TOWARDS A NATIONAL COLLECTION

UKRI Arts and Humanities Research Council

# FINAL REPORT
# COVID-19 PROJECTS

## Digital footprints and *search* pathways: working with National Collections in Scotland during Covid-19 lockdown to design future


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# Executive Summary

With the aim of understanding how people accessed cultural heritage content during the Covid-19 lockdown period, the Digital Footprints project conducted log analysis of access to the digital collections of the National Museums Scotland (NMS) and National Galleries of Scotland (NGS) over a period of 12 months from April 2020 to March 2021 and compared those with the equivalent months for the past three years. NMS has over 12 million objects with about 783,000 available to search online; and NGS's online collection has over 98,000 objects of which about 80,000 are available to search. Both online collections have varying degrees of related content and associated data; and user journeys to collection items vary across platforms due to design and the data around the collection items.

In the report that follows, the key insights from the log analysis are discussed in depth. These insights include:

1. patterns of access during the year saw greater engagement with collections during lockdown compared to the previous years, but with a very significant prevalence of new over returning visitors;
2. most access to the NMS and NGS sites came from computers (desktops or laptops), reflecting the particular conditions of the pandemic but also the continued existence of a broad device ecosystem of access to collections;
3. despite the relevance of many NGS and NMS objects and collections to developing a richer understanding of contemporary social, political and other issues, users do not often search for such issues, and user studies demonstrate that users might not expect to find 'topical or trending' content on cultural heritage collections; and although few online collection items are 'tagged' with language associated with contemporary issues, inconsistencies and what is tagged make exploring online collections challenging for users; and
4. the return on investment for the use of external platforms is mixed and institution-specific. Different collection items gain traction in different places, and the number of items available on the partner platforms does not necessarily translate to more views on the cultural institutions' website.

These findings indicate that collection institutions should consider:

- how to retain users alongside attracting new users, and should investigate why people access their site but do not spend more time which may be indicative of the fact that users don't see what they expect or are unable to find the content that they are looking for;
- the needs of users on multiple devices;
- how the lessons learned from targeting users through email campaigns can inform future digital strategies;
- whether making collections topical and accessible on a large scale is worth undertaking; and
- a strategy for sharing collections with external platforms through wider discussions on: the institution's expectations vs additional efforts and resources required to make content suitable for specific external platforms, the policies on open access, and a longer term strategy on which collections and objects should or should not be shared and with what potential benefits.

Recognising the fact that log analysis studies can't tell us why users do, or don't do, certain things while accessing collections online, and also to explore whether there are any differences in the way collection items are indexed by the institutions and searched for by the users, two controlled experiments were conducted with two small groups of users. This user study revealed that:

- participants tended to utilise the general search bars for open information needs, such as finding the influence art and culture has had on the field of medicine; advanced search was preferred for queries that were narrow in scope e.g., what is the species of a certain frog;
- participants familiar with NMS or NGS utilised more features than new users; in particular, 'explore our collections' from NGS was widely referenced by experienced users to find items as opposed to collection pages;
- participants preferred the search functionality offered by NGS, as they were offered example terms that they could search for. NMS does not provide such terms e.g. people did not know what collections were available to search and incorrect collections would return no results; and
- three barriers relating to the descriptions of items were observed: (1) often items were presented with the same basic tags; (2) omission of important metadata such as a date or names of people and place; and (3) the lack of associated images.

Findings from the user studies, and subsequent discussions with the senior members of staff of NMS and NGS, and with the participants at a webinar in March 2022, revealed that the Spectrum standard which is widely used for cultural heritage content management is not user focused as such, and also that cultural institutions do not use any agreed metadata standards or vocabulary control tools that could introduce standardisation in indexing, and overall meet the requirements of the FAIR (Findability, Accessibility, Interoperability, Reusability) principles. Overall, the findings reveal the needs for:

- Better understanding of user (and non-user) needs and contexts;
- Strategies to prioritise the digitisation and sharing of collection items online, to identify which partner platforms to use and with what benefits, and to reach out to different audiences to achieve different levels of engagement;
- Creation of minimum data standards – metadata, vocabulary, which are user focused; and
- Future use of emerging technologies like AI and ML for linking collections and improving search experience for cultural heritage collections.

# Background

Users of cultural heritage can be diverse, and include members of the general public, subject experts, cultural heritage professionals, researchers, scholars, historians, business and industries, and so on. Different audiences have different backgrounds, and different cultural needs. Therefore, cultural heritage objects have different meanings based on varied user types and their cultural context and information needs (Hooper-Greenhill, 2000).

Society has changed dramatically over the past two years because of the Covid-19 pandemic, which has transformed many aspects of human lives – the way we work, live and function. Digital information and communication behaviours and needs of humans have come into greater focus during the pandemic. The number of users on both internet and social media around the world has increased by more than 300 million between 2019 and 2020 (Kemp, 2020).

A key benefit of digital technologies in the cultural sector is to reach larger and more diverse audiences, including those who were previously disengaged or uninterested (Department for Digital, Culture, Media and Sports (DCMS), 2018). In recent years, in particular during the Covid-19 lockdown period, digital media has played an important means of engaging new audiences in the Galleries, Libraries, Archives and Museums (GLAM) sector. Bailey-Ross (2021) observes that 'the COVID-19 pandemic has had a beneficial impact on audience engagement with, and openness to, cultural digital experiences. However, there is a shift in audience needs both emotional and social created by pandemic lockdowns and audience behaviour will be different after the pandemic, particularly in relation to greater digital engagement' (Bailey-Ross, 2021, p.4).

GLAM organisations have a vital role in addressing societal needs for access to and engagement with cultural heritage, and this role has only increased during the pandemic. During the crisis, nearly 90% of museums, or more than 85,000 institutions worldwide, closed their physical doors for some period of time (Unesco, 2020). As a result, the sector was badly affected both socially and economically. However, in times of crisis, museums are more relevant than ever (https://www.wearemuseums.com/dialoguesonmuseumresilience).

The GLAM sector has experimented, innovated, and found ways to provide access to culture and education during the pandemic, despite the challenges they faced. Many cultural institutions and professionals undertook activities to support local communities, and continued to serve as a source of resilience during lockdowns. Some memory institutions have engaged with less traditional audiences, especially those whose needs are closely linked to the societal developments during the pandemic, such as people isolating, people with dementia, social isolation, mental health issues, chronic pain, and have provided practical support when and as necessary, such as the Black Lives Matter movement during the pandemic (Culture Health & Wellbeing Alliance 2020; Greer 2020; Olorunshola, 2020; Samaroudi, Rodriguez Echavarria, and Perry, 2020; Wali, Williams, and Kelly 2020). Even greater ambitions for digital cultural heritage can be met by museums working together to safeguard humanity's heritage, promote peace and build resilience (https://www.wearemuseums.com/museums-facing-crisis). One important source of shared insight and potential co-operation is in the development of better understandings of users and potential users of digital cultural heritage: who they are, what they want, and how to best support their engagement.

## Users of Cultural Heritage

Digitisation of cultural heritage has created large digital collections that have the potential to open up cultural heritage and reach local and global audiences. However, users often have difficulties in locating objects of interest from very large and distributed collections. Just as in any information system or service, users should be the focal point of the design, management and delivery of any cultural heritage information service (Chowdhury, 2015a). Identifying user interests in different parts of an online collection and investigating the related search behaviour can help to improve system support in Interactive Information Retrieval where users are engaged in purposeful and directed searching (Han and Wolfram, 2016). Users of cultural heritage information can have specific characteristics that need to be considered in order to design the most effective digital information systems that will facilitate interactive and contextual access to information (Ruthven & Chowdhury, 2015). The findings of user behaviour studies can change what an organisation is doing (Farrell, 2017). The use of interactive displays in museums help visitors to learn about the objects and artefacts in an exhibit (Roberts et al., 2018).

However, many cultural heritage institutions have diverse and often very large collections which attract a large number of heterogeneous users, such as researchers, professionals, historians, students, creative practitioners, curious visitors, and so on. However, these diverse user groups have different interests and motivations for search, and it is a challenging task for the institutions to bring together digital content and meet user-specific information needs through an interface that takes a 'one size fits all' approach. It is a huge task to address issues such as information organisation, access, delivery, navigation, use, interpretation; and to understand and support varied users' information-seeking behaviour (Chowdhury, 2015a,b).

There is a clear need for cultural heritage institutions to find out more about how resources can be widely used in ways that meet users' needs. Villaespesa (2019) suggests that "the evaluation framework needs to include metrics to measure the user experience from three perspectives - as a resource for research and learning, as a source of inspiration, and as a tool for planning a visit to the museum". Research shows that "there has been a focus within the GLAM sector on quantitative reporting which lacks detail and nuance in terms of audience behaviours. This leads to a lack of richer and deeper understanding of digital users" (Bailey-Ross, 2021). Digital cultural heritage and digital engagement demonstrated its value during the pandemic crisis "by bringing people together, encouraging creativity, sharing experiences, and offering a virtual space to build ideas together" (Network of European Museum Organisations, 2020). Therefore, it is of utmost importance to understand how people engage with websites and search systems. This can help to identify what information they require, how they look for it and how well the content strategy meets their needs, as well as identifying potential findability issues (Farrell, 2017).

To understand the wide variety of users, and information seeking behaviour that is rapidly changing, is a complex task. Log analysis paints a picture of what users have done in relation to a specific information product or service. Logs provide real-life data that can be analysed to get a true picture of the usage patterns of an information product or service (Chowdhury & Chowdhury, 2011). One of the most important techniques for enhancing users' search experience in large information spaces, is the exploitation of the knowledge contained in query logs (Ceccarelli et al., 2011). Search log data helps to understand the search categories most frequently used by its users (Hale, 2016); identify search patterns related to the success of search sessions (Petras, Stiller, & Gäde, 2014); understand users' needs and their information journeys to develop interfaces that can support them (Speakman, Hall, & Walsh, 2018; Hall, 2018); and to engage the user in a new relationship with digitised heritage (Henchoz & Crank, 2018).

Search log analysis can help stakeholders to see how visitors are struggling to find what they need (Farrell, 2017); and to better understand search behaviour and evaluate search systems (Bogaard, 2018). Log analyses can lead to developing enhancements to the architecture, metadata or content of a digital collection to improve the user experience (Kelly, 2014). However, through log analysis it is hard to demonstrate the level of engagement with content and user satisfaction, etc. Additional tools for automating and analysing user engagement and interactions data are still needed to make log analysis more useful (Kelly, 2017).

A number of previous studies have discussed how to identify users and understand their information needs, challenges and solutions of information access, search strategies and challenges of digital cultural heritage (Petras et al., 2017; Dani et al., 2015; Clough et al., 2017; Europeana, 2014; Haskiya et al., 2015); the cultural artefacts and collections switching from the traditional "keep and protect" mode to the "experience and engage" mode (Krstić & Masliković, 2019); digital heritage embodiment including active participation, task accomplishment, and practical action and feedback from end-users (Rahaman, 2018); assessing museum websites (Walsh et al., 2018); and active senior visitors' perceived value of digital museum transformation (Traboulsi, Frau, & Cabiddu, 2018).

Log analysis can support engagement strategies (Walsh et al., 2019). The analysis of transaction logs provides insights into users' searching and navigational behaviours and support engagement strategies (Walsh et al., 2019). A number of documented activities identified in the server logs can identify potential user groups that emerge from the data (Walsh et al., 2019; Villaespesa, 2019); and user categories (Walsh, Clough, & Foster, 2016). Some research studies help clustering sessions identified in user logs (Bogaard et al., 2019a; Giannopoulos et al., 2011; Brida, Meleddu, & Pulina, 2016; Jorion et al., 2020; Moreno-Mendoza et al., 2021).

Text mining techniques can also help cultural heritage institutions to deal with huge data sets and obtain more representative results (Chardonnens & Hengchen, 2017a; Chardonnens et al., 2018). However, it is resource intensive (Chardonnens & Hengchen, 2017a, 2017b) to analyse users' behaviours to generate effective models (Trabelsi et al., 2019).

Skov and Ingwersen (2014) identified four main characteristics of online museum visitors' searching behaviour, viz., a highly visual experience (such as, photographs are used as scanning, identification, selection, and zooming devices); exploratory behaviour (such as, accidental discoveries across search tasks); broad known item/element search (users know what they are looking for; in other words, browsing through a list of results to find the known item); and meaning making (users rely on their specific background knowledge and experiences and putting the retrieved information in context). Segmenting user sessions can help to perceive information needs and assess how they are satisfied, and to better direct content to certain users (Gomes, Martins & Cruz, 2019); and studying users using cluster analysis and classification (Walsh et al., 2019, 2020, 2021). More collection-oriented questions may be addressed when studying the logs, for example, whether users need different support in different parts of the collection (Bogaard et al., 2019a).

Previous research shows how to identify different types of search behaviour using the metadata explicitly, for example, how to explain and predict user interactions for the different types of behaviour found (Bogaard, 2018); how to use metadata categorization as a way to analyse distinct search patterns in a collection (Bogaard et al., 2019b); and how different methods to find sessions containing specific topics can be applied by digital humanities scholars and practitioners (Bogaard et al., 2021). Metadata Augmented Graphs for User Sessions (MAGUS) allows professionals to extract more valuable information on how users

search within a collection (Bogaard et al., 2020); a framework-based approach helps users to have the possibility to interconnect the events to cultural heritage objects and the other way around (Dorobat & Posea, 2019). Hale (2016) notes that while seeking art information, the department, classification, and artist fields have the highest usage while searchers rarely submit specific medium-related queries; and Petrelli et al. (2016) show the benefits of a tangible data souvenir for an interactive museum exhibition. The concept of faceted search – where a user can narrow down the search results by using multiple facets or filters relevant for the search topic – is understood naturally and easily by most and it improves the search accuracy; however, the faceted search doesn't shorten the search time and it is used more for open-ended tasks and difficult tasks that require more effort to learn, investigate, and explore (Niu and Hemminger, 2015).

Evidence shows that online access to museums' collections is increasing, but high numbers of users are looking at only one or two pages within 10 seconds and then leaving (Walsh et al., 2017). Therefore, it is important to have a better understanding of the types of users who visit museums' websites, such as the users' motivations, tasks, engagement and domain knowledge. However, results show that the frequently understudied general public and non-professionals make up the majority of the users (Walsh et al., 2017, 2020). Some research shows the relationships between online collections and their visitors (Villaespesa, 2019; Walsh et al., 2016), but it is important for museums to create multiple kinds of online experiences to reflect the kind of motivations, art background, context, and online behaviour of website users (Villaespesa, 2019).

The museum's own web site and digital collections interface and optimisation is just one part of the story of digital engagement with cultural heritage. Many cultural heritage information services can be accessed through "what is known as referrals, where the users are referred to them by search engines" (Aparac-Jelusic, 2017). Platforms like Wikipedia and Wikimedia have a global audience, and hence are used by many cultural institutions for sharing their content to draw more users and build audiences and awareness. Research examining the different ways in which different museums handle open access policies, exemplified by case studies of three institutions in the United States: the Metropolitan Museum of Art, the Cleveland Museum of Art, and the J. Paul Getty Museum, noted that "a credit line is a way for museums to advertise their name and publicise their collections, which can increase visitorship in the physical space and viewership of online museums" (Hoster, 2020). However, many museums have no clear strategy for sharing content with partner platforms, and often their institutional copyright policies prevent them from engaging and openly sharing all their collection information. Institutional identities and philosophies are reflected in technological choices and content provision (Gil-Fuentetaja & Economou, 2019), but various strategy and policy factors can be barriers to achieving reach and relevance and to meeting audiences "where they are" - for example on Wikipedia (Dickison, 2018). Nevertheless, log analysis can indicate opportunities for wider reach.

A further challenge to understanding user experience and information needs online comes from the variable quality of digital objects and collections themselves. Most of the time the metadata associated with images is either sparse or inconsistent, and this makes keyword-based exploratory search difficult and therefore slows down the research or engagement process (Eramian et al., 2016).

Understanding users and their contexts is a prerequisite to designing usable information systems (Chowdhury & Chowdhury, 2011). Personas provide a way of thinking and communicating about how groups of users behave, how they think, what they want to accomplish, and why (Brummer, 2021; Cooper et al., 2015). Falk (2009, 2016) identifies five distinct personas or Museum Visitor Motivation Identities: explorers, facilitators, professional/hobbyists, experience seekers, and rechargers. Once a museum understands who visits them, they can design the right experience for their visitors (Falk, 2016).

Understanding museum personas can help museums to prepare marketing and communication tools that appeal to their target audience and encourage their return visits (Abrams, 2019).

Some researchers have used the concept of personas to model users into distinct sub-populations of museum visitors, and studies show that museum visitors can be clustered by their visit motivation and perceived success factors, and consequently, these two features can be used to reliably identify the visitor persona, and therefore, can be used for user modelling (Almeshari, Dowell & Nyhan,2019; Not & Petrelli, 2019). However, personas, just like real people, can and do change over time as personal experiences change and therefore, successful museums will modify their strategies and designs accordingly (Abrams, 2019).

Some research demonstrates new forms of knowledge creation activities around cultural heritage content, for instance on social media platforms (Budge, 2017; Camarero, Garrido, & San Jose, 2018; Cunningham, 2019; Pierdicca et al., 2018; Vi et al., 2017). Budge (2017) notes: "the implications are extensive for cultural institutions given the uptake of social media in all corners of life, with museums and galleries being a lively context for social media use via mobile technologies". In addition, various approaches have been taken to open GLAM collections to wider audiences, such as: generous interfaces (Whitelaw, 2015); digital museum map (DMM) (Hall, 2018); thematic maps (Mauro, 2019); tag-based browsing interfaces from the user's point of view (Yi-Ling et al., 2019); and search-based interfaces (Windhager et al., 2019). Usage data provide an opportunity to assess whether the efforts made by institutions to develop new ways to access collections actually meet users' needs (Chardonnens et al., 2021); and the role of technologies in cultural heritage domains and interactions (Budge, 2017; Cunningham, 2019; Marín-Morales et al., 2019).

The exploration of needs through user queries can be enhanced and semi-automated by making use of natural language processing (Harris et al, 2020), and knowledge bases published as linked data (Chardonnens et al., 2021); and introducing an open data framework to enhance the discoverability and impact of culture heritage (Candela et al., 2019). Search query processing and the application of NER (named entity recognition) in particular is a significant step toward a better understanding of user-generated inputs in information retrieval systems (Cowan et al., 2015). Recent research sheds light on to what extent users perform queries based on a personal name or a place name and therefore, place names and personal names extracted from the queries may be used as a new stepping-stone for more in-depth studies of information-seeking behaviour (Chardonnens et al., 2021). Dijkshoorn et al. (2018) note that it is beneficial for institutions to provide their datasets as Linked Data in order to achieve easy cross-referencing, interlinking and integration. Within the more specific area of online digitised newspapers, De Wilde and Hengchen (2017) evaluated user demands before focusing on the potential of named entity recognition and linked data to semantically enrich multilingual archives metadata and evaluate user demands. However, the scarcity of training data for NER for cultural heritage poses some difficulties; therefore, a semi-automated approach to create high-quality training data by leveraging existing cultural heritage resources has been proposed (Jain & Krestel, 2019).

Users' information seeking behaviour is of utmost importance, and more research needs to be done to support wider access to vast and rich cultural heritage collections. For instance, Davine (2015) suggests that more interconnected initiatives within museums would help support visitor experiences by providing more seamless transitions between digital channels. Building more usable, user-centred and value-added information services can ensure economic and social sustainability of cultural heritage information systems and services (Chowdhury, 2015b). Konstantakis et al. (2018) argue that user modelling can describe the interaction process between users and cultural heritage applications and products. Falk (2016) stresses that museums should strive to meet a diversity of visitor needs. Engagement with museums and galleries both

online and offline remains deeply varied (Mihelj, Leguina, & Downey, 2019). There are some barriers to digital accessibility for particular groups (Samaroudi, Rodriguez Echavarria & Perry, 2020), but digital provision catering for disabled audiences during the Covid-19 crisis has proved very limited (DCMS, 2020). Darvishy and Manning (2020) propose a set of guidelines to recognise the barriers faced by disabled people in getting access to cultural and linguistic heritage.

