Inger John, who had run the Pembrokeshire Candle Makers

Centre in Wales, announced that she had used up her remaining candle wax, was stopping production, and that she would be closing the associated museum ('Pembrokeshire Candle Centre - About Us' 2020). The museum exhibits were offered for sale. Similarly, in early 2020 the owner and director of the military museum at Fort Paull, a Napoleonic fortress in Yorkshire, decided to sell the site and retire (Robinson 2020). The owner was eighty years old and keen to find a buyer who would preserve the attraction. A group of enthusiasts formed a company with a view to bidding for the property, but they were unable to raise sufficient funds. The contents of the museum were sold at auction in September 2020 (*BBC News* 2020).

Four museums closed due to the loss of their premises, although why this happened varies. The Commando Museum had been open since 1993 at the Spean Bridge Hotel near Fort William. The property changed hands and with redevelopment pending, the volunteers started looking for alternative accommodation. When that proved unsuccessful, they put the exhibits into storage until such time that a new venue could be found ('Commando Museum at the Spean Bridge Hotel Closed' 2020). Staff at the Maritime Museum in Walton-on-the-Naze in Essex found themselves in a similar situation. The museum occupied a historic lifeboat house owned by Tendring council who in 2015 announced a rent hike, to be introduced in steps. The volunteers were keen to relocate since the building was cold, damp, and situated at the end of a cul-de-sac, so footfall was low, but two attempts at relocation fell through and the museum had to close. According to the East of England Museum Development Network, the collections are in storage.

The Metropolitan Police Service Museum Heritage Centre also found itself out of a home, but in this case it was due to a change of use for the building. Run by the police, and part of that service, the building was moved to secure level operational status, making it off-limits to the general public, and the Heritage Centre was duly closed. It relocated to a new space in Sidcup in October 2022 and visits are by appointment only ('Metropolitan Police Museum' n.d.). The Bruntingthorpe Aircraft Museum in Leicester

shire closed in the summer of 2020 when the site was sold ('Aviation | Bruntingthorpe' 2020). According to an enthusiasts' forum the land was owned by the Walton family and while David Walton had supported the museum over many years, other family members had opted to sell the land for redevelopment as a large carpark. The owners of the aircraft were given until October 2020 to vacate the site. Similarly, the Cornwall Aviation Heritage Centre was forced to close when its lease was terminated by Cornwall Council and the future of the collection of aircraft is uncertain ('Cornwall Aviation Heritage Centre' 2022).

Elsewhere, finances were an issue. The Victoria Cross Trust opened the Ashworth Barracks Museum in Doncaster in 2014 to house their collection of military artefacts. In 2020 they announced its closure, commenting that running a museum had never been among its core objectives, rather they had been established to maintain war graves. No reasons for the closure were given, but the lease on the premises was due to expire in June 2020 and the trust had been struggling to generate enough income to cover the museum's overheads ('Ashworth Barracks Museum – Mapping Museums' n.d.). We were told by Museum Development Yorkshire that parts of the collection were loaned to the National Emergency Services Museum in Sheffield with other exhibits going into storage. Hull People's Memorial Museum also cited financial reasons for their closure in 2022. These included

increasing costs, reduced donations from visitors and, more specifically, the increased difficulty for volunteers of parking near the museum (Brigham 2022).

All the museums mentioned so far were unaccredited, all but one were small and, with the exception of the Metropolitan Police Heritage Centre, run by private owners or voluntary groups. We also know of seven accredited museums that closed, for a variety of reasons. In this category was another museum affected by a change of premises, the Museum of Army Music formerly in Twickenham. The Ministry of Defence had decided to sell Kneller Hall, which housed the museum and other facilities, as part of a wider renationalisation of MoD estates ('Thank You for the Music: Kneller Hall Closes Its Doors after 170 Years' 2021). The museum closed in early 2020 and is now in storage in Chatham until a new location can be found ('Museum of Army Music' 2022).

The Falconer Museum in Forres on the North East coast of Scotland was an accredited local authority museum, and indeed the only museum in the Moray area that was funded by the local council, two others having been closed in the previous six years. Faced with budget cuts of around £10m, in 2019 the council decided to close the museum service with estimated savings of around £87,000 per year. The museum was established in 1871 and exhibited artefacts belonging to the Victorian geologist and botanist Hugh Falconer and his brother Alexander, as well as social history, archaeology and world heritage collections of national and international significance. Attempts to find a third party to run the museum were unsuccessful, not least because the building is in need of repair, and the museum remains mothballed as of May 2023 ('The Falconer Museum' n.d.).

Other museums closed following changes in governance. In 2021, Baysgarth House in Barton-upon-Humber closed. Open since 1981, Museum Development Yorkshire told us that the museum was shut pending redevelopment after management was returned to the local authority, so this closure may turn out to be temporary. Early in 2022, Eastleigh Museum in Hampshire closed. Management of the museum was devolved in 2014 to Hampshire Cultural Trust and One Community, a local health and wellbeing charity. The museum was staffed by volunteers from One Community and served as an access point for their outreach services. The charity relocated their services and Hampshire Cultural Trust stated that the museum generated insufficient revenue to make it possible for them to keep it open ('Eastleigh Museum to Close Its Doors From 1 April' 2022). Flame Gasworks Museum in Carrickfergus also shut in 2022 and, like other examples here, cited a lack of financial resources as the predominant reason (McManus 2022).