Forty percent of museums have noticed an increase in online visits during recent years, but as Bailey-Ross (2021) has noted, this does not provide direct evidence for meaningful audience "engagement, understanding and appreciation" - and accurate data on user behaviour is still much needed. Data on search engine queries can provide almost real-time indicators of visitor interests, priorities, and wider social changes that might influence how such engagement is taking place, or could take place (Botta, Preis & Moat, 2020). Attempts to harmonise the metrics used to measure online visits can also "facilitate benchmarking and assist decision-making and resource allocation" (NEMO, 2020).

It is evident that the Covid-19 crisis has been a pivotal moment for museums and the heritage sector more generally, having accelerated the need for relevant and meaningful digital practice. It is important that museums consider their digital strategies and evaluate audience needs rigorously when developing online offerings to increase the value to users of cultural content (King et al., 2021). There is a potential that museums can attract new audiences online, and meet objectives for reaching outside their expected or existing audience demographics (Thelwall, 2018). Improving ways to connect communications and collections online will drive interest in the collections themselves, demonstrate their social relevance and capacity to strengthen social bonds and build resilience (Samaroudi, Rodriguez Echavarria, & Perry, 2020). More focus on the information needs and behaviours of a wider group of users can lead to increased usability and reduced digital exclusion. Going forward, understanding different audiences and their diverse needs, and developing services and content that can bring collections and users closer, should be the focus of cultural heritage institutions and the sector as a whole.

# Project Introduction

'Digital footprints and search pathways' was one of three projects supported by the Arts and Humanities Research Council's Towards a National Collection programme (TaNC) as part of UKRI's call for Covid-19 projects[1]. With the pandemic severely affecting every aspect of daily life, including the human need to connect with collections held in museums and galleries, there was a clear opportunity to investigate peoples' engagement with cultural heritage sites in Scotland during lockdown. National Galleries of Scotland (NGS) and National Museums Scotland (NMS) offered two interesting case studies, since Scotland's arts and culture sector was disproportionately affected by the pandemic in comparison to the rest of the United Kingdom[2]. The lessons learned from the findings from this project may therefore be used to improve online engagement as we move towards a new way of life where digital practices have a more prominent role throughout society.

The goals of the project also align with the wider research priorities of the United Nations Educational, Scientific and Cultural Organisation (UNESCO), who aim to increase access to culture and heritage online, support the resilience of artists during crisis situations, and bring governments together to improve on existing policies[3]. UNESCO estimated that at the height of the pandemic, 89% of all world heritage properties experienced some sort of closure and therefore lost millions in revenue each day. In addition, these institutions were often unprepared for a sudden shift towards digital provision, due to patchiness in their online resources and a lack of expertise and budget to make changes[4], which exacerbated financial concerns. This further highlights the need for improved digital provision in general, but especially in preparation for future crises.

The project was split into two parts to determine:

1. How people engaged with the online collections of NGS and NMS during the Covid-19 pandemic and whether lockdown changed digital access patterns; and
2. How the knowledge of online access patterns can be used to design search pathways that can lead to an ontology-based approach to linking collections combining the user search terms and semantics-based representations of the collections/items accessed.

The first part of the project involved a longitudinal study of the digital footprints of users across the two national collections. Access patterns were analysed during the first 12 months of lockdown and compared with the same time periods from the previous three years. Changes in these patterns were then fed into an internal workshop with all project partners to discuss implications for the policies of NGS and NMS, as well as the wider sector.

The second part of the project aimed to understand what barriers exist across the search pathways and interfaces of NGS and NMS and what improvements can be made to enhance user experience. This part consisted of a user study to identify the characteristics of collection items deemed most important when

[1] https://www.nationalcollection.org.uk/Urgency
[2] https://www.museumsassociation.org/museums-journal/news/2020/05/29052020-scotlands-museums-disproportionately-hit-by-covid-19-crisis/#
[3] https://en.unesco.org/covid19/cultureresponse
[4] https://www.artfund.org/blog/2020/05/28/covid19-impact-research-report

searching, in addition to the search strategies employed across the sites. This enabled us to compare current metadata standards with end user search queries, whilst also identifying user experience barriers across the interfaces of NGS and NMS.

In summary, 'Digital Footprints and Search Pathways' highlights that a better understanding of digital user context and access behaviour can help cultural institutions create meaningful representations of national collections to increase access and user satisfaction.

## Project Team

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# Overarching Methodology

As highlighted previously, the project was split into two distinct phases of work to determine how Covid-19 affected online access/provision for NGS and NMS and the changes that can be made to their search infrastructures to increase such access as well as user satisfaction. The considerations that led to this split will be discussed below.

## Phase 1: Longitudinal Study of Access Patterns

At the start of lockdown, the online provisions of NGS and NMS varied widely. NGS' collections included over 98,000 art works, of which about 80,000 had digital assets represented on the NGS website. Whereas the NMS collection comprises over 12.4 million objects and specimens, of which 783,319 items are accessible via the NMS website. Both worked with Google Analytics[5] to monitor and report on the traffic received by their respective websites. Due to the discrepancy in both the size and representation of each institutions' online collection, their web traffic data was embedded in a separate longitudinal log analysis. Access patterns from the first 12 months of lockdown were split into blocks of four (April to June 2020; July to September 2020; October to December 2020; and January to March 2021) and compared with the same periods from the previous three years. Such a process meant that we were able to study the wider effects of Covid-19 but also the difference in access patterns as lockdown restrictions changed. A half-day workshop was carried out in November 2021 with the project team and additional relevant stakeholders to discuss how the results can have a positive impact on the policies of NGS and NMS. In addition, we hosted an online seminar in March 2022 to share findings, and discuss their potential implications for NMS and NGS, and the cultural heritage sector as a whole.

## Phase 2: User Study on Search Pathways

Performing a log analysis of access patterns has its limitations. For example, the data did not clearly highlight who the users were, what their intentions or motivations were, and whether their information needs were met. Such aspects were of particular importance to the team members from NGS and NMS, to drive potential user-centred improvements to their digital provisions, thus promoting access and overall experience. Therefore, user studies were carried out with experienced and inexperienced visitors to the NGS and NMS sites to determine whether the search features and infrastructure provided matched their own needs and ways of searching. This involved looking into the metadata assigned to items, as well as the overall design of each site.

More details on the studies are provided in their respective sections, below.

[5] https://analytics.google.com

# Longitudinal Analysis of Access Patterns

A log analysis of the access patterns from the first 12 months of lockdown was conducted for NGS and NMS and subsequently compared with the previous three years. This enabled the team to determine what changed during lockdown and the potential improvements that can be made to the internal policies of NGS and NMS, focusing on their digital provisions.

## Methods

As discussed, the log analysis of access patterns was split into blocks of four (April to June 2020; July to September 2020; October to December 2020; and January to March 2021) and compared with the same periods from the previous three years. This process facilitated an analysis of the wider impact of Covid-19 but also how engagement changed as lockdown restrictions eased. Table 1 incorporates a list of the attributes considered, along with their reasons for inclusion. The 'General Log Analysis' section discusses the main outcomes from the analysis, with the findings driving further explorations into: the use of external platforms such as Google Arts and Culture; users' engagement with trending and cultural topics; and the structure of the most and least popular collection items. These topics are discussed in their respective sections.

**Table 1:** Attributes considered during the initial log analysis

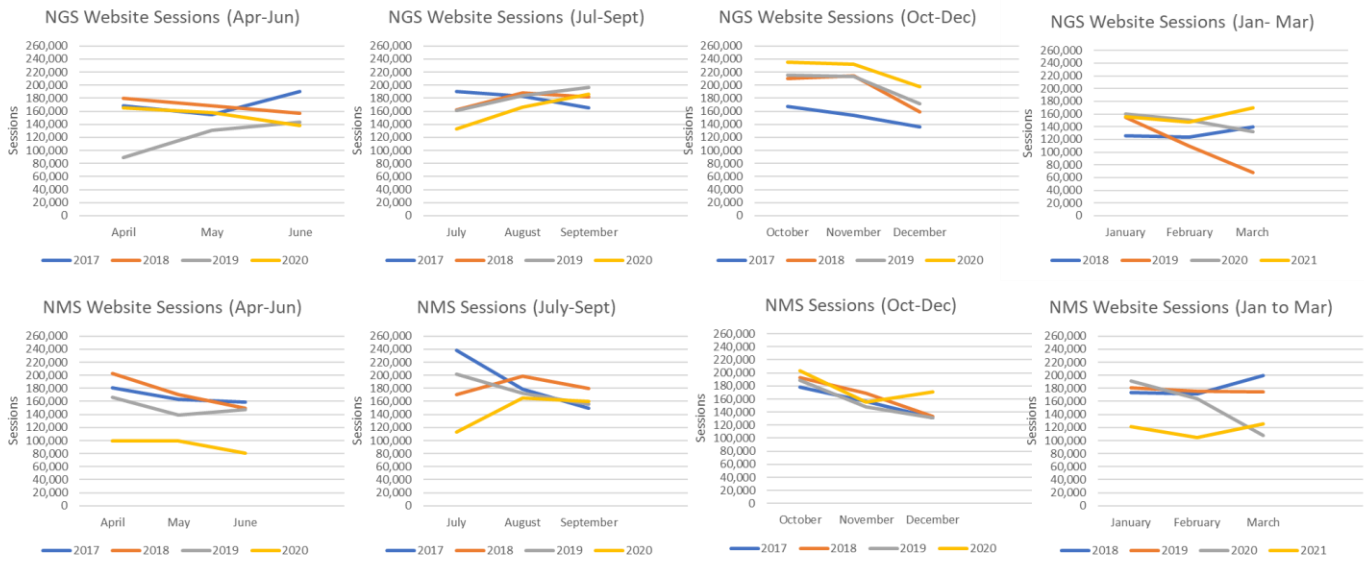
| Attribute | Reasons for Inclusion |
|---|---|
| Sessions | To determine changes in the amount of traffic coming to the sites during lockdown |
| Visitors (unique) | To determine the number of users accessing and returning to the sites |
| Pageviews (Unique) | To determine users' engagement with pages across the entirety of each site |
| Collection Views | To determine users' engagement with collection pages across each site |
| Pages per Visit | To determine the breadth of interaction across each site |
| Duration | To determine the depth of interaction across each site |
| Device | To determine the devices used to access the sites (mobile, tablet, desktop) |
| Source of Traffic | To determine where users were accessing the site from |
| Social Media Referrals | To determine the impact of social media on people's access to the site |

# General Log Analysis

The main headlines from the initial log analysis will now be discussed, focusing on aspects such as user interaction, the source of traffic, and the operating systems used.

## User Interaction

In general, the number of commenced sessions in lockdown across both organisations was low compared to previous years - see Fig. 1. This isn't entirely surprising since there would have been a natural drop off from users who are looking for information related to in person visitations e.g. opening hours and exhibitions on display. Nevertheless, there was an exception to this trend during the months of October to December 2020. In the lead up to the festive period, the number of sessions across NGS and NMS rose to the highest levels. This demonstrates that despite restrictions, the wider public's interest in cultural heritage remained high during seasonal holidays - an aspect that organisations can capitalise on in the near future and during forthcoming crises. The phased reopening of both institutions in August 2020 also seemed to have an impact on the sessions commenced, with NGS experiencing a 20,000 rise (24.53%) and NMS a 50,000 rise (45.43%).

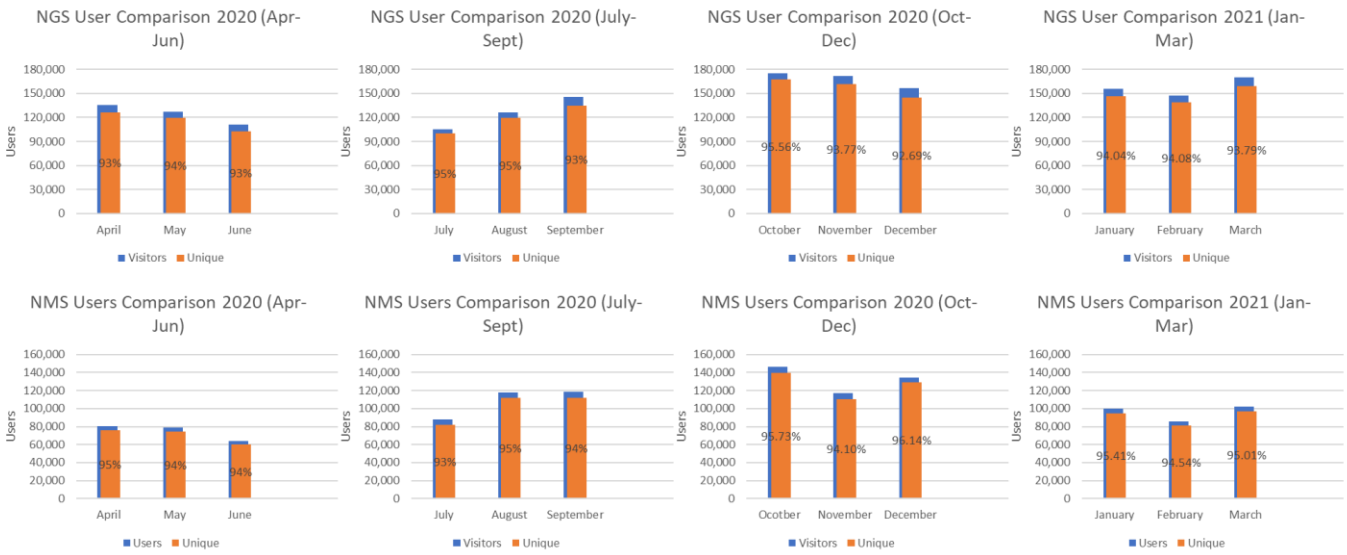



**Less sessions were commenced during lockdown across both organisations except the period leading up to Christmas for NGS and NMS where sessions increased.**

**Fig. 1: The number of sessions commenced across both sites.**

The number of users accessing each site per month followed a similar trend to the sessions commenced. This was largely due to a severe lack of returning visitors during lockdown (see Fig. 2) where less than 8% of users frequented the sites more than once per month. Such a statistic matches the traffic received by NMS during previous years; however, NGS traditionally experienced a larger percentage of returning users, particularly in 2017 where up to 45% of visitors per month came back to the site. The publication rate of new content is likely to have an effect on returning users, whilst an exploration into the quality of content on offer is also

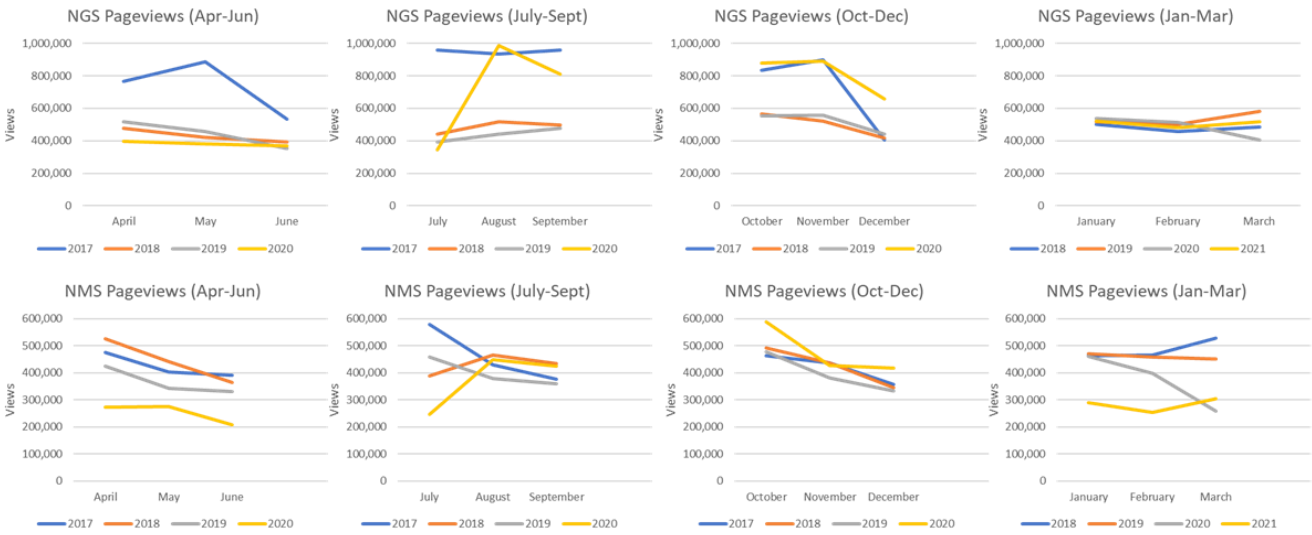
required. The easing of lockdown in August 2020 once again resulted in more users accessing the site but had no impact on the percentage of people returning.




**Over 90% of users are unique users. The data shows there are less returning/regular users.**

**Fig. 2: Total number of users vs. unique users across both sites during lockdown.**

In terms of site-wide pageviews, less pages were being accessed in general throughout lockdown. Nevertheless, there was a significant jump of over 600,000 views for NGS in August 2020, with interest persisting at the highest levels compared to previous years until December 2020. This rise once again coincided with the easing of lockdown measures, as well as the lead up to the festive period, and was also observed in NMS, albeit at a lower rate ~200,000 views.




**Pageviews were generally lower across both organisations. Nevertheless, there was a large peak in views for NGS across August to December.**

**Fig 3. The number of pageviews received per month by NGS and NMS**

Many of the pages included in the NGS and NMS websites provide information regarding in person visits (such as 'What's On' or 'Visit Us'), meaning they experienced a natural drop off in interest when the physical institutions were closed. Nevertheless, collection pages offer a source of information for a variety of populations, not just those planning on visiting the museum or gallery. For example, academics and students may search collection databases to support their research or hobbyists can browse the collection to find items of interest. It was therefore important to analyse the impact of Covid-19 on the collection pages in comparison to the wider sites. As can be seen in Fig. 4, user views of collection pages and collection search databases were consistently higher for both organisations during the pandemic compared to previous years. This is in contrast to site wide views (Fig. 3), which tended to be lower, thereby demonstrating that cultural heritage continued to be an important aspect of life throughout the pandemic. NMS users also seemed to return to specific collection pages at a much higher rate than NGS (~65% of the views were unique compared to ~85%), although there was no explanation recorded for this gap.

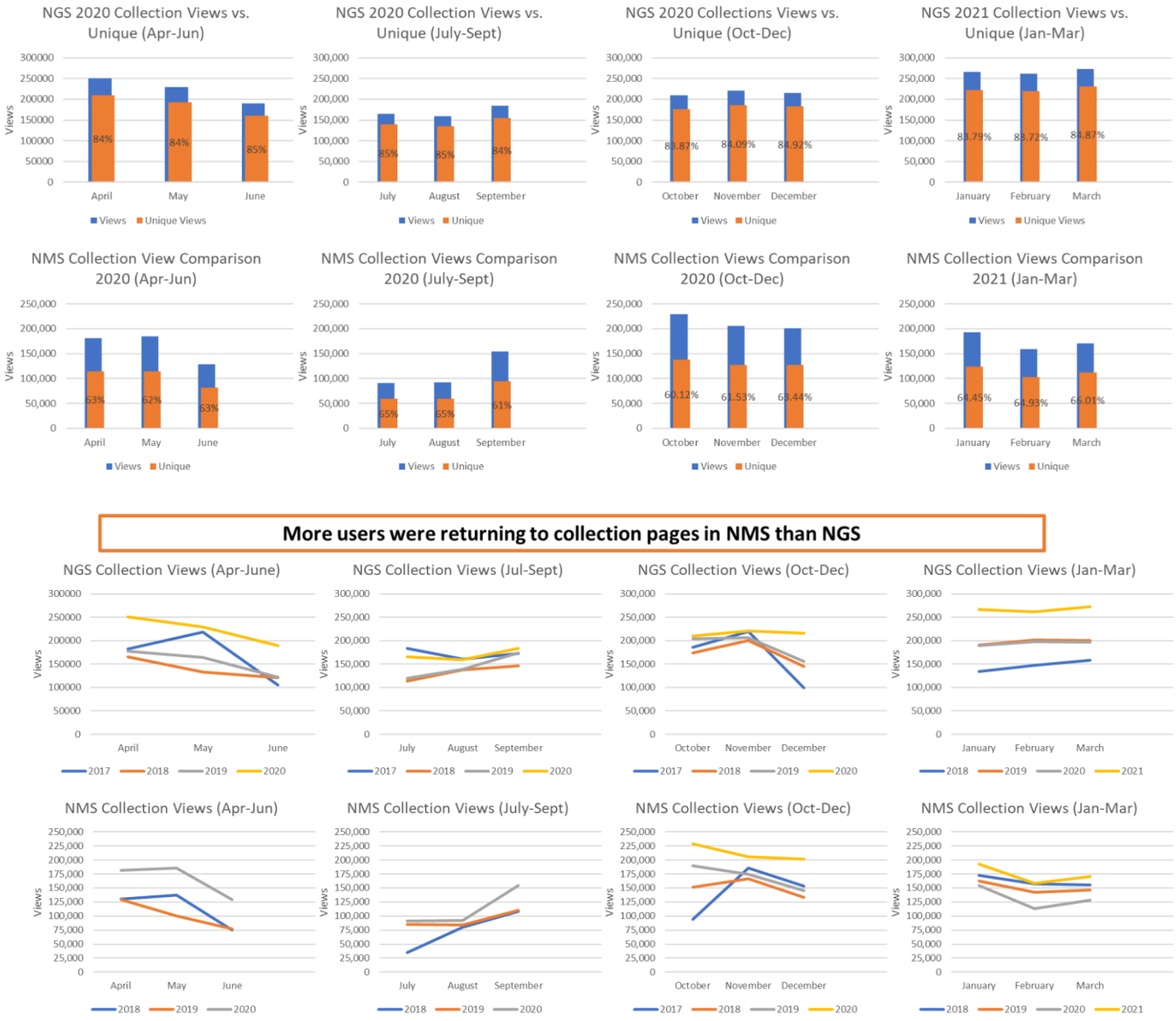
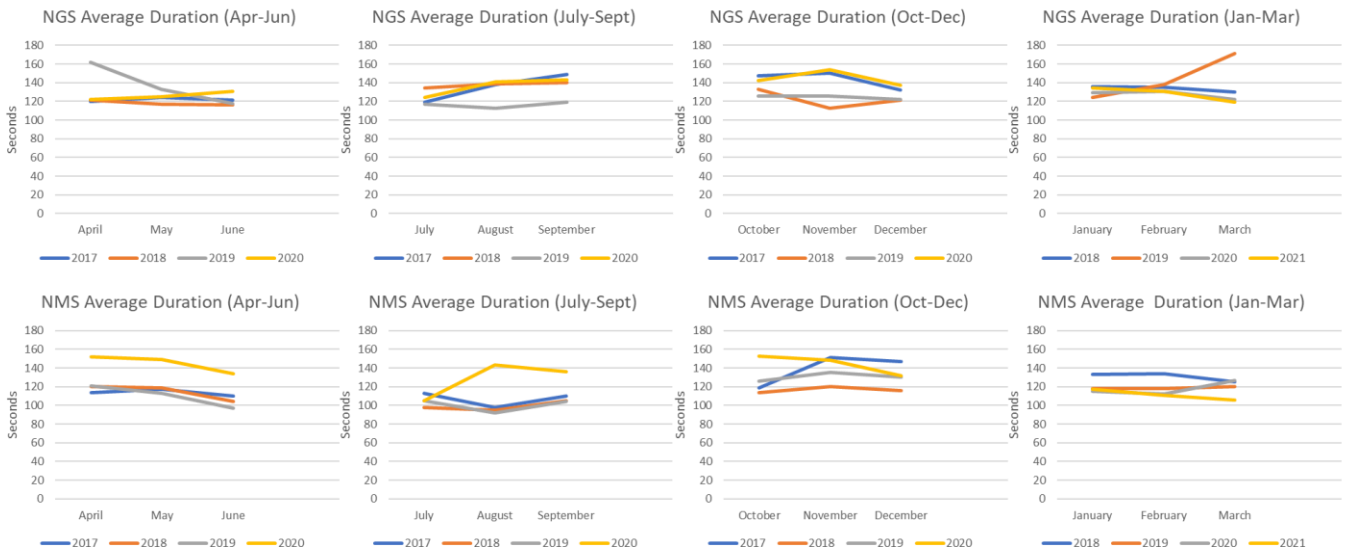
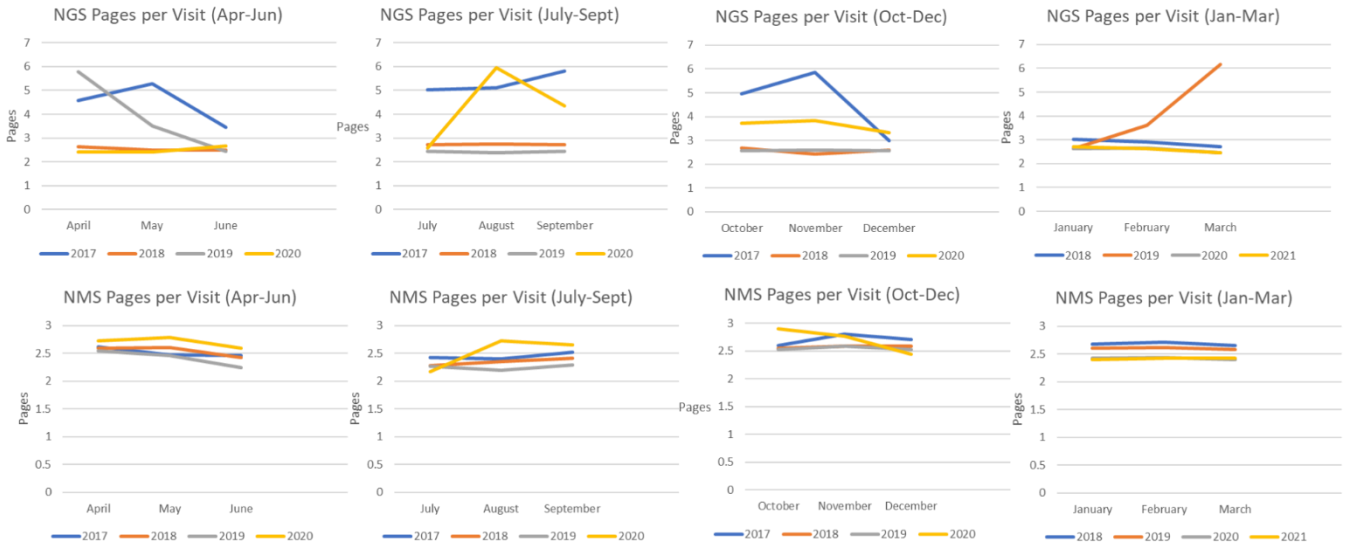



**Fig. 4: Total number of collection views vs. unique across both sites during lockdown.**

Page views and user statistics only provide a shallow insight into engagement. It is therefore necessary to complement this data with information regarding the amount of time users spend on the sites and the number of pages accessed to provide a more complete view of the breadth and depth of interaction. In terms of average duration (Fig. 5), users spent more time on NMS' site during the first six months of lockdown (up 40 seconds more than previous years) in comparison to the last six months analysed. NGS users spent a similar amount of time as the pre-lockdown rates, with a slight increase across the Christmas months. Unsurprisingly, the average number of pages per visit followed a similar trend to duration, with the exception of NGS experiencing a large spike in page access during August, which coincided with the easing of lockdown restrictions.




**NMS users spent more time on the website at the beginning of lockdown (April to October). NGS users increased their activity during the Christmas months (November and December).**

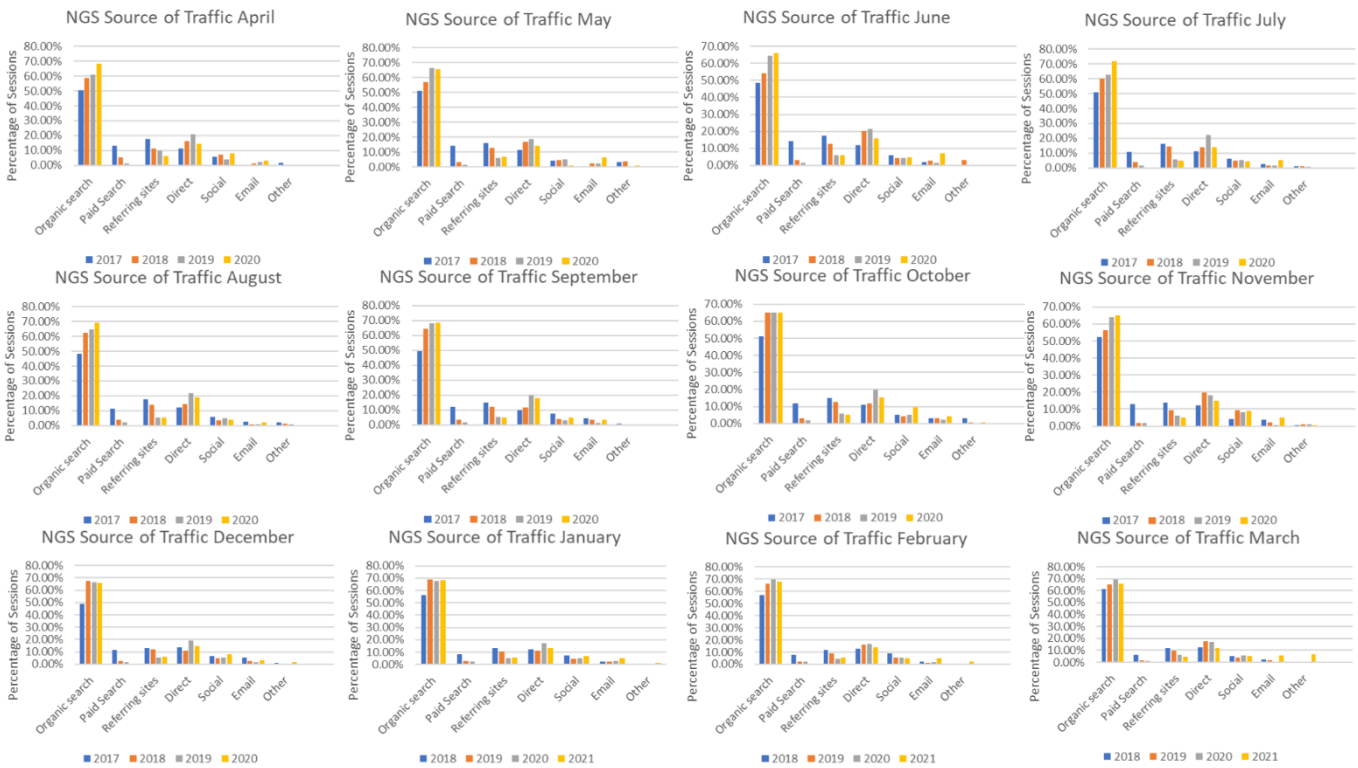



**NMS' pages per visit followed the same trend as duration – more pages were visited during the first half of lockdown. NGS visitors generally browsed less pages apart from a spike during August to September.**

**Fig. 5: Average duration and number of pages accessed per visit.**

## Source of Traffic

In addition to user engagement, the channels utilised by individuals to gain access to the NGS and NMS sites were analysed. Organic search (i.e. query results that are not influenced by paid advertising) overwhelmingly produced the largest amount of traffic and actually increased during most months of lockdown across both sites; see Fig. 6. Access via email for NGS was more popular during 9 of the 12 months in lockdown compared to previous years. This was mainly due to an increase in the frequency in which their digital newsletters were published, each of which centred on a different piece of content. On the other hand, direct search increased for NMS across nine of the months during lockdown.



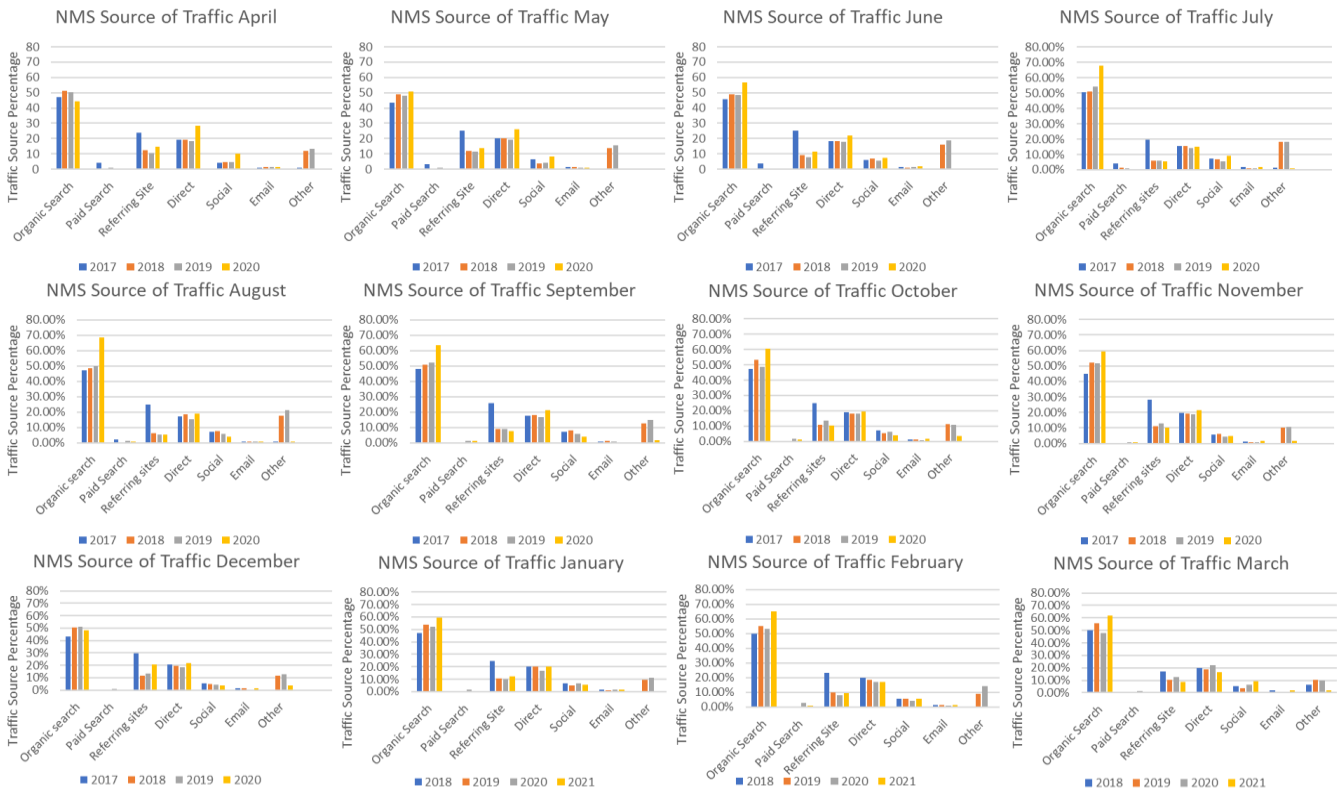
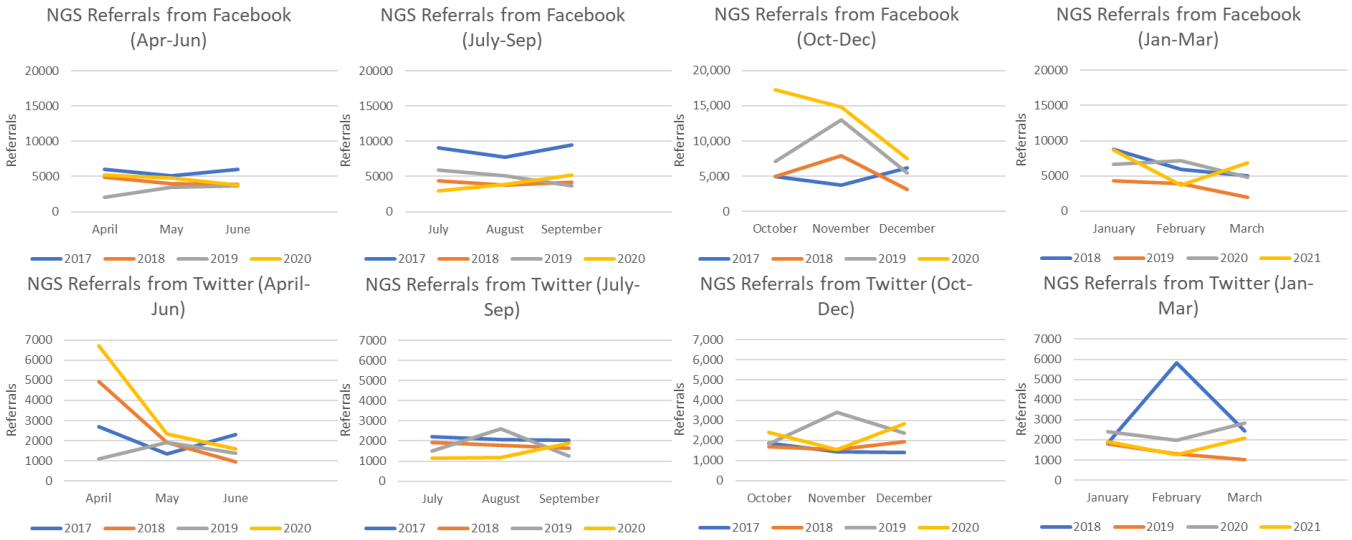



**Fig. 6: Source of traffic across both sites.**

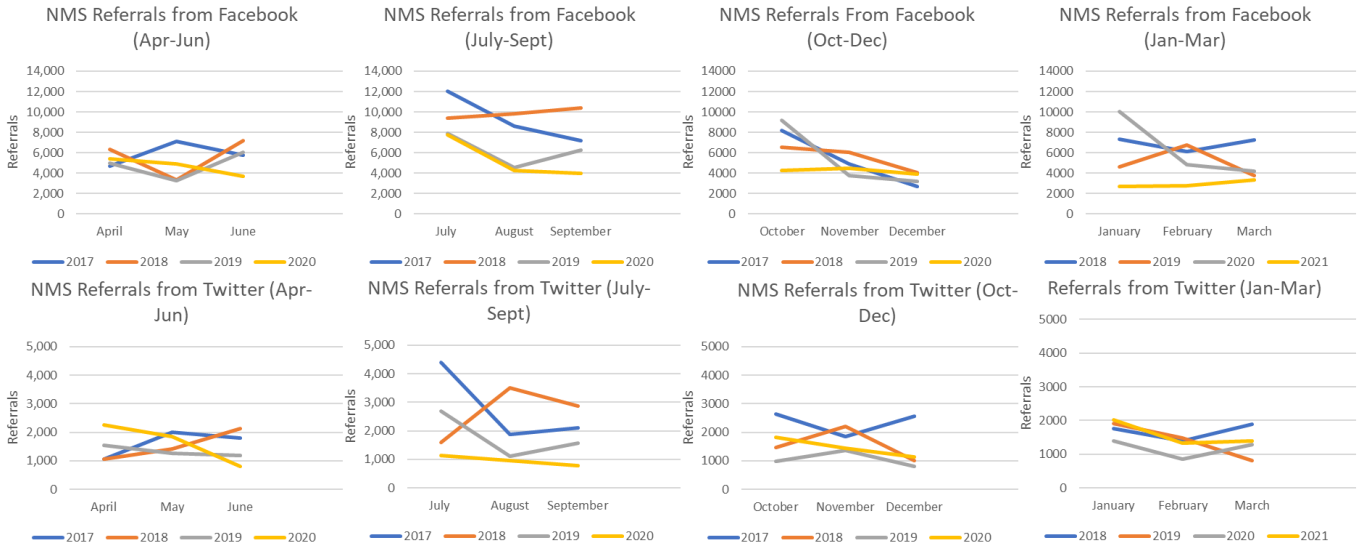
Both organisations utilised Facebook and Twitter to promote their collections and events. As such, greater scrutiny was placed on the referrals received from these platforms. Overall, NGS' traffic from social media - see Fig. 6 - picked up during the second half of lockdown (consistently the first or second highest rates compared to previous years); whereas, access via social media was higher for NMS at the start. NGS received a jump of over 12,000 referrals from Facebook in October 2020 (see Fig. 7), with this popularity continuing at the highest rates compared to previous years until December 2020. Referrals from Twitter started off high at close to 7,000 but reduced quickly to average levels from June onwards. NMS' referrals from Facebook was low across the 12 months of restrictions, whereas the referrals from Twitter picked up to average rates in the final six months analysed.