Lastly, the Museum at the Mill in Newtonabbey, Northern Ireland, closed in 2020 having been open since 2010, and as of early 2023 the Northern Ireland Museums Council have not been able to discover any information about the circumstances of its closure. This was one of three closures that occurred for reasons unknown. The date of the other two closures is somewhat uncertain, but it seems likely that the Shire Horse Farm and Carriage Museum in Redruth closed in 2020, and the Mechanical Memories Museum in Brighton closed sometime between 2020 and 2021. These two were both small and privately run.

Of these twenty closures, most museums were small or of unknown size, with the remaining six museums thought to be medium-sized. Seven were run on a not-for-profit basis, six were private, and four were run by local authorities. Fourteen – the majority – were unaccredited. In those respects this group of museums broadly follows patterns of closure since 1960 observed by the Mapping Museums project, with the exception that slightly fewer private museums closed during this period in contrast to private museums leading closures over the longer term (27% of closures for 2020–22, compared with 33% for 1960–2019).

What is striking about most of these closures is that they have little obvious relation to the pandemic and instead are due to other more usual factors such as retirement, the loss of a site, the difficulty of finding new accommodation or changed accommodation, lack of income, and government cuts to local authority budgets, often in combination. Not only were the early fears of widespread museum closures not realised, but the rate of closures slowed compared to previous years and, making allowances for the uncertainty surrounding the timing and reasons for some of the closures, only two of them can be directly attributed to the pandemic.

Conclusions

Museums around the world were forced to close their doors as a result of pandemic lockdowns. Surveys by large-scale museum organisations including ICOM revealed understandable fears early in the pandemic about widespread closures, and those fears prompted our research to monitor how the UK sector was responding to the unprecedented circumstances. Our work on the MiP project was a rapid response to an unfolding situation and we adopted a speculative data-driven approach with the aim of testing the effectiveness of new methods and tools for investigating sector-wide behaviours.

In the UK, museum closures did not happen at anything like the scale anticipated. Some museums did close permanently, but overall these were at a level less than that seen in the years before the pandemic. Only two closures were directly attributable to the pandemic, while others were for a variety of reasons less obviously related to Covid such as retirement, loss of premises, or financial difficulties not explicitly linked to the pandemic.

One likely reason for the lack of closures is the extensive funding provided by the governments in the UK. The complexity of the funding arrangements was hard for many museums to navigate, which may be an inevitable consequence of sectoral bodies developing funding streams in response to a rapidly unfolding crisis situation. One lesson to be learned is that simplified funding provision would have made matters easier for everyone involved in applying for support.

Beyond individual closures, we monitored the whole sector using text scraped from museums' websites. To enable this large-scale data collection, we assembled a list of UK museum website URLs, using machine learning techniques and extensive manual checks. We then collected data regularly for more than a year and analysed it using machine learning techniques. Those were informed by

textual indicators derived from a sample of websites at the outset of the project, and we produced statistical overviews of the sector using a small set of those indicators.

Our analysis showed trends in some of those indicators, while other indicators did not produce as clear a signal as we had anticipated. The timing of our project may have had some bearing on these results. We began work in January 2021, ten months into the pandemic, and wanted to start collecting website data as soon as possible. Despite investing considerable time to refine the list of indicators, a process that went through several iterations, had we taken longer to collect a larger sample of indicative website text at the start then clearer signals may have been visible in our analysis.

Nonetheless, some of the clearest trends observed were those in closure and opening; analysing those trends pointed to a mixed picture within the sector with regard to museums reopening. Against expectations, hundreds of museums appear to have remained closed beyond the end of lockdowns. Looking at patterns of reopening, we found that museums in different categories behaved differently and were less likely to reopen if they were privately run, or were unaccredited, or were smaller. While these trends indicate general patterns, the reasons for each museum remaining closed will probably be as individual as the museums themselves.

We also developed a Search App to search our text corpus and this enabled us to investigate the reasons for the trends, some of which were a surprise. Closer analysis of the data using the app revealed that terms such as 'open' and 'closed' can bear a variety of meanings. This reveals ambiguities in the data, but it also shows variations in temporary or partial closure at museums. For example, due to rules that affected indoor and outdoor venues differently, some museums were able to reopen in stages, with indoor areas remaining closed while some outdoor spaces were reopened. As our website data collection covered a period of over a year, we also found seasonal closures as another form of temporary closure – albeit not occurring as often in the data – and refurbishments.

As our observations of trends within the sector during this period are based on data collected from museum websites, the accuracy of that overview depends partly upon what museums chose to announce on their websites, and partly upon the analytical power of the machine learning approaches that we used. But when we checked the statistical trends against the detail of individual websites, in general the micro analysis confirmed that the bigger picture was broadly accurate.

The overview presented here builds upon the comprehensive data on the sector assembled by the Mapping Museums project and shows the potential of that dataset for sectoral analysis, in combination with an experimental set of tools developed in a short space of time. Although our analysis had a particular focus on the behaviour of museums during the pandemic, this kind of sector-wide observation could have many other applications. We look forward to seeing what else might be accomplished with this interdisciplinary combination of data science and museology.

Data availability statement

The dataset supporting this article is openly available from the King's College London research data repository at https://doi.org/10.18742/23253329 and on GitHub at https://github.com/Birkbeck/museums-in-the-pandemic. Some data, including scraped museum websites and social media messages, cannot be republished as open data for copyright reasons. The input dataset about UK museums used to retrieve online content is available at https://github.com/Birkbeck/mapping-museums.

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