In terms of strategies, NMS deployed more staff to their digital media team, which led to a higher frequency of posts on social media, as well as a change in direction from purely promotional content to a more empathetic style using collections to reflect the circumstances people were living through with the pandemic[6].

[6] https://twitter.com/ntlmuseumsscot/status/1240699557341564928?lang=en




**More referrals from social media were received during the second half of lockdown, particularly from Facebook.**

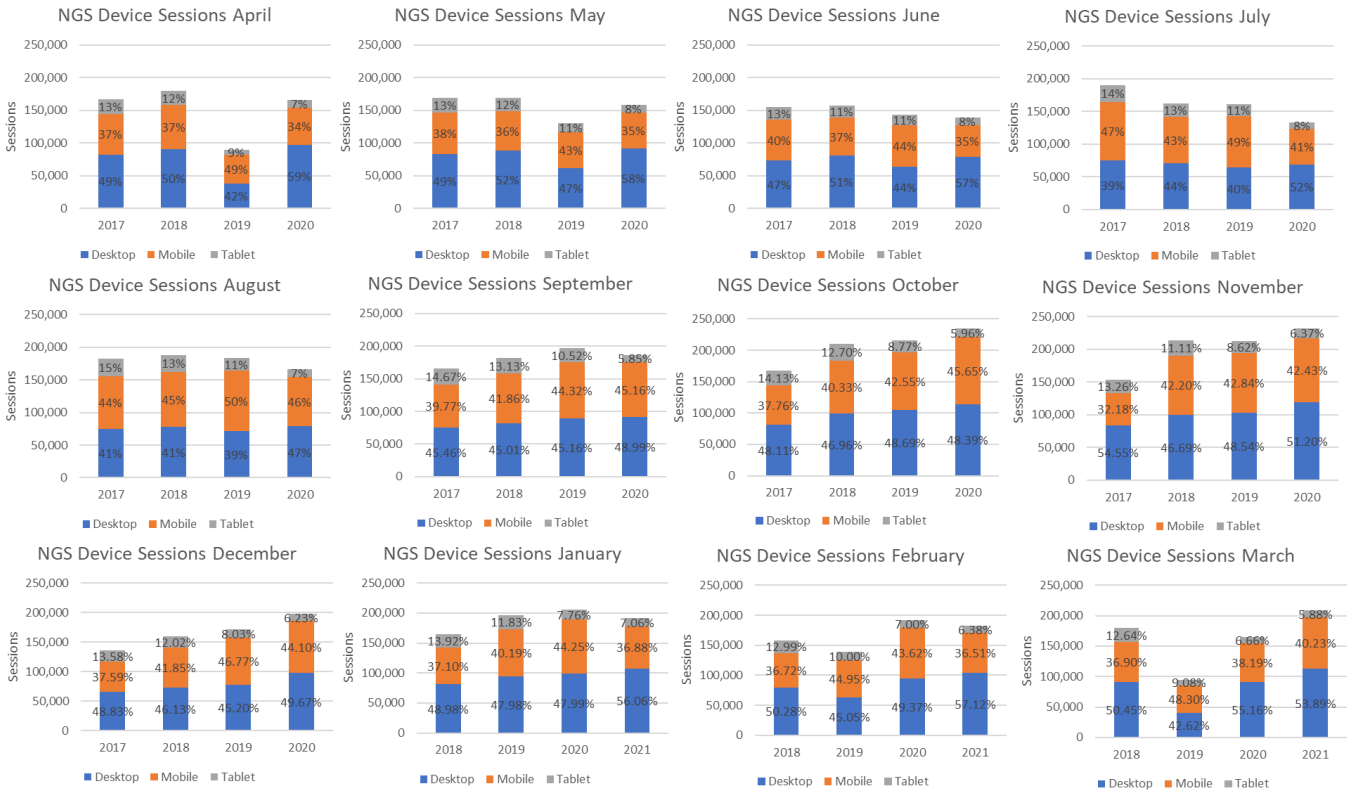



**More referrals from social media were received during the first half of lockdown, particularly from Facebook.**

**Fig. 7: Referrals from Facebook and Twitter**

## Devices

On top of access channels, the devices utilised to access each site were also analysed due to their potential impact on user experience. Desktop use increased for both NGS and NMS during lockdown and actually commanded above 50% of the share in eight out of the 12 months for NGS and nine for NMS - see Fig. 8. This isn't entirely surprising for NGS, where desktop was traditionally the most popular device used to access their site. Nevertheless, the bulk of NMS traffic typically came from mobile devices, with the design of the website being optimised for this medium[7]. As such, a sudden shift toward desktop use could have resulted in potential user experience barriers.




[7] https://blog.nms.ac.uk/2019/04/04/rethinking-navigation/

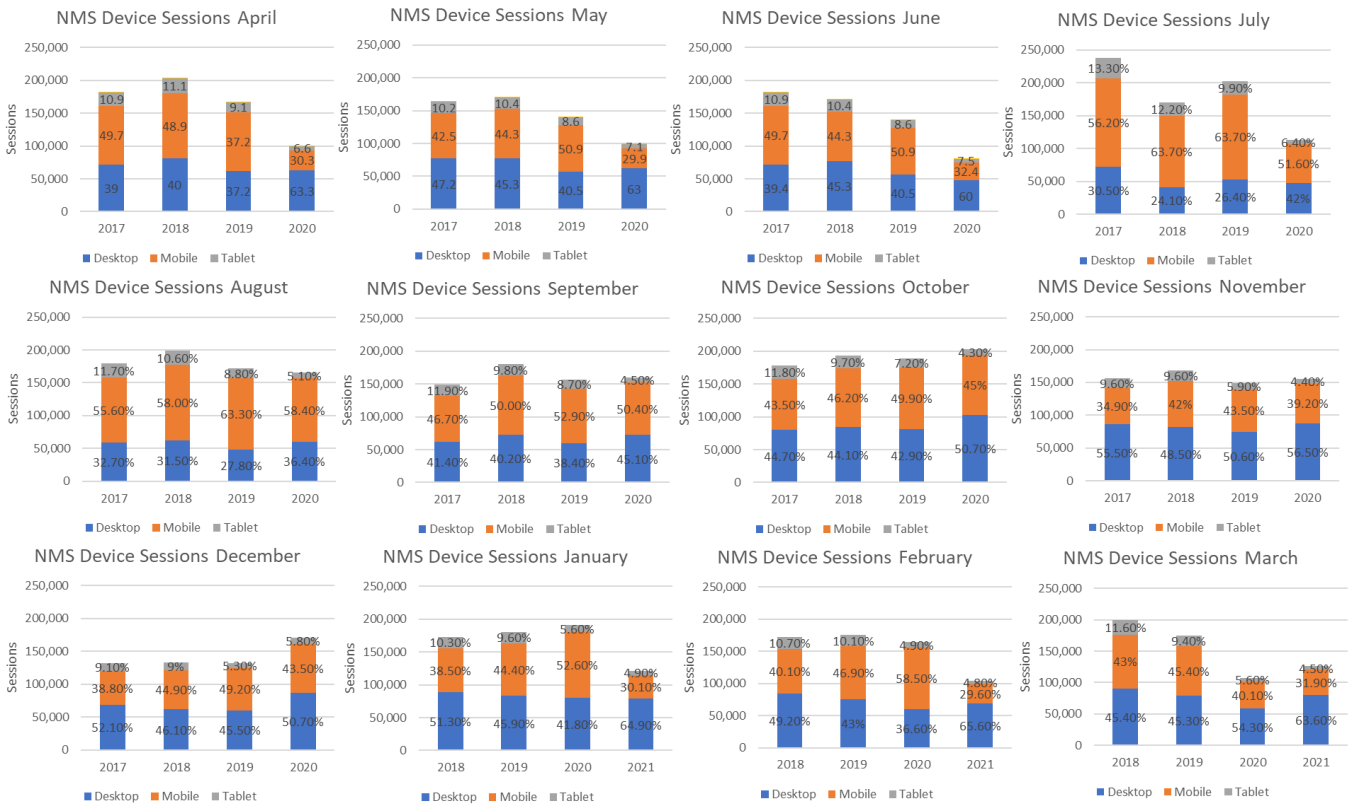



**Fig. 8: Percentage share of devices used to access NGS and NMS**

## Implications for Policy

Table 2 highlights potential considerations for both internal and wider sector policy changes based on the results of the initial log analysis.

**Table 2:** Potential policy introductions/changes based on the results of the log analysis

| ID | Considerations for Future Policy |
|---|---|
| 1 | In response to potential future pandemics/crisis, cultural heritage organisations should have clear content strategies in place to promote engagement with collections and subsequently capitalise on the increase in interest in their digital provisions as lockdown restrictions ease. NGS experienced a 600,000 rise in pageviews when the physical institution reopened and NMS a 200,000 rise. This suggests that online visits may have some links to visits in person |
| 2 | Interest in cultural heritage remained high throughout the festive period of lockdown. Organisations should therefore have content and communication plans in place to capitalise on this seasonal holiday |
| 3 | Cultural heritage organisations should focus on developing engaging, user-centred content to promote the return of users. Despite interest in collection pages increasing during lockdown, less than 8% of users returned to the sites |
| 4 | Clear strategies should be developed to promote access and engagement with cultural heritage websites via email and social media. NGS' traffic via email increased throughout lockdown, whilst their social media referrals picked up during the second half |
| 5 | Cultural heritage websites should prioritise responsive website designs that adapt to the devices in use |

# External Platforms

During the initial log analysis, it was revealed that user interest in collection items throughout lockdown increased. This trend spurred a further investigation into the popularity of NGS and NMS items on external platforms (in comparison to their own sites) to determine the benefits of such alliances.

## Methods

At the time of the analysis, NGS had formed working partnerships with Google Arts and Culture, and Art UK, where they had made 198 and 4,245 items available respectively. NMS, on the other hand, had made 42 items available on Wikimedia and 618 on Google Arts and Culture. A log analysis of the access patterns from these sites from April 2020 to March 2021 was carried out and contrasted with the results from the previous section to determine differences in overall views and referrals. In addition, a comparison of the descriptions included in the top five and bottom five most popular NGS items on Art UK was made, along with the top five and bottom five most popular NGS items on Google Arts and Culture. Finally, the structure of items across each of the three external sites was contrasted.

## Traffic Across Each External Site

As shown in Fig. 9, the most successful site in terms of views differed for both NGS and NMS. Google Arts and Culture performed relatively well for NGS, with their items receiving at least 35,000 views per month and peaking at 400,000 in May 2020 - largely due to an increase in traffic towards the Van Gogh painting 'Orchard in Blossom (Apricot Trees),' particularly from users in Italy and Spain. This also demonstrates changes in audience patterns through time, although further exploration was not possible as to why such an increase in views occurred due to restricted access to the data from Google Arts and Culture. On the other hand, NGS items on Art UK consistently received below 10,000 views per month despite far more being available – 4,245 compared to 198 on Google Arts and Culture.

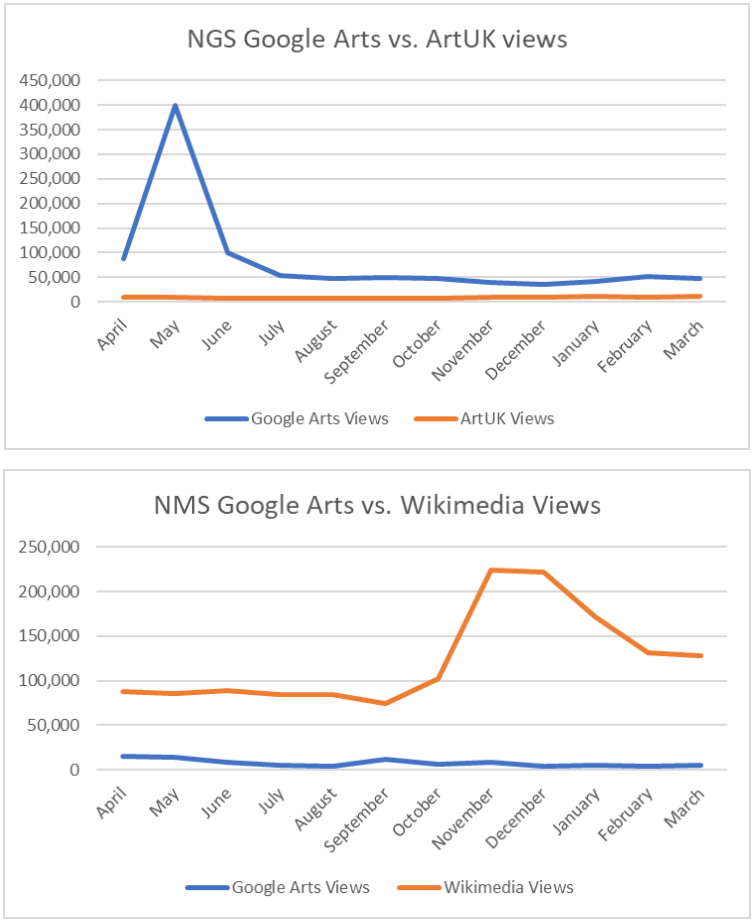



**Fig 9: NGS and NMS external site views.**

Google Arts and Culture performed less well for NMS, despite hosting over three times more items than NGS (618 compared to 198). Such a statistic highlights that external platforms are unlikely to have the same impact across all cultural heritage organisations and that the mere presence of items does not necessarily translate to views. In contrast, Wikimedia had a far greater impact for NMS, with their items receiving over 70,000 views per month.

In terms of referrals back to the host sites - see Fig. 10 - each of the external platforms were inconsistent apart from Wikimedia; more than 1,000 referrals back to NMS were recorded each quarter analysed. Nevertheless, it is important to note that the views and referral statistics for Wikimedia also include those from the Wikipedia domain as a whole, where anyone can upload content from, and links to, NGS and NMS. The number of referrals back to NGS from Google Arts and Culture started off strong with over 700 in the first quarter analysed but consistently declined to almost zero in the fourth. Referrals back to NMS were less strong and hovered just above zero for each of the four quarters, yet this was mainly due to the fact that referral links were not included for the collection items when uploaded to the site. Referrals back to NGS from Art UK hovered above 100 for the first three quarters but reduced to almost 0 in the fourth.

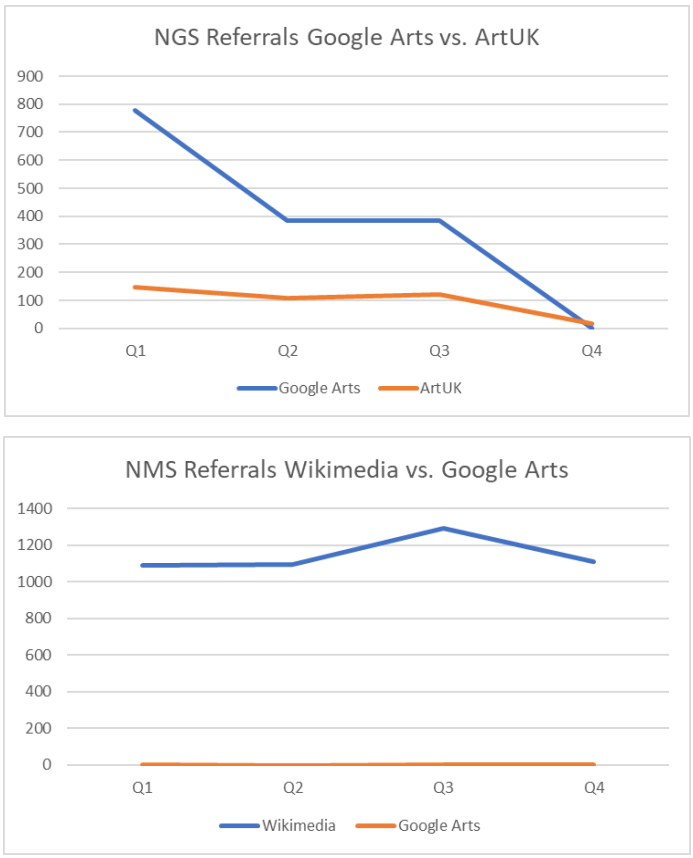



**Fig. 10: Referrals back to NGS and NMS from external platforms.**

## Item Popularity

Table 3 compares the top ten items from Art UK in August 2020 with the same items in NGS. As can be seen, there is a discrepancy in which items were being viewed across both sites. Just two of the ten items analysed can be found in NGS' top 20, with four ranking outside the top 100. In particular, "Little Nude" is the most viewed collection item in the whole domain of Art UK, yet only ranked 25th in NGS' most viewed list. Art UK suggested that the inclusion of the word "Nude" in the title may be the reason for its popularity[8].

[8] https://artuk.org/discover/stories/five-years-on-celebrating-art-uks-fifth-birthday

**Table 3: A comparison between collection items in Art UK and NGS during August 2020.**

| Item | Art UK Views | NGS Collection Views | NGS Collection Rank |
|---|---|---|---|
| Little Nude (211602) | 2,602 | 207 | 25 |
| Jane Maria Grant (1840–1928), Lady Strachey, Writer (212175) | 64 | 9 | 1,341 |
| Collioure (211267) | 45 | 52 | 180 |
| A Bloomsbury Family (211556) | 40 | 105 | 73 |
| Poppies in Pewter (211551) | 39 | 133 | 55 |
| Summer Fields (211289) | 29 | 347 | 12 |
| The Monarch of the Glen (184975) | 27 | 616 | 6 |
| James Hepburn (c.1535–1578), 4th Earl of Bothwell, Third Husband of Mary, Queen of Scots (Study of Mummified Head) (212099) | 25 | 158 | 42 |
| Olive Trees (210113) | 25 | 39 | 163 |
| Landscape of the Vernal Equinox (III) (211528) | 24 | 33 | 301 |

Table 4 compares the top ten most popular items from Google Arts in August 2020 with the same items in NGS. Once again, there was a discrepancy in the items being viewed from each site. Just one featured in NGS' top 20 collections, with five ranking outside the top 100. This trend suggests that external platforms could potentially be a useful resource to highlight items from cultural heritage databases that do not receive the expected interest. Nevertheless, it is important to consider that the items uploaded to external platforms also receive a variable amount of views, since 132 of the 198 NGS items available on Google Arts and Culture in August 2020 were accessed less than 100 times. Data was not available to consider the performance of NMS' items on external platforms.

**Table 4: A comparison between collection items in Google Arts and NGS in August 2020**

| Item | Google Art Views | NGS Collection Views | NGS Collection Rank |
|---|---|---|---|
| An Old Woman Cooking Eggs | 3,966 | 300 | 15 |
| Orchard in Blossom (Plum Trees) | 3,150 | 55 | 169 |
| Ghost of a Genius | 3,141 | 51 | 181 |
| Three Tahitians | 2,795 | 72 | 123 |
| A Seascape, Shipping by Moonlight | 2,346 | 91 | 90 |
| The Quarrel of Oberon and Titania | 1,987 | 106 | 71 |
| Poplars on the Epte | 1,664 | 122 | 64 |
| Pink Roses, Chinese Vase | 1,584 | 70 | 130 |
| Venus Rising from the Sea ('Venus Anadyomene') | 1,294 | 167 | 37 |
| Mary, Queen of Scots | 1,034 | 23 | 462 |

## Item Structure

In addition to quantitatively measuring the impact of external platforms in terms of views and referrals, it is also important to take into consideration user experience to determine the true value of interacting with these sites. Consequently, the structure of the most and least popular items from August 2020 were analysed to establish the depth of information available.

Regarding Art UK, the structure of the top five and bottom five items from NGS were considered. Figure 11 highlights the typical structure of an item uploaded to Art UK, which includes basic metadata such as: name, artist, date, medium, measurements, acquisition method, and work type. In addition, items had between 0 and 10 tags to facilitate search, along with links to blogs from Art UK in which they featured. Finally, most of the items had an associated written description (except ‘The Artist's Wife, Margaret Lindsay of Evelick’), yet it seemed as if such descriptions had been crawled from the item pages in NGS and often stopped mid-sentence. Therefore, the information needs of users from Art UK may not be fulfilled in comparison to those of NGS, although a link back to NGS is clearly visible.

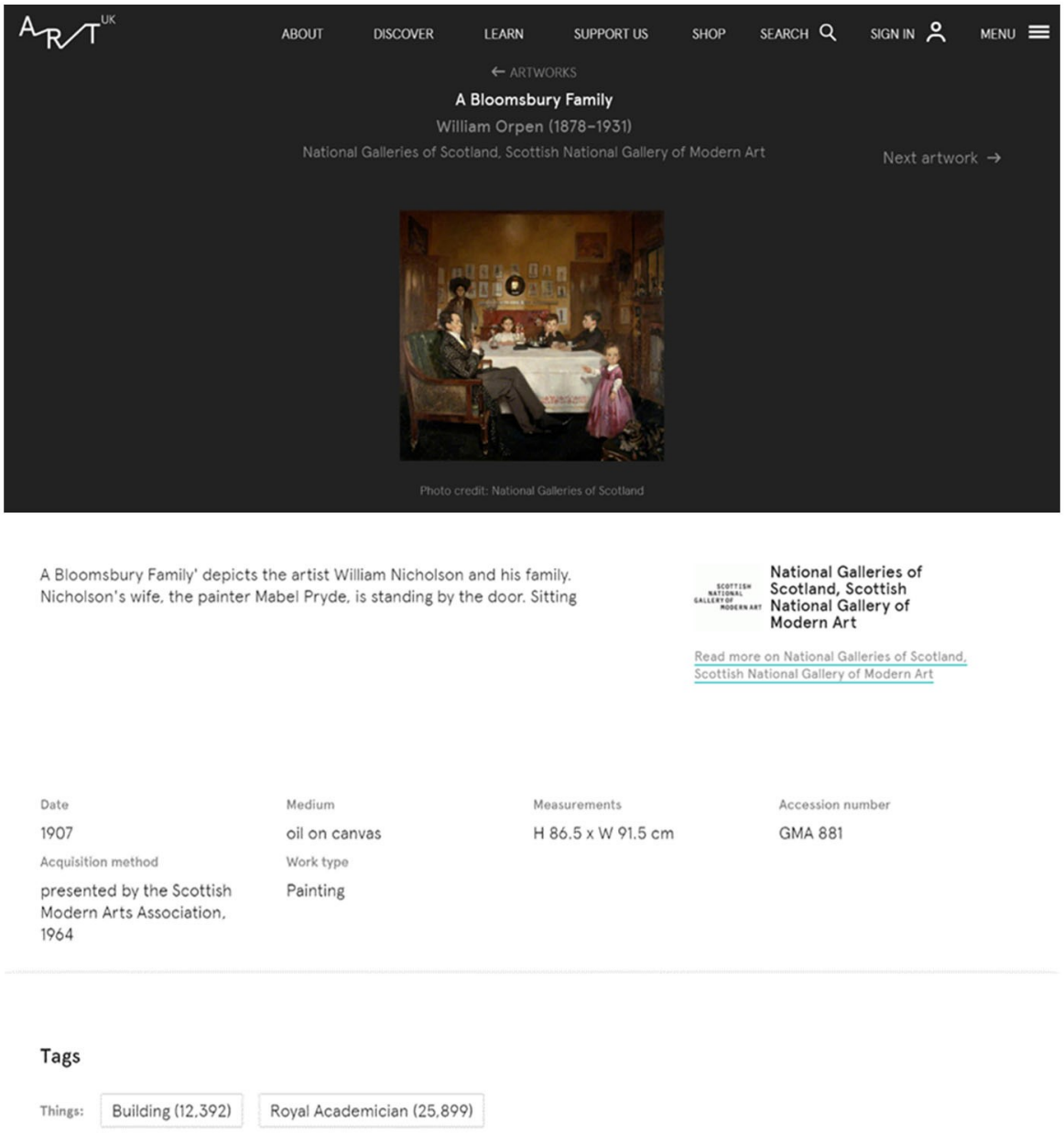



**Fig. 11: Information associated with Art UK listings.**

Like Art UK, the structure of the top five and bottom five items from NGS Google Arts and Culture were analysed. Figure 12 highlights the typical structure of an item uploaded to Google Arts and Culture, which once again included basic metadata such as: title, creator, date created, physical location, location created, physical dimensions, type, rights, external link, medium, art movement, support. Items had fewer search tags than Art UK (between 1 and 8) and only one 'Mary, Queen of Scots' offered an additional description on top of the basic metadata. The referral link back to NGS is once again clearly visible meaning it should be relatively easy for users to obtain further information on the items included.

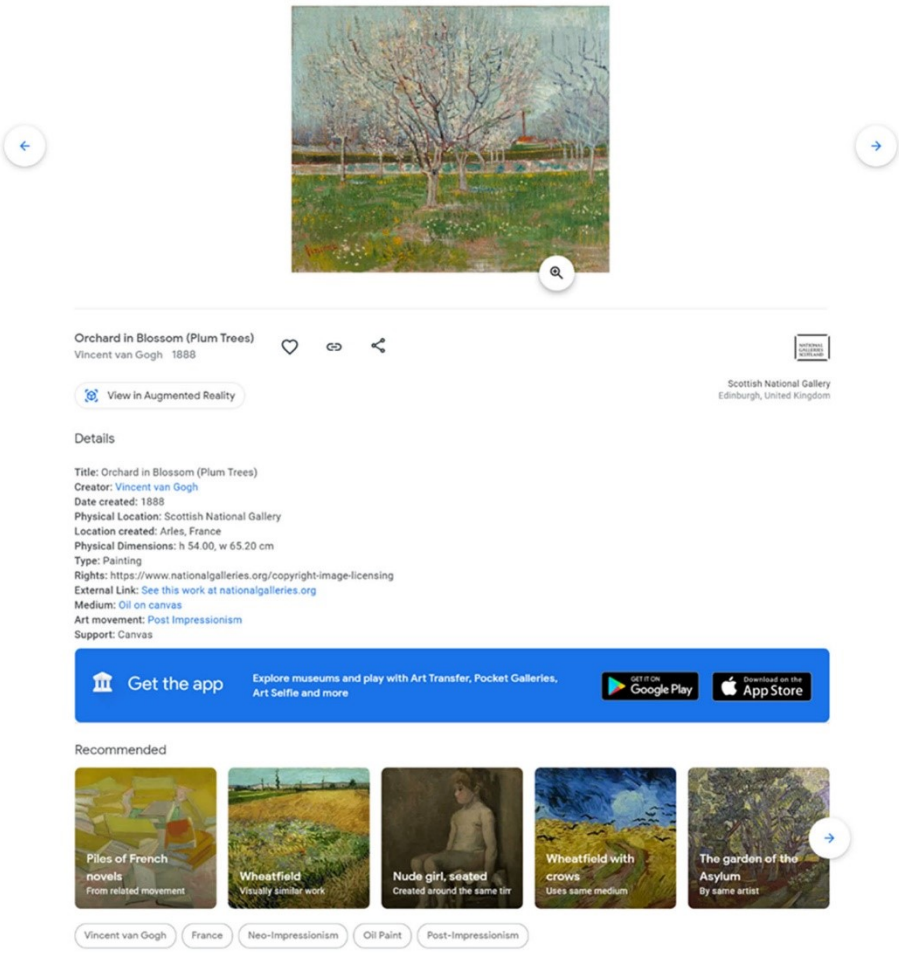
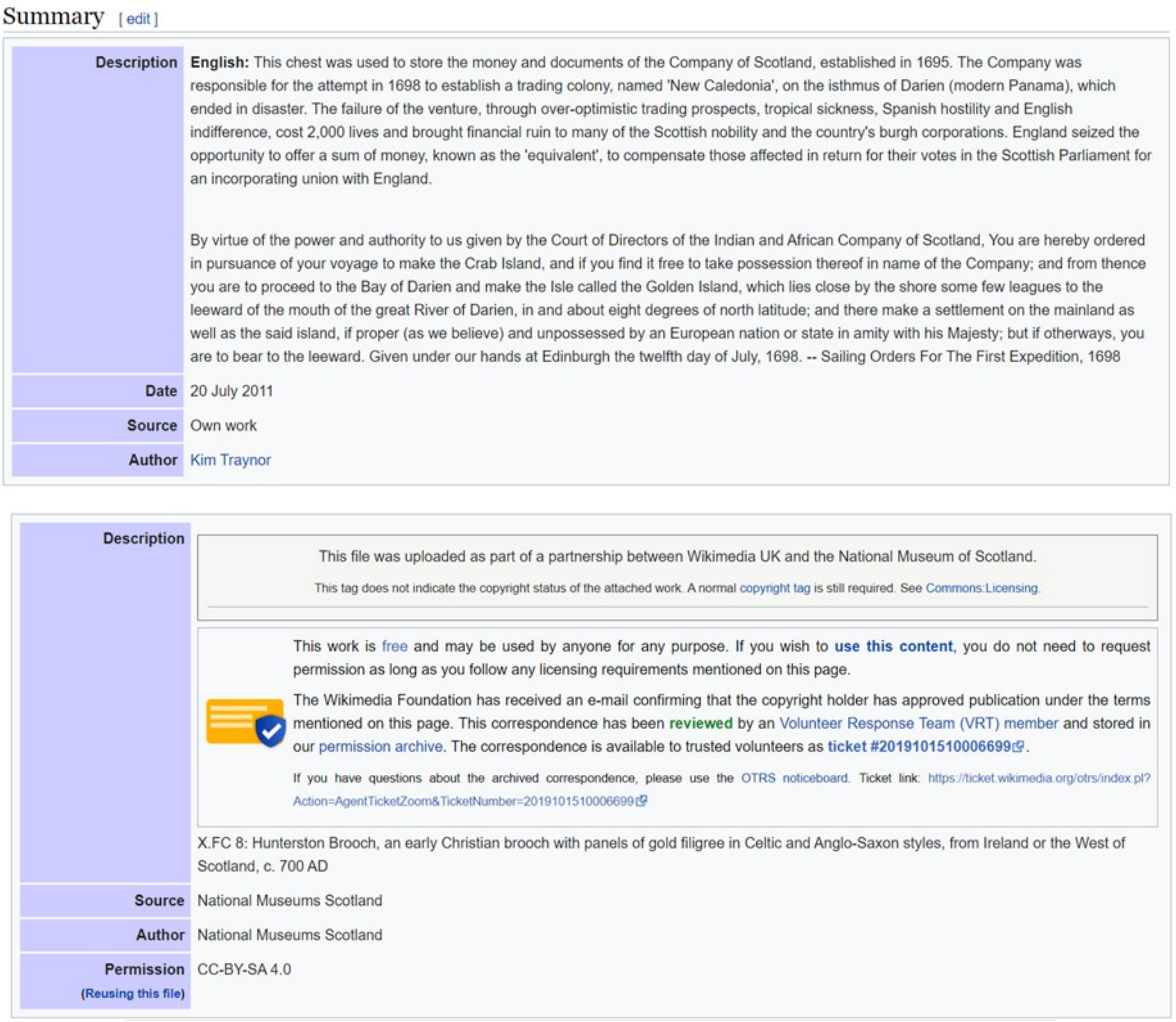



**Fig. 12: Information associated with Google Arts & Culture listings.**

The top five and bottom five items from Wikimedia that did not include the 'Lewis Chess Pieces' were analysed since this traditionally popular collection was split into individual items and therefore dominated the top 10 items across each month. As shown in Figure 13, the information embedded in Wikimedia's listings was extremely variable. Darien's Chest included a two-paragraph description of the item's provenance, whereas the Hunterston Brooch only had one line. In addition, there were snippets of information missing that are included in the other sites, for example dimensions. Nevertheless, further information may be found in the individual articles across Wikipedia that discuss the items embedded within Wikimedia.



Summary [edit]

| | |
|---|---|
| **Description** | **English:** This chest was used to store the money and documents of the Company of Scotland, established in 1695. The Company was responsible for the attempt in 1698 to establish a trading colony, named 'New Caledonia', on the isthmus of Darien (modern Panama), which ended in disaster. The failure of the venture, through over-optimistic trading prospects, tropical sickness, Spanish hostility and English indifference, cost 2,000 lives and brought financial ruin to many of the Scottish nobility and the country's burgh corporations. England seized the opportunity to offer a sum of money, known as the 'equivalent', to compensate those affected in return for their votes in the Scottish Parliament for an incorporating union with England.<br><br>By virtue of the power and authority to us given by the Court of Directors of the Indian and African Company of Scotland, You are hereby ordered in pursuance of your voyage to make the Crab Island, and if you find it free to take possession thereof in name of the Company; and from thence you are to proceed to the Bay of Darien and make the Isle called the Golden Island, which lies close by the shore some few leagues to the leeward of the mouth of the great River of Darien, in and about eight degrees of north latitude; and there make a settlement on the mainland as well as the said island, if proper (as we believe) and unpossessed by an European nation or state in amity with his Majesty; but if otherways, you are to bear to the leeward. Given under our hands at Edinburgh the twelfth day of July, 1698. -- Sailing Orders For The First Expedition, 1698 |
| **Date** | 20 July 2011 |
| **Source** | Own work |
| **Author** | Kim Traynor |

| | |
|---|---|
| **Description** | This file was uploaded as part of a partnership between Wikimedia UK and the National Museum of Scotland.<br>This tag does not indicate the copyright status of the attached work. A normal copyright tag is still required. See Commons:Licensing.<br><br>This work is free and may be used by anyone for any purpose. If you wish to **use this content**, you do not need to request permission as long as you follow any licensing requirements mentioned on this page.<br>The Wikimedia Foundation has received an e-mail confirming that the copyright holder has approved publication under the terms mentioned on this page. This correspondence has been **reviewed** by an Volunteer Response Team (VRT) member and stored in our permission archive. The correspondence is available to trusted volunteers as **ticket #2019101510006699**.<br>If you have questions about the archived correspondence, please use the OTRS noticeboard. Ticket link: https://ticket.wikimedia.org/otrs/index.pl?Action=AgentTicketZoom&TicketNumber=2019101510006699<br>X.FC 8: Hunterston Brooch, an early Christian brooch with panels of gold filigree in Celtic and Anglo-Saxon styles, from Ireland or the West of Scotland, c. 700 AD |
| **Source** | National Museums Scotland |
| **Author** | National Museums Scotland |
| **Permission** (Reusing this file) | CC-BY-SA 4.0 |

**Fig. 13: Information associated with the Darien Chest and Hunterston Brooch listings in Wikimedia.**

## Implications for Policy

During the aforementioned internal workshop, the project team discussed factors that cultural heritage institutions have to consider when selecting external platforms. Figure 14 includes a potential framework that encapsulates two of the main factors - engagement and policy - whilst highlighting how NGS and NMS' external sites fit into it. Wikimedia has a high volume of traffic, as highlighted by the number of views NMS items receive per month, but the quality of engagement users may have with the collection assets could be considered as relatively low since they may be embedded deep within semi-relevant articles. Art UK has far less traffic coming to the site but users could be considered to have deeper engagement with the content since they view collection assets in the context of the UK art community and make connections between them. Google Arts and Culture receive a fair amount of traffic but it enables users to have a much deeper engagement with items due to the search interfaces provided and the ability for curators to develop additional content such as exhibitions.

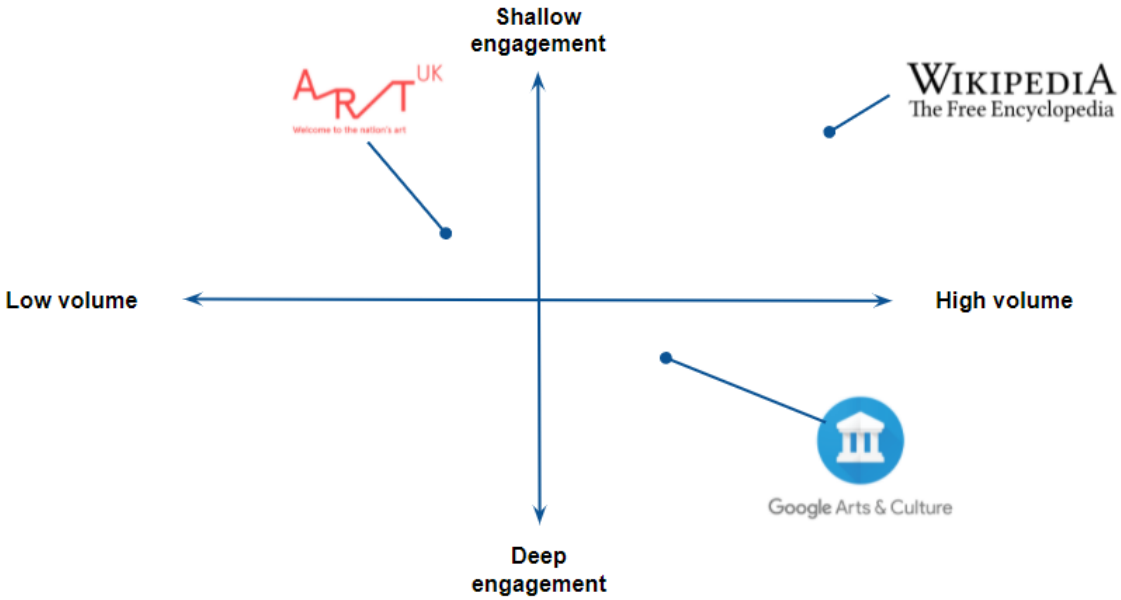



**Fig. 14: An indicative matrix capturing the engagement levels and volume of traffic of Art UK, Wikimedia and Google Arts and Culture.**

In addition to engagement, institutions may also consider the amount of effort required to aggregate content to external sites. Such a process could be manual, whereby items are uploaded with entirely new descriptions therefore creating a different experience for the user, or could be automated with content simply being duplicated via an API. This effort should be balanced with the expectations of the institutions, which may include an increase in audience reach and brand value or the creation of deeper engagement with online collections. Furthermore, external platforms frequently require specific licensing for the reuse of items. Ensuring these licensing requirements align with the institution's overall approach to the reuse of items is essential. Nevertheless, such a concern is mitigated for collection assets that are licenced under open access, meaning they are far easier to also publish on existing sites e.g. there is no need to issue Google with a separate licence on Google Arts and Culture. Due to the difference in performance recognised across NGS and NMS' external sites, it is important to trial platforms to determine if they achieve the desired engagement levels before committing large quantities of resources. Finally, cultural heritage organisations should contemplate whether the external sites' values link up with their own in terms of long-term usage of collection assets. For example, what is the likelihood of the working terms changing; what efforts will be required to ensure the content is kept up to date; and how stable is the platform in case data is permanently lost?

## Contemporary and Trending Topics

Whilst observing the search queries made by the users of NGS and NMS throughout lockdown, it became clear that people were utilising cultural heritage websites to search for information related to contemporary and trending topics. The depth in which users searched for these subjects was further analysed by retrieving popular topics from Google Trends and examining their access patterns across NGS and NMS.

## Methods

Current statistics suggest that over 85% of the search queries conducted in the UK travel through Google[9], meaning Google Trends can be considered as the optimum site to identify what topics the British public are interested in. As a result, the top 25 topics across each month were retrieved from Google Trends, starting from January 2017 until April 2021, and a pool of potential search terms was then created for each topic deemed to be of interest to users of NGS and NMS. This pool was used to total searches related to the identified events during the month they occurred, which were compared with the searches made during the month prior to determine if changes occurred.

## Changes in Search Patterns

Table 5 highlights the topics where an increase in interest was noted, with the searches being grouped by a related theme. "No change" is used when the institution did not receive an increase in search traffic related to the topic under scrutiny.

**Table 5: Contemporary and trending topics where an increase in user interest was recognised.**

| Theme | Topic | Searches during month of event | Searches during previous month |
|---|---|---|---|
| Breaking news | Death of Stephen Hawking (March 2018) | NMS – 2 searches for the term "Stephen Hawking"<br><br>NGS – 4 searches for the term "Stephen Hawking" | NMS – 0<br>NGS – 0 |
| Celebratory events | Demolition of Berlin Wall – 30th anniversary (November 2019) | NMS – No change<br><br>NGS – No increase in "Germany" related searches recorded. Nevertheless, specific search terms were identified including: "figure demolishing berlin wall"; "figure demolishing berlin"; "berlin wall"; and "Check Point Charlie, west berlin" | NMS – No change<br>NGS – No change |
| Celebratory events | Moon Landing – 50th anniversary (July 2019) | NMS – 29 "space" related searches, with the terms "moon landing" and "Apollo 11" appearing multiple times<br><br>NGS – 22 "space" related searches | NMS – 11<br>NGS – 3 |

[9] https://www.statista.com/statistics/280269/market-share-held-by-search-engines-in-the-united-kingdom/

| | | | |
|---|---|---|---|
| Celebratory events | VE Day – 75th anniversary (May 2020) | NMS – 57 "war" related searches, where the term "VE Day" featured 8 times<br><br>NGS – 27 "war" related searches | NMS – 29<br>NGS – 13 |
| Cultural Movement | Black Lives Matter (May 2020) | NMS – 9 Black culture related searches in May, with more results in June (24) and September (25). "Black Lives Matter" searched for 13 times across this period. Direct searches for "Black Lives Matter" resurfaced in October (6) and November (2) in the lead up to the American election.<br><br>NGS – 10 black culture related searches in May, with more results returned in June (26) and September (10). "Black Lives Matter" was searched 4 times in this period. | NMS – 2 in April<br>NGS – 10 in April |
| Pop Culture | Queen Anne – Release of the film "The Favourite" (January 2019) | NMS – No change<br><br>NGS – 9 "Queen Anne" related searches, with "Queen Anne" specifically searched multiple times. | NMS – No change<br>NGS – 1 |
| Sporting Events | Wimbledon (July 2017) | NMS – No change<br>NGS – 42 "Tennis" related searches | NMS – No change<br>NGS – 9 |
| Sporting Events | British Open (July 2018) | NMS – No change<br>NGS – 33 "Golf" related searches. | NMS – No change<br>NGS – 8 |
| Sporting Events | Ryder Cup (September 2018) | NMS – No change<br>NGS – 17 "Golf" related searches. | NMS – No change<br>NGS – 10 |
| Seasonal Events | Burns Night (January 2019) | NMS – 60 "Burns" related searches.<br>NGS – 122 "Burns" related searches. | NMS – 19<br>NGS – 64 |
| Seasonal Events | Black Friday (November 2017 & 2018) | NMS – 38 "Shopping" related searches in 2018 | NMS – 17 in 2018<br>NGS – 33 in 2017, 22 in 2018 |

| | | | |
|---|---|---|---|
| | | NGS – 92 “Shopping” related searches in 2017, 49 in 2018 (including multiple searches for “Black Friday”) | |
| Seasonal Events | Chinese New Year (February 2018) | NMS – 33 searches including 2 direct for “Chinese New Year”<br><br>NGS – 37 searches including the terms “new year” and “year of” | NMS – 14<br>NGS – 22 |
| Seasonal Events | Christmas (December 2017 to 2020) | NMS – 43 Christmas related searches in 2019<br><br>NGS – Consistently over 250 searches | NMS – 30 in 2019<br>NGS – consistently over 250 searches |
| Seasonal Events | Easter (April 2017 & 2021) | NMS – 66 “Easter” related searches in 2017<br><br>NGS – 99 “Easter” related searches in 2021 | NMS – 0 in 2017<br>NGS – 17 in 2021 |
| Seasonal Events | Halloween (October 2017 & 2019) | NMS – 36 “Halloween” related searches in 2017 and 22 in 2019<br><br>NGS – No change | NMS – 9 in 2017, 9 in 2019<br><br>NGS – No change |

As can be seen in Table 5, people utilised the NGS and NMS sites to search for topics relating to breaking news, events of celebration, cultural movements, pop culture, sporting occasions, and seasonal events. The change in views may be inherently small; however, the findings suggest an initial interest that may be exploited to drive deeper engagement with such content in the future. Potential reasons for the low figures include: a lack of awareness of the content on cultural heritage sites and little motivation to seek information out with popular search engines such as Google; items not being tagged with the language associated with contemporary issues; the need for cultural institutions to be more reactive and surface these issues promptly on the homepage of their websites and beyond; and the efforts required by institutions to make collections topical and accessible on a wide-scale basis.

There was evidence of seasonal increases in search relating to national and international events such as Black Friday, Burns Night, Chinese New Year, and Christmas. Cultural heritage institutions therefore have the opportunity to invest in creating promotional content for such events that may be used year on year with minor amendments. More interestingly, however, was the nature of the searches being conducted. Across both organisations, users recorded searches that had the potential to bring money back to the institution such as ‘cards’ or ‘Christmas decorations.’ Consequently, the costs needed to lay the foundations of promoting seasonal content could be offset by additional purchases of such items.

Celebratory and sporting events fall under the same category as seasonal in that they occur on a pre-planned basis. Yet the rise in popularity for searches related to these events seemed to be dependent on the collections provided by each institution. For example, NMS received a much higher increase in war related

searches in the lead up to the 75th anniversary of VE Day, largely due to the National War Museum. This suggests that cultural heritage institutions should be selective in the contemporary and trending topics they wish to promote.

Breaking news events are more difficult for cultural heritage organisations to respond to and create content for. This may be the reason why few events had an impact on the search traffic of NGS and NMS. Nevertheless, there was some interest as highlighted by the direct searches for 'Stephen Hawking' during the month of his death. Finally, there was evidence of people searching for the 'Black Lives Matter' movement across the months of May, June, September, October and November. Initially, this was due to the George Floyd incident, but searches re-emerged during the American election where racial tensions heightened. Cultural heritage sites therefore have the opportunity to be a key educational resource for such movements, particularly those that are likely to reappear consistently.

### Implications for Policy

During the internal workshop, the project team highlighted three distinct ways of providing content on contemporary and trending topics:

- Curated content where the institution is actively identifying relevant collection items and creating stories/content, which is shared via social media, website pages, etc.
- Surfaced content where the institution creates "canned searches" in online collection databases that point users towards existing relevant collection items.
- Discoverable content where users are searching and finding collections directly relevant to the search term they are using.

Both NGS and NMS have dedicated teams that work to create and share curated content and canned searches, meaning they could utilise such teams to target some of the pre-planned topics discussed above that align with their collections and values. Nevertheless, neither institution has a dedicated strategy for creating discoverable content and recognised that further research is required in this area. For example, the use of AI (artificial intelligence) and ML (machine learning) could be a promising approach to support more timely and wide-reaching metadata tagging. However, this would require items to have a standard of existing data that neither NMS nor NGS currently achieve across their collections. Investigations should start off small, focusing on collection items that have no licensing issues, good data standards, and which speak to seasonal trends/contemporary, before upscaling across the collection.

## Most and Least Popular Items

During the initial log analysis, it became apparent that the most and least popular item lists remained largely unchanged from month to month. Therefore, to determine why certain items are accessed more than others, an analysis of the structure of the most and least popular items was carried out.

## Methods

The top 100 most accessed items and bottom 100 least accessed items were retrieved for each month between April 2020 and March 2021. Due to limitations in the item lists returned by Google Analytics, 'least' was defined as the lowest accessed items with at least one view. The following characteristics were then recorded for each item: views; object type; collection type; artist; and image availability. In addition, the quality of the descriptions included in the items were manually classified using the following scale: low - items with significant metadata missing and basic descriptions only; medium - items with almost all relevant metadata fields but more basic descriptions; high - items with all metadata and fuller descriptions. Fig. 15 highlights an object that was classified as having a high-quality description. These aspects were then compared between the most and least accessed items to determine if any differences were present.

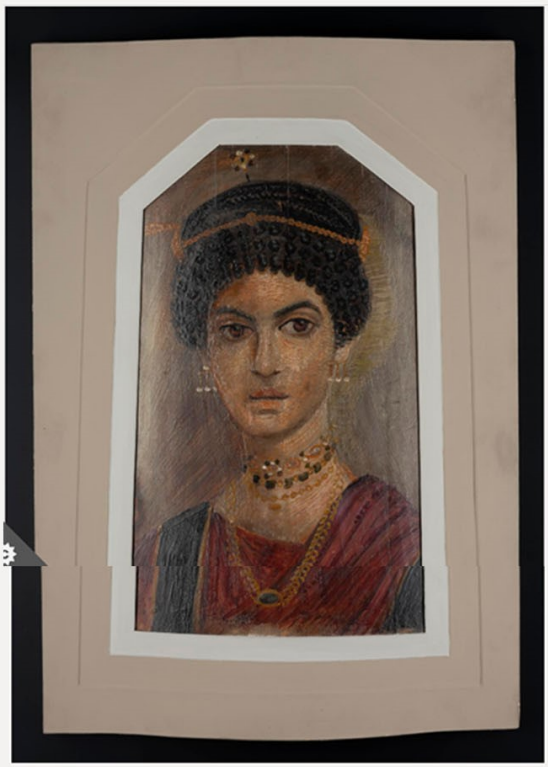


Image © National Museums Scotland

View full screen

# Mummy portrait

## Description

Mummy-portrait in encaustic waxes on a wooden panel, depicting a woman wearing a red tunic and elaborate jewellery, excavated by Petrie: Ancient Egyptian, Hawara, Middle Egypt, Roman Period, c. AD 110-130

## Museum reference

A.1951.160

## Collection

World Culture

## Object name

Mummy portrait, Portrait-board

## Production information

Unknown
Hawara, Middle Egypt, Egypt, Northern Africa

## Date

Roman Period

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## Style / Culture

Ancient Egyptian

## Materials

Wood, Wax, Gold

## Collection place(s)

Hawara, Middle Egypt, Egypt, Northern Africa

## Associations

British School of Archaeology in Egypt
Excavator: Petrie, William Matthew Flinders, Professor Sir, 1853 - 1942
Egyptian Research Students Association [Edinburgh and Glasgow]

## Exhibitions

**Ancient Egypt Rediscovered** (08 Feb 2019)
National Museum of Scotland

**Ancient Faces** (20 Jul 1997)
British Museum

**Egyptian Gallery, 2003 - 2008** (2003 - 2008)
Royal Scottish Museum

**Pittura Romana** (24 Sep 2009 - 30 Mar 2010)
Scuderie del Quirinale

**Ancient Egypt** (29 Jul 2011)
National Museum of Scotland

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## References


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## On display

National Museum Of Scotland »
Level 5 »
World Cultures, Ancient Egypt Rediscovered

**Fig. 15: An example of an item with a high-quality description**

## Differences in Item Structures

Table 6 highlights the typical structure of the objects that formed the most popular and least popular item lists across NGS and NMS.

**Table 6: Overview of the most and least popular item structures**

| Attribute | NGS | | NMS | |
|---|---|---|---|---|
| Miscellaneous | A greater variety of artists were found in the top 100 compared to the bottom. This may indicate a lack of interest in the artists who frequently appear toward the bottom of the list | | Similar types of objects appeared in the bottom 100 lists, which may indicate a lack of interest from the public | |
| Item Views | About 95% of the items returned had less than 10 views; 88% to 92% of items had less than 5 views | | Less than1.6% of the artefacts listed on NMS are being accessed. About 98% of those received less than10 views, and about 95% received less than 5 views | |
| Other attributes | Bottom 100 | Top 100 | Bottom 100 | Top 100 |
| Item Types | Typically works on paper or photographs | Mostly paintings (60+) but more variety: works on paper, photographs, sculptures, and installations | Variety of types, archaeology most featured | Variety of types, fashion & textiles and archaeology most featured |
| Images | At least 90 items with images | At least 90 items with images | At least 90 items with images | At least 95 items with images |
| Item Description | Typically less than 90 items with basic descriptions only | Typically less than 65 items had in-depth descriptions | Typically less than 25 items with descriptions classified as less than high-quality | Typically less than 35 items with high-quality descriptions. There were less medium quality descriptions as opposed to low |

Overall, the number of items receiving at least one view per month across both organisations was extremely limited, with less than 2% being accessed. In addition, those that generated some interest were typically viewed less than ten times, which further highlights a narrow engagement with the collections as a whole. Surprisingly, the availability of an associated image did not seem to contribute to a user's lack of interest in a particular item since large quantities of the bottom 100 items included high-definition pictures. On the other

hand, the quality of an item's description seemed to have more impact on the likelihood of access, with more objects in the top 100 lists being classified as having high quality descriptions.

## Implications for Policy

Due to the limited percentage of collection items being accessed across both NGS and NMS, a discussion is needed on whether the mass upload of objects is the most effective strategy. It is important to ensure that an institution's assets adhere to the FAIR principles in that they are findable, accessible, interoperable, and reusable; however, an argument can be made that cultural heritage organisations should focus on developing a smaller amount of high-quality content, which users are interested in and ultimately engage with. Guidelines to support cultural institutions in selecting and developing such content would be needed.

# User Study of Access Patterns

As highlighted previously, the log analysis alone was not sufficient to drive potential user-centred improvements to the digital provisions of NGS and NMS. Consequently, a two-part user study was conducted with experienced and inexperienced visitors to the NGS and NMS websites to evaluate the search infrastructures provided. Approval to carry out the research was obtained from the Department of Computer and Information Sciences, University of Strathclyde ethics committee, ID: 1593.

## Objectives

Two primary research questions shaped the design of the user studies:

1. How does the metadata assigned by cultural heritage organisations meet or differ from the search needs of users?
2. How can the search strategies of users inform the search pathways employed by cultural heritage organisations?

## Participants

In total, 10 people completed the virtual study individually between the months of January and March 2022. Table 7 includes the demographics of these participants, where a deliberate decision was made to recruit both experienced and first-time users of the NGS and NMS sites to reflect the trends observed during the initial log analysis. Inexperienced users who had some knowledge of search were recruited from higher education institutions across Scotland, whilst more experienced users were contacted directly from the mailing lists of NMS. All participants had access to an information sheet during the recruitment process and provided informed consent before contributing to the study.

**Table 7: Participant demographics**

| ID | Gender | Age | Education | Profession | Regular User | English as 1st language |
|---|---|---|---|---|---|---|
| 1 | M | 25-34 | Bachelors | PhD Student | No | Y |
| 2 | M | 25-34 | Masters | PhD Student, Teaching Assistant | No | Y |
| 3 | F | 25-34 | Masters | PhD Student | No | N |
| 4 | F | 25-34 | Masters | PhD Student, Teaching Assistant | No | N |
| 5 | M | 25-34 | Masters | PhD Student | No | Y |
| 6 | F | 25-34 | Masters | Post-graduate Student | NMS | N |
| 7 | F | 45-54 | PhD | Teaching Fellow | NMS | Y |
| 8 | F | 18-24 | Bachelors | Post-graduate Student | NMS, NGS | Y |
| 9 | F | 25-34 | Bachelors | Post-graduate Student | NMS, NGS | Y |
| 10 | M | 35-44 | Bachelors | Post-graduate Student | NMS | N |

## Protocol

The user study was split into two separate tasks, which were completed virtually via the Zoom video conferencing system to adhere to social distancing measures. Task one was performed on Mural[10] and consisted of an item categorisation process, where participants assigned search phrases to items from NGS and NMS before grouping them together to form 'collections' - similar to Rainbow et al. (2012). The second task involved a scenario-based search observation process, where participants performed live searches across the NGS and NMS websites to fulfil their information needs - similar to Skov and Ingwersen (2014).

For task one, NGS and NMS selected one regularly accessed item and one less popular item from five of their collection departments. Digital flashcards were then developed for each of these items, which included the available metadata and an associated image - see Appendix A. These flashcards were pooled into a Mural worksheet (see Figure 16 for an example of a completed sheet), with the participant selecting the first item and assigning tags that would assist in its retrieval. They were then asked to describe their reasons for the tags they assigned, before placing the flashcard in an appropriate space in the worksheet, which may have included grouping similar items together to form 'collections.' This process was repeated until the resource pool was empty, at which point the participant was given the opportunity to make amendments to the tags and/or groupings. Such a procedure enabled the participants to consider, outside of the infrastructures of NGS and

[10] https://www.mural.co/

NMS, the characteristics of collection items that are most important to them when searching. As such, a comparison between these characteristics and the data management standards employed by NGS and NMS were made.

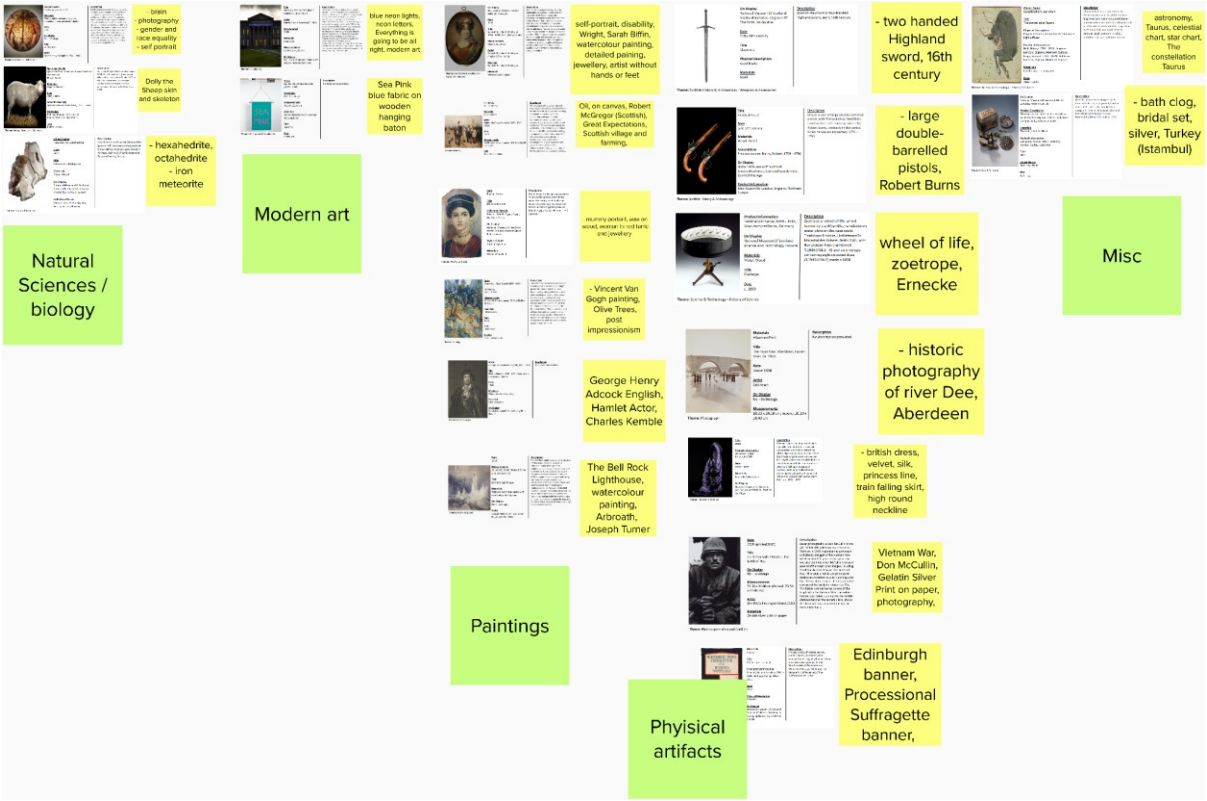


**Fig. 16: A completed Mural Worksheet demonstrating some of the search tags assigned to the collection items.**

It was also important to consider the search strategies of users when carrying out tasks within the real digital infrastructures of NGS and NMS. Therefore, task two involved a search observation process, with each participant being required to locate various items across each site. Based on Borlund's evaluation framework for interactive retrieval systems (Borlund 2000), four simulated search scenarios were created by NGS and NMS focusing on the following goals:

1. Researching a well-defined topical information need
2. Researching topics via data elements only e.g. titles and locations
3. Researching an ill-defined topical information need
4. Researching a known item via data elements

The specific search scenarios can be found in Appendix B and were designed to ensure all features across both sites were accessed. Participants completed one search task at a time and were permitted to utilise as many features and access as many pages as they deemed necessary to satisfy the information need. Whilst locating search items, each participant was encouraged to 'think aloud' (Nielsen et al., 2002): to talk through the rationale behind their actions as they were carried out. Help was not provided by the investigator unless explicitly requested, and no time limit was placed on the search tasks. On completion, a discussion took place about the features the participant liked on each site and the potential improvements that could be implemented.

## Analysis

Both tasks were recorded and transcribed verbatim, with participant consent for further analysis. The first task was subjected to a deductive content analysis, using the Spectrum data management standards as the driving structural framework, since Spectrum is employed by both NGS and NMS. Content analysis is a term used to describe a number of text analysis strategies:

It is a systematic coding and categorising approach used for exploring large amounts of textual information unobtrusively to determine trends and patterns of words used, their frequency, their relationships, and the structures and discourses of communication…The purpose of content analysis is to describe the characteristics of the document's content by examining who says what, to whom, and with what effect. (Vaismoradi et al., 2013)

With its added focus on the use of particular words, content analysis was an ideal method to determine the characteristics users find most interesting when searching for cultural heritage items and whether these align with Spectrum. An in-depth description of the steps involved in content analysis is described by Erlingsson and Brysiewicz (2017).

During task two, participants employed a range of search strategies and therefore encountered a variety of barriers. Consequently, an inductive framework analysis was considered to be the most appropriate method since it facilitates the natural comparison of participants' views, which led to more concrete recommendations on how to improve the search pathways across NGS and NMS. Gale et al. (2013) provide an in-depth description of the steps involved in framework analysis.

## Results: Metadata Tagging

Overall, the majority of the search tags created by the ten participants could be retrofitted to meet the cataloguing fields proposed by Spectrum. Nevertheless, this process often consisted of assigning tags to wider encasing fields, such as description or physical description, where curators have some freedom in determining the characteristics that should be included. As such, there is a risk that potentially important information could be overlooked due to the structures of expertise and knowledge frameworks, or the lack of it, that inform the institutions' indexing practices. For example, in Ian Hamilton Finlay's 'Sea Pink' (see Appendix A), many of the participants focused on the colours pink and teal when assigning search tags due to their lack of knowledge about the object, yet such descriptors are not included in the metadata. NMS in particular offer no specific search functionalities related to colour, which participant eight suggests would be helpful to distinguish between similar items from the same era: *"I think something that might also be helpful to include within the websites is if you can kind of also add colours as ways to sort objects, especially within fashions and textiles. If there's a lot of similar objects within the same era, then being able to identify them by colour might be helpful."*

Some of the tags proposed by the participants could not be modelled under the existing Spectrum standards, with the majority of these aligning with the ability to link loosely coupled objects together. For example, reflecting contemporary concerns with inclusion and equality, many of the participants honed-in on characteristics that related to disability (such as Mrs E.M. Wright being painted by an artist with no hands) and women's rights (e.g. the suffragette banner) and therefore suggested that such topics could be grouped together under the same collection. This included highlighting female subjects or artists from older time

periods, due to their previous exclusion from the field of art and culture. Currently, such information could be captured in Spectrum's description field, yet this would not be sufficient to link inherently different items together, meaning an additional field would be necessary.

Similarly, some of the participants assigned search tags based on the presence of an animal or person, regardless of whether they were well known: participant four: *"There's also people in this painting [Great Expectations] so I'll put it here [next to portraits] and I'll just put like a theme like people in general or something";* participant one: *"People do look for art that relates to animals in particular."* Creating new fields that enable users to search for people or animals in general (e.g. linking the zoetrope with more obvious items such as Dolly the sheep) could help facilitate future research into areas such as class or the role of animals in human culture. Sub-categories may also be developed to support more specific research, as highlighted by participant two: *"This is going to be such an awkward one to do but it's like famous or renowned. Yeah it's like famous faces. And I'm going to put in Stevenson, you can put in Dolly the Sheep, uh, where's Van Gogh gone. I'm going to put him there and connect him to Burns."*

Participants also consistently assigned tags that group items from a particular domain. Some of these tags cited well indexed areas such as anatomy, Scottish history, space and war; nevertheless, many were poorly captured by NGS and NMS, including animation, activism, taxidermy etc. Spectrum's Object Category / Classification field can permit the retrieval of items from a particular subject, yet once again the nature of these subjects rely on the views of curators, which can differ from end users.

Finally, there was a difference observed in the manner in which participants from outside of Scotland tagged specific items compared to the available metadata. Those individuals with English as an additional language particularly relied upon Spectrum's Object name category when tagging items, which encapsulates more basic descriptions. Nevertheless, there were instances of local or culturally specific terms being embedded in this category, for example 'claymore' in the highland sword, which had no meaning to these participants, who instead opted for simpler terms such as 'sword': participant 6: *"Because I don't know what [a] claymore [is] so I will just type sword."* This highlights the importance of providing synonyms to support search from a range of users. Non-native participants where English was their first language also had similar experiences. In addition, participants tended not to tag more scientific terms and opted for terms that were used on a more general basis: participant 8: *"I don't think most people know a hexahedrite or things like that in their daily vocabulary. But meteorite would be something that more people of any age can sort of search for and maybe if you are a younger audience you might just search rocks."*

## Spectrum Fields

This section provides a discussion on some of the interesting tags assigned by the participants and how they relate to Spectrum fields.

### Dimensions

Participants consistently referred to the size of tangible items (i.e. physical, 3-D objects) when providing tags. This did not solely involve specific dimensions, with other more general descriptors being used such as 'miniature'. Nevertheless, participants requested further information on the size of certain items, such as the claymore, which highlights the variability of the metadata being assigned to collection objects: participant 7:

*"Has it got the dimensions? No it doesn't, um, because some of these were symbolic, you know, they were so big that they weren't actually weapons but they're classed as weapons."*

## Location

The location tag in Spectrum calls for full location audit information, including current display locations. Some of the participants were interested in the exact rooms items were held, yet many cared more about whether they were on display to support their decision for an in person visit: participant 1: *"You want to group together things that were on display…but also if it wasn't on display they [users] wouldn't waste their time going to the museum to go see it if it wasn't there because obviously, you know, during the pandemic everyone's working from home. Some people may have moved away from the city and a lot of people who visit museums aren't actually from the city…they might not want to visit or come to travel that far if that wasn't there. And a lot of international people go to the museum."*

## Materials

Materials were one of the most commonly tagged aspects, particularly when an unusual or defining substance was used by an artist: participant 4: *"If I want like a more specific [tag] I would look at material, so here, like, it's really different to have a wood material [for paintings]."* In addition, the participants would often fall back on tagging the material if they were unsure of the purpose of a specific item; participant 8: *"I don't think people would necessarily remember it's a bridal set or anything like that, I think a keyword to be in here would be silver."*

## Production Dating

The Spectrum Production Dating field urges indexers to provide a specific date an item was made or a broader range if one is not available. This was evident in the participants' own tags, where four different classes of date were mentioned: the exact date; the century; an era such as Victorian; and modern vs old art. Different indexing strategies could link vastly different items together, particularly via the latter method as highlighted by participant two: *"I would have guessed that [mummy portrait] would have been like, you know, maybe pre Victorian times but if that's where that's from then it's ancient, that's pretty amazing. So yes, to go with modern history there's also your ancient history. Anything that's over 1000 years would go into ancient history. Or like anything over 800 years. Yeah, yeah I'd say 800 years cause then you get into like the middle ages, your dark ages and middle ages."*

## Production Place

Spectrum also places significance on the area an item is associated with, which may include multiple locations such as the place it was designed and the place it was manufactured. The participants also felt such information was important, and also suggested emphasising Scottish and non-Scottish objects for tourists who may want to prioritise local artefacts: participant 9 *"When I go to [anon] and they like present some Scottish local artists and some creation in a particular space. So I think some of the audience will be interested in Scottish artists. So I might put these kind of key words in it."*

### School / Style / Culture and Title

In terms of the style of an object and its title, many of the participants who had little experience in the domains of art and culture were hesitant to tag such fields unless they contained common knowledge such as Dolly the Sheep. Nevertheless, they recognised that users with more experience would deem these characteristics to be important: participant 8 *"I mean I'm not an artist, I'm not but is he classified as an impressionist or something but I guess if people are looking for Van Gogh though they know about him."* Participant 10 *"I don't know a lot about guns so I wouldn't know that [flintlock]. But I bet if someone knew something about guns and they were searching for it I'm sure they would know that term."*

## Personalisation

Following on from the 'School / Style / Culture and Title' section, participants recognised that search terms are personal and are influenced by an individual's preferences and experiences: participant 10: *"Yeah so it was easier because I have a background knowledge on Dolly I know what search terms would probably work for that one, whereas the other ones I don't have any background knowledge on those";* participant 2: *"It's not something that I'd be particularly interested in looking at, I mean it's a very pretty dress but again it needs to be something a lot more outlandish. You know, some sort of famous person…but if it's just a pretty dress, it doesn't appeal to me as much as a lot more smaller, physical objects."*

In terms of the tagging process, the variability of the metadata available had an effect on the depth of the search terms assigned to an item. Some participants had great difficulty tagging items that had little description; whereas others were absorbed by more complex items and found themselves applying less relevant tags; participant 5: *"Because there's no information on it, it makes it hard to classify it and give it worth. I'd imagine walking past that and being like you'd want to know why it's there and then when there's no information on it you're like there's nothing there to tell me why it's here and that someone made it*"; participant 1: "*I could list everything in that photo, waves, sea, boat, lighthouse but you know then I'm just listing everything in it rather than trying to generalise a theme...I don't want thousands of themes. How do I encompass most of them?"* There was also some evidence of participants breaking wider encompassing tags into smaller sub-tags.

## Physical vs Digital Space

When attempting to group items, participant eight consistently referred to the physical spaces of museums and how collections are formed: *"Thinking about the actual physical space of where these objects would be and I think that is really important for a lot of people when it comes to sorting things especially if you've been to the physical spaces, they're like oh this was probably in this room whereas this was in this room."* This was surprising since recent literature (e.g. Burke et al., 2020) focuses on taking advantage of the different experiences offered by digital spaces and moving away from simply mirroring the layout of physical museums and galleries.

## Implications for Policy

The results highlight that indexing cultural heritage objects for a range of target users is an extremely difficult and time-consuming task, even with curators being guided by data management standards such as Spectrum. These standards encourage a variety of different characteristics to be considered when developing metadata, yet much of the content is left to the interpretations of curators e.g. description or physical description. Rather, user- and context-specific guidelines could be useful in ensuring the aspects considered most important by consumers are indexed, thereby producing more relevant search results. In addition, there is an opportunity to explore the use of AI and ML techniques in supporting the indexing process, to expand item descriptions based on the knowledge of users and previous access patterns. Such a process has the potential to ensure metadata is more user-centred and takes into consideration the needs of users with different ethnicities, varied experience in cultural heritage, search motivations, and so on.

## Results: Search Tasks

In addition to evaluating the search tags employed by NGS and NMS, it is also important to consider the overall user experience of individuals searching for information across the sites. Whilst completing the search tasks, the participants discussed aspects relating to the way they search, the search features (pathways) available, and the structure of the items returned.

### Search Procedures

Continuing on from the first task, the search terms employed by participants were generally basic, consisting of a few descriptive phrases such as 'brooch, love.' Most, centred on terms that could be captured by Spectrum's Object Name field, with colour, style, and materials also being used to narrow searches that returned a wide range of results. Barriers related to search terms primarily consisted of a lack of support for synonyms, misspellings, and grammatical constructs such as pluralisation: participant 2: *"It would be dreadful if you type in something and it turns out you've missed your spelling slightly, yeah instead of archaeology I put archaeologists instead and got nothing."*

Two main search strategies were utilised by the participants depending on the topic being explored and their familiarity with the websites. First, if a topic was particularly broad, or the participant was new to the NGS or NMS websites, then they would prefer to use the site-wide search box: participant 4: *"I feel like the advanced search is too narrow for this, like I don't know where to put the Covid-19, like should this go into the collection or description, so I'm just gonna go with the normal search, Covid-19."* There was also evidence of participants falling back to the site-wide search bar if other features such as advanced search produced no relevant results: participant 7: *"So when in doubt usually my last step, I think, is just going to the actual search bar up here and searching like art and culture."* Second, participants who were familiar with the websites tended to use more of the available search features, often beginning with advanced search when the object had a particularly distinguishable feature: participant 1: *"You would like to find out what other religious events inspired works by Durer, so immediately, you might want to search for the artist."*

In general, participants tolerated between four and six pages of items being returned. If the results became too obscure, then they would narrow the search by adding further terms to the advanced search bar: participant 5: "*We're getting a bit obscure, well there's a brooch but if I started to see like it was getting a bit abstract, like that plaid I'd be like, oh right, I may be going too far."*

## Search Features

The motivations behind utilising each of the available search features across NGS and NMS, as well as the advantages and barriers to using these features are presented below.

### *Advanced Search Bars*

As discussed previously, the participants tended to use advanced search features when they were familiar with the websites and had a particular characteristic in mind that they wanted to search for, especially when narrowing results. Figure 17 highlights the differences in the advanced search features offered by NGS and NMS.

Users of NMS felt that the advanced search bar was missing crucial characteristics such as colour, whilst they were also unsure on what information to include in the categories that were provided. For example, all were hesitant to input a collection when searching for items as there was no easy way to find a list of collections made available by the museum: participant 5 *"Knowing what the collections are called helps. But then again, I feel like that should just be something I can find out very easily rather than having to look for one example then work my way back up the chain."* In addition, the results were overly restrictive, in that inputting a wrong word or misspelling in one category would simply break the search.

The participants preferred the ability to select pre-determined search categories - like those offered by NGS - since this supports users who are less familiar with their item to find what they are looking for: participant 1: *"I like that they both had an advanced search option. I like the fact that this one has the search option, where it kind of gives you things - if I wanted to search Van Gogh, you can see the artist and his artworks. It will give you, like, very specific things that might have been the actual search term to use."* Nevertheless, they felt that the free-text search bar was difficult to locate within the 'More' menu item and should instead be embedded in the main Artworks page. Improvements to NMS' advanced search feature focused on guiding the user on what terms to use either via an autocomplete feature or similar drop-down menus to NGS: participant 2 *"I think something that pops up with recommendations of tags that do exist…I think that would help."*

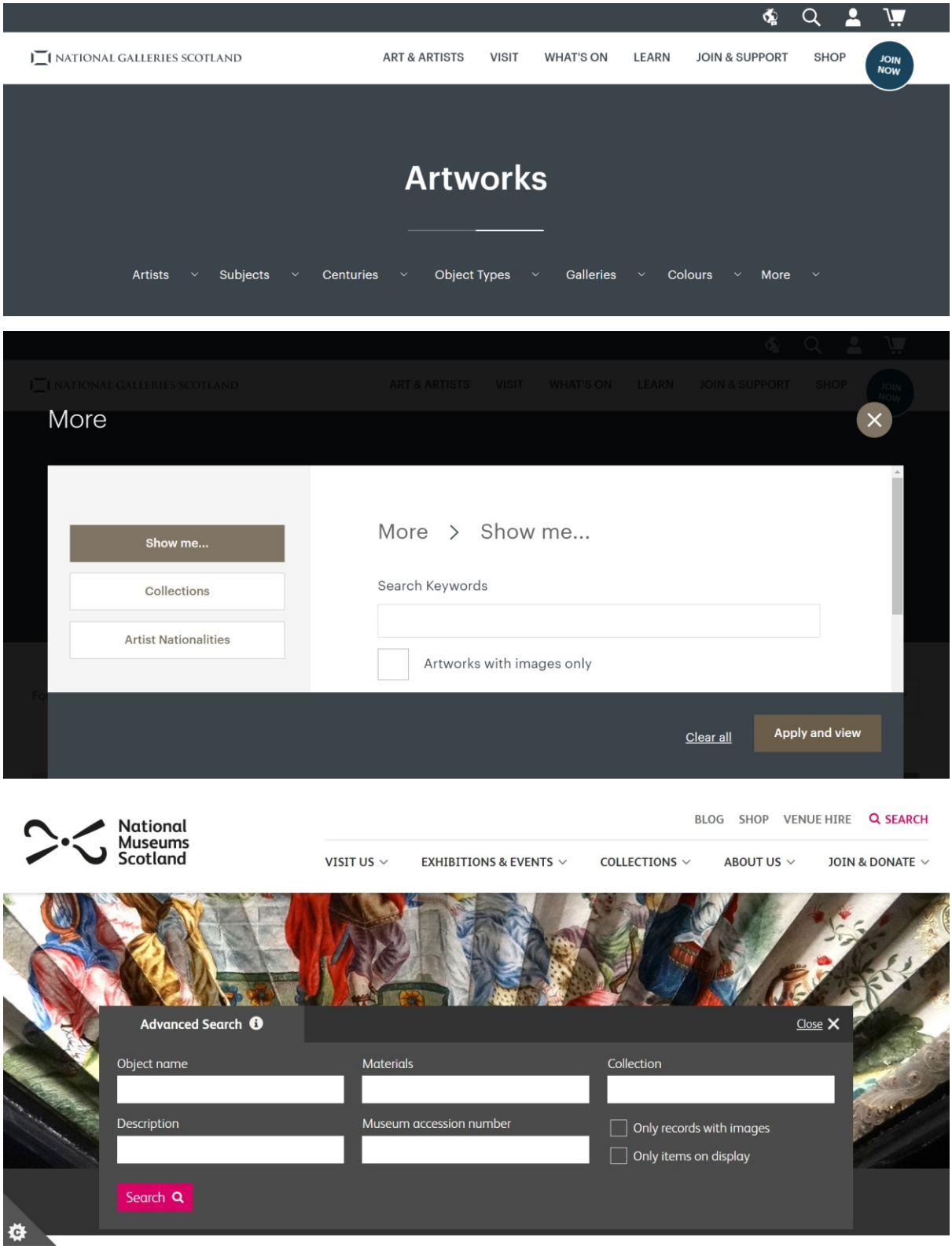


**Fig. 17: NGS and NMS advanced search bars.**

### *Artists Search NGS*

The participants who utilised the 'Artists' search feature from NGS appreciated the additional information that may be obtained - such as a link to the artists Wikipedia entry - and felt that the pages were well structured overall. Yet, there were some instances where they attempted to find an unlisted artist using this feature and subsequently requested a more complete catalogue.

### *Collections NGS*

The 'Collections' feature from NGS was misused by the participants who were unfamiliar with the site, as they felt that the page would offer a way to search for collection items (like the advanced search bar found in 'Artworks'), as opposed to describing collections that are available in the gallery. This may suggest that a re-think of the headings may be necessary to support new users in accessing the features they are looking for but also encourage them to utilise a wider range of functionalities.

### *Glossary NGS*

Surprisingly, NGS' glossary was underutilised by the participants, especially those who were less familiar with art and culture. Nevertheless, when shown the feature, most suggested it could be extremely useful to identify potential search terms, with participant four advocating for a link to be embedded within the site-wide and advanced search features: *"It's difficult to find it. I feel like it should be near the search bar and then, like, under the search bar it should be written like 'don't know what terms to search, look at our glossary' or something like that."*

### *Site-wide Search Bars*

As discussed previously, the site-wide search bars were mostly utilised by new users or when participants were researching more open or new topics such as Covid-19. In addition, the experienced users of NMS used this feature in circumstances where an article would be more insightful than a collection page: participant 6 *"The phrasing of that question, which was art is addressing the topic of climate change, that doesn't make me think I'm looking for artwork for climate change because there's probably lots of that but more maybe articles."* On the other hand, less experienced users expected a combination of articles and collection pages to be returned by the NMS site-wide search bar, which was not the case. In terms of the NGS bar, the participants appreciated the suggested terms drop-down menu that appears when typing but found it distracting when a suggestion permanently fills the search box once you have hovered over it.

### *Stories and Resources NMS*

This feature was mainly used by participants who were familiar with the NMS site. They suggested that 'Stories and resources' offered an alternative way of gaining additional information on items via articles that are grouped together by themes and subjects: participant 7: *"This is quite an interesting way to go because this includes lots more than just the actual artefacts, so I think the themes are quite good. I have found you've got to know to go there, and I think that that could be clearer. Romans' life in the frontier, Romans, the Roman army. These are really, really good, these sorts of articles. I think that's actually gonna tell me a bit more."* Improvements to the feature centred on the ability to restrict search results via subject, theme, and type as opposed to just one of those categories: participant 8 *"I think if there was a way to sort of more*

*narrow down, like if you could choose both the theme and subject because as you can see you can't choose both. So having, like, explorer by type or subject or theme or a mixture of all of them I think would be a lot more helpful."*

## Item Descriptions

Three barriers relating to the descriptions of items were observed. First, participants found the collection search results to be difficult to navigate when the items were presented with the same, basic tags: participant 5 *"It's frustrating how they're all called brooch. If they even had brooch brackets, something, a year, a period, a style anything because otherwise what you've got is brooch, brooch, brooch…even like a preview of what it could be [would be helpful]."* Some of the participants were also hesitant to conclude that their search tasks had been completed due to the omission of important metadata such as a date: participant 3 *"I would be really missing a year. At the least, I like an approximate year because if it says Roman site at Newstead I don't know whether there might be, like, an actual Roman site still now at Newstead and it's been found like a week ago so it's dated like 2021. I know I'm overthinking this but it's clear for this object but it might not be clear for other objects that are not so well known in history."* Finally, the lack of associated images hindered participants during the tasks where they had to use a picture of an object as a reference.

## Limitations

The n-size (population) for the study was small, yet the results enabled a conclusion to be formed that the knowledge of stakeholder needs and preferences can help drive user-centred improvements to the digital infrastructures of cultural heritage institutions. All of the participants were highly educated and were either pursuing or had obtained a postgraduate degree. This may reflect the bulk of users visiting the NGS and NMS sites; nevertheless, future studies should also consider individuals who may be representative of one-time users looking for information, for instance in relation to in-person visits.

## Implications for Policy

The results indicate that a user-centred approach to designing cultural heritage websites would help to improve an individual's experience when searching for information. Such a process requires institutions to form a concrete understanding of who their target users are before developing features and designs to suit their specific needs and interests. To elaborate, those participants who had less experience with art and culture, including the NGS and NMS sites, experienced different barriers than those who did, and used a narrower range of search features - primarily the site-wide and advanced search bars.

# Conclusion

This research provides some insights into the online search behaviour of NMS and NGS users that can inform future policies around digital presence and provisions for these institutions, and the sector as a whole. The findings are likely to contribute to future digital policies in making decisions on:

- whether mass digitisation and uploading of objects is the most effective strategy or whether cultural heritage organisations should focus on developing a smaller amount of high-quality digital content, which users are interested in and ultimately engage with;
- improving interface design to align with changing users' needs and behaviour such as the use of multiple devices and mobile access;
- improving user engagement through targeting known user groups, for example, by using mailing lists, and unknown users (wider audience) through social media;
- improving retention rates and attracting returning users;
- understanding which collections/objects get least number of visits and how to improve access;
- using existing staff resources to attract more users to some pre-planned topics/ themes that align with the institutions' collections and values;
- how to draw public attention to collections/objects that have links to topics of contemporary discussions on search engines, mass media and social media;
- reasons for sharing content with external partners and reviewing their policies in relation to content sharing;
- resources required to make content suitable for external platforms vs. expected benefits, which may include an increase in audience reach and brand value or the creation of deeper engagement with online collections; and
- ensuring that access, re-use and licensing requirements of partner platforms align with the institution's overall approach to the reuse of items.

Existing collection management standards like Spectrum are not user-centred and often the metadata implemented by collection institutions to index objects are not designed for the diverse needs and contexts of users. This calls for more research – with diverse groups of both users and non-users, and selected collections/objects, to capture multiple perspectives of items. Such a process has the potential to ensure metadata is more user-centred and the search interface employed takes into consideration the needs of people with different backgrounds, motivations, ethnicities, and varied experience in cultural heritage. Research literature, discussed in the background section, shows promising prospects for the use of AI (artificial intelligence) and ML (machine learning) to support more timely and wide-reaching metadata tagging. However, this would require items to have a standard of existing data that neither NMS nor NGS currently have across their collections; and this could be true for most cultural heritage institutions. Investigations should start off small, focusing on collection items that have no licensing issues, good data standards, and which speak to diverse sets of users and their search motivations, before upscaling across the collection.

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# Appendix A: Flashcards of Collection Items

**Title**
Dress

**Product Information**
Unknown, Maker
Britain, EUROPE

**Date**
1874 – 1879

**Materials**
Shot silk, Velvet, Lace

**On Display**
National Museum Of Scotland
Art, Design And Fashion, Fashion And Style

**Description**
Woman's dress, in purple and black shot silk, trimmed with silk velvet, constructed with the princess line, with a high round neckline and centre front fastening trimmed with velvet, full-length velvet sleeves with shot silk cuffs trimmed with lace, narrow skirt with train falling in swags and cascade, with purple silk ribbons trimming the centre front, panels of velvet and velvet finishing the train: British, c. 1874 - 1879

**Theme:** Fashion & Textiles

**Specimen Details**
Specimen form: Mounted skin and skeleton
Sex: Female
Phase: Adult

**Materials**
Organic Material

**Date**
1996 – 2003

**Scientific Name(s)**
Species: Ovis aries Linnaeus, 1758 – Sheep

**On Display**
National Museum Of Scotland
Natural World, Animal World

**Title**
Dolly the Sheep

**Description**
Dolly the Sheep, Ovis aries Linnaeus, 1758, Finn Dorset breed, mounted skin and skeleton, born 5 July 1996 at the Roslin Institute, Midlothian, Scotland of a Scottish Blackface surrogate mother, died 14 February 2003

**Theme:** Natural Sciences - Mammals

**On Display**
National Museum Of Scotland Scotland Galleries, Kingdom Of The Scots, Na Gaidhei

**Date**
Early 16th century

**Title**
Claymore

**Physical Description**
Steel Blade

**Materials**
Steel

**Description**
Scottish claymore or two-handed Highland sword, early 16th century

**Theme:** Scottish History & Archaeology - Weapons & Accessories

**Product Information**
Ferdinand Ernecke, 1859 - 1915, Manufacturer Berlin, Germany

**On Display**
National Museum Of Scotland Science And Technology, Enquire

**Materials**
Metal, Wood

**Title**
Zoetrope

**Date**
c. 1890

**Description**
Zoetrope or wheel of life, wheel turned by crank handle,manufacturers metal plate on the base reads 'Ferdinand Ernecke, Hoflieferant Sr. Majestat des Kaisers, Berlin S.W', with five picture-films (numbered T.1949.X.54.2 - 6) and an envelope containing eight coloured discs (T.1949.X.54.7) made c.1890

**Theme:** Science & Technology – History of Science

**Date**
Roman Period

**Title**
Mummy Portrait

**Collection Place(s)**
Hawara, Middle Egypt, Egypt, Northern Africa

**On Display**
National Museum Of Scotland World Cultures, Ancient Egypt Rediscovered

**Style / Culture**
Ancient Egyptian

**Materials**
Wood, Wax, Gold

**Description**
Mummy-portrait in encaustic waxes on a wooden panel, depicting a woman wearing a red tunic and elaborate jewellery, excavated by Petrie: Ancient Egyptian, Hawara, Middle Egypt, Roman Period, c. AD 110-130

**Theme:** World Cultures


**Materials**
Cotton

**Title**
Banner, processional

**Production information**
Sennett, Maude Arncliffe, 1862 – 1936, Suffrage Atelier, 1909 - 1913

**Date**
1914

**Physical Description**
Cotton?

**On Display**
National Museum Of Scotland Scotland Galleries, Scotland, A Changing Nation, Voice Of The People

**Description**
Processional Suffragette banner, double-sided with three white compartments edged with red ribbon on a black background, for the Northern Men's Federation of Women's Suffrage, Edinburgh: by Maude Arncliffe-Sennet of the Suffrage Atelier, 1914

**Theme:** Art & Design – Fashion & Textiles

**Object Name**
Hexahedrite, Octahedrite

**Date**
1947

**Title**
Sikhote-Alin Meteorite

**Materials**
Metal, Wood

**On Display**
National Museum Of Scotland
Natural World, Earth In Space, Matter (Rocks From Space)

**Collection Places**
Sikhote-Alin, Primorsky Krai, Russia, Eastern Europe

**Description**
Hexahedrite or Coarsest Octahedrite (group IIAB, iron meteorite), reddish-brown skin with silver-grey metallic cut face, fell in 1947 at Sikhote-Alin, Eastern Siberia, Russia

**Theme:** Natural Sciences

**Title**
Flintlock Pistol

**Date**
Late 18th century

**Materials**
Wood, Metal

**Associations**
Previous owner: Burns, Robert, 1759 - 1796

**On Display**
National Museum Of Scotland
Scotland Galleries, Scotland Transformed, Spirit Of The Age

**Product Information**
Blair, Gunsmith, London, England, Northern Europe

**Description**
One of a pair of large double-barrelled pistols, with flintlocks inscribed Blair, London, late 18th century, owned by Robert Burns, probably in the period when he was an exciseman, 1791 - 1796

**Theme:** Scottish History & Archaeology


**Object Name**
Celestial chart, Star Chart

**Title**
The constellation Taurus

**Physical Description**
Engraved hand-coloured card, thin paper light-diffuser

**Product Information**
Hall, Sidney, 1788 - 1831, Engraver
London, England, Northern Europe
Leigh, Samuel, 1780 - 1831, Publisher
London, England, Northern Europe

**Materials**
Cardboard, Tissue paper

**Date**
1820 - 1825

**Description**
Urania's Mirror, or a View of the Heavens, one of a set of thirty-two engraved and hand-coloured tissue-backed celestial charts for educational use by novice astronomers, engraved by Sidney Hall and published by Samuel Leigh, London, c. 1823, entitled 'The constellation Taurus'

**Theme:** Science & Technology – History of Science

**On Display**
National Museum Of Scotland, World Cultures, Patterns Of Life

**Physical Description**
Plywood, leather and sheet silver; silver worked with designs in relief in embossed stamped and gilded techniques

**Materials**
Plywood, Leather, Silver

**Product Information**
Gulludere, Manuk, 1945 - 1991 (fl.)
Istanbul, Turkey, West Asia

**Date**
1991

**Object Name**
Bath clog, Nalin

**Title**
Bath clog

**Description**
One of a pair of bath clogs or nalin from a bridal set, of plywood, leather and sheet silver, silver worked with designs in relief in embossed stamped and gilded techniques: Turkey, Istanbul, by Manuk Gulludere, 1991

**Theme:** World Cultures


**Title**
Work No. 975 EVERYTHING IS GOING TO BE ALRIGHT

**Artist**
Martin Creed, Scottish (B. 1968)

**Date Created**
2008

**Materials**
Blue neon

**Measurements**
62.50 x 1541.60 cm

**On Display**
Yes - Scottish National Gallery Of Modern Art (Modern One)

**Description**
'Work No. 975 EVERYTHING IS GOING TO BE ALRIGHT' is one of Martin Creed's most iconic works. It characterises his desire to communicate and interact with the viewer – to create a reaction and stir an emotion. For Creed, experience is fundamental to understanding his work and he asserts that his art is "50% about what I make and 50% about what other people make of it." His work is often playful and minimalist and 'Work No. 975 EVERYTHING IS GOING TO BE ALRIGHT', blazoned across the Gallery's frieze, operates in a similar vein. Visually spectacular in its neon audacity, the work, however, encourages a more contemplative response. Although it is at first an overtly familiar and reassuring phrase, it plays on our personal insecurities and gently suggests that everything might not be alright.

**Theme:** Installation

**Measurements**
50.90 x 44.60 x 11.80 cm

**Materials**
Photographic transparency, glass, aluminium frame and electric lights

**Date**
1991

**On Display**
No - In Storage

**Title**
Self-Portrait

**Artist**
Helen Chadwick English (1953 - 1996)

**Description**
Self-Portrait is from the Meat Lamps series of works. A photographic transparency is mounted on a glass plate and lit from behind by an electric light. The piece is simultaneously fascinating and repulsive. Cradled carefully in the artist's hands, the shapes of the brain are echoed by the folds of material. The work is a kind of collective self-portrait. Regardless of gender, age or race, everybody's brain looks the same. When we look at the work, our brain is effectively looking at itself, a potentially unsettling experience given that the brain is at the core of our identity.

**Theme:** Installation – Self Portrait

**Theme:** Decorative & Applied Art – Portrait Miniatures

**On Display**
No - Scottish National Portrait Gallery(In Storage)

**Date**
1830

**Title**
Sarah Biffin, Mrs E.M. Wright, 1784 - 1850. Artist (Self-portrait)

**Measurements**
Height: 10.30 cm

**Artist**
Sarah Biffin, Mrs E.M. Wright
English (1784 - 1850)

**Depicted**
Sarah Biffin, Mrs E.M. Wright

**Materials**
Watercolour on paper

**Description**
This miniature self-portrait by the artist Sarah Biffin, also known by her married name, Mrs E.M. Wright, bears the following inscription on the back: 'Painted by Mrs Wright – born without hands or feet'. It is a remarkable and incredibly detailed portrait by a courageous woman, who taught herself to sew, write and paint using only her mouth to steady her needle or brush. This miniature measures just over 10 cm in height and has been painted in watercolour on paper. Like many portrait miniatures, it is set in a gilt-metal frame and has a little eye for a chain, which would allow the owner to wear it like a piece of jewellery.


**Theme:** Decorative & Applied Art

**Artist**
Ian Hamilton Finlay Scottish (1925 - 2006)

**On Display**
No – In storage

**Measurements**
41.50 x 21.20 cm

**Materials**
Embroidered fabric on wooden hanging baton

**Title**
Sea Pink

**Date**
Unknown

**Description**
No description provided.

**Date**
1968 (printed 2013)

**Title**
Shell-shocked US Marine, The Battle of Hue

**On Display**
No – In storage

**Measurements**
53.50 x 36.00 cm (framed: 76.50 x 57.00 cm)

**Artist**
Don McCullin English (born 1935)

**Materials**
Gelatin silver print on paper

**Description**
Seven photographs by Don McCullin in the ARTIST ROOMS collection were taken in Vietnam in 1968, depicting the prolonged and bloody struggle of the Vietnam War which reached its peak in that year. This was also the time when McCullin produced several of his most iconic images, including 'Shell-Shocked US Marine, The Battle of Hue'. This widely publicised photograph depicts an American soldier, clutching onto his rifle in a state of quiet distress amid the carnage of the battle to retake Hue City. This battle is remembered as one of the toughest in the Vietnam War. The soldier's intense expression, staring into the middle distance beyond the camera's lens, shows the deep personal impact of the war on many individuals.

**Theme:** Photograph – Wars and Conflicts

**Materials**
Albumen Print

**Title**
The River Dee, Aberdeen, Frozen Over, ca. 1900

**Date**
About 1900

**Artist**
Unknown

**On Display**
No – In Storage

**Measurements**
18.20 x 24.00 cm; mount: 20.20 x 28.40 cm

**Description**
No description provided.

**Theme:** Photograph

**Theme:** Work on paper

**Date**
1819

**Measurements**
30.60 x 45.50 cm (framed: 59.40 x 72.10 x 5.00 cm)

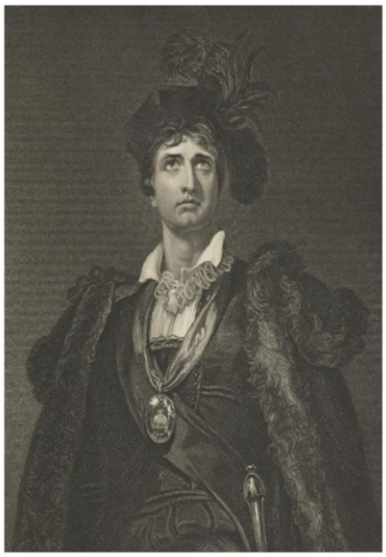
**Title**
Bell Rock Lighthouse

**Materials**
Watercolour and gouache with scratching out on paper

**On Display**
No – In storage

**Artist**
Joseph Mallord William Turner
English (1775 - 1851)

**Description**
The Bell Rock Lighthouse, which is situated off the Angus coast south-west of Arbroath, is one of the greatest achievements of early nineteenth-century engineering. It was designed by Robert Stevenson and built between 1807 and 1811 on a partially submerged reef, using the latest and most revolutionary construction methods. In 1819, Stevenson commissioned Turner to design a frontispiece for his 'Account of the Bell Rock Lighthouse'. This watercolour was the result. Turner never actually visited the lighthouse, and probably based his design on drawings. It was subsequently engraved for Stevenson's account by John Horsburgh and published in 1824.



**Theme:** Work on paper

**Artist**
George Henry Adcock English (1803 – 1850)

**Title**
Charles Kemble, 1715 - 1854. Actor, in the character of Hamlet

**Date**
1844

**Materials**
Stipple and line engraving

**Depicted**
Charles Kemble

**On Display**
Scottish National Portrait Gallery(Print Room)

**Description**
No description provided.

**Theme:** Painting

**Artist**
Vincent van Gogh Dutch (1853 - 1890)

**On Display**
Yes – On loan

**Measurements**
51.20 x 65.30 cm (framed: 72.40 x 85.40 x 11.10 cm)

**Materials**
Oil on canvas

**Date**
1889

**Title**
Olive Trees

**Subject**
Post Impressionism

**Description**
The writhing brushwork and strident colours contribute to the painting's powerful impact. Van Gogh was fascinated by the gnarled structures and changing colours of olive trees. He was also fully aware of their association with the story of Christ's Passion and the episode of Christ in the Garden of Gethsemane on the Mount of Olives. This picture is one of at least fourteen canvases of olive trees Van Gogh painted while in the asylum at Saint-Remy, and its intense character may well reflect the artist's agitated state of mind.

**Theme:** Painting

**On Display**
No – In storage

**Materials**
Oil on canvas

**Artist**
Robert McGregor Scottish (1847 / 1848 - 1922)

**Date**
1879

**Measurements**
76.00 x 137.30 cm (framed: 101.20 x 161.20 x 9.50 cm)

**Title**
Great Expectations

**Description**
At the outset of his career most of McGregor's subjects were drawn from the life of Scottish village and farming communities. In their general conception and monumental treatment of rustic figures, these pictures show an obvious affinity with earlier French Realism (including the work of Millet) and the Hague School. Here, in the diffused light of evening, a group of field labourers is depicted returning home and clustering excitedly round a poster for a travelling circus. McGregor himself was to become an important influence on the younger painters of the Glasgow School during the 1880s.

# Appendix B: Search Scenarios

## NMS Scenario 1 - Well-defined topical information need

You recently purchased an unusual brooch at a car boot sale (see the image below) and would like to identify its designer so you can work out its value and browse other products.

## NMS Scenario 2 – Data Element Search

You have recently become interested in the roman empire and would like to find out information on the types of materials romans used to forge their weapons.

## NMS Scenario 3 - Ill-defined Topical Information Need

With the Covid-19 pandemic approaching the two-year mark you begin wondering about the influence art and culture has had on the medicinal field and would like to find out more.

## NMS Scenario 4 – Combined Known Item and Data Element Search

You remember viewing a model of a frog during your recent visit to the National Museum of Scotland and would like to find out more about its species, along with information on other types of frogs.

## NGS Scenario 1 - Well-defined topical information need

You were walking down the high street and the following work of art caught your eye. You decided to take a picture to research the style of the painting since you would like to purchase a similar piece for your own home.

## NGS Scenario 2 – Data Element Search

You recently attended a temporary exhibition hosted by NGS. The piece that stood out most to you was Albrecht Dürer's The Crucifixion (The Large Passion), shown below, due to your interest in religious works. You would like to find out what other religious events inspired works by Dürer.

## NGS Scenario 3 - Ill-defined Topical Information Need

After reading about the recent COP26 event in Glasgow, you become interested in the ways in which artists are addressing the topic of climate change and would like to find out more.

## NGS Scenario 4 – Combined Known Item and Data Element Search

You viewed an old drawing of Edinburgh Castle by John Westgarth at a recent exhibition. You want to find a record of this drawing and compare it with more recent pictures to see how the landscape has changed over the years.