Accessing digital cultural heritage information: users vs institutional perspectives of metadata and searching

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Abstract. A controlled experiment was conducted with ten participants, involving two tasks and a selected set of digital cultural heritage content, to explore (a) How does the metadata assigned by cultural heritage organisations meet or differ from the search needs of users? And (b) How can the search strategies of users inform the search pathways employed by cultural heritage organisations? Findings reveal that collection management standards like *Spectrum* 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 beneficial in ensuring the aspects considered most important by consumers are indexed, thereby producing more relevant search results. A user-centred approach to designing cultural heritage websites would also help to improve an individual's experience when searching for information. However, a process is needed for institutions to form a concrete understanding of who their target users are before developing features and designs to suit their specific needs and interests.

Keywords: Cultural heritage information, Information access, Users, Metadata, Spectrum.

1   Introduction

Users of cultural heritage can be diverse, and may include members of the general public, cultural heritage professionals, academics, historians, and industry workers, amongst others. Such audiences have different backgrounds and experiences, meaning cultural heritage objects can have multiple interpretations based on varied user types, as well as their cultural context and information needs [1]. 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.

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 [2-5]. The findings of user behaviour studies can also change what an organisation is doing [6]. A further challenge to understanding user experience and information needs online comes from the variable

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quality of digital objects and collections themselves. Most of the time the metadata associated with cultural objects, such as images, is either sparse or inconsistent, and this makes keyword-based exploratory search difficult and therefore slows down the research or engagement process [7]. User modelling can describe the interaction process between users and cultural heritage applications and products [8]; however, despite a myriad of research reported over the past two decades or so, there is a lack of a richer and deeper understanding of digital users [9].

Research reported in this paper is part of a larger project, funded by the Arts & Humanities Research Council (AHRC) in the UK that aimed to investigate how people accessed cultural heritage information during the COVID-19 pandemic. The main project examined user search behaviour and patterns via the log analysis of access data collected from two national institutions in Scotland, viz. National Museums Scotland (NMS) and National Galleries of Scotland (NGS). Details of the log analysis, findings and conclusions, are available online.[1]

This paper complements the report by providing additional discourse on two controlled experiments that were conducted with two groups of users, and selected sets of digital content from NMS and NGS, to explore whether there are any differences in the way collection items are indexed by the institutions and searched for by the users. More specifically, the research aimed to understand what barriers exist across the search pathways and interfaces of cultural heritage institutions – like NGS and NMS – and what improvements can be made to enhance user experience. This consisted of a user study to identify the characteristics of collection items deemed most important when searching, in addition to the search strategies employed across the sites. As such, we were able to compare current metadata standards with end user search queries, whilst also identifying user experience enhancers/barriers across the interfaces of NGS and NMS. 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?

The rest of the paper presents the methodology and protocols used in this research, along with key findings and discussions around how various user-defined metadata can be accommodated within the existing framework of the collection management standard, called Spectrum[2], used throughout the cultural heritage sector in the UK.

2   Methodology

2.1   Study Participants

In total, 10 people completed the virtual study, via Zoom, between the months of January and March 2022. Table 1 includes the demographics of these participants, where a deliberate decision was made to recruit both experienced and first-time users of the

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NGS and NMS sites to understand whether there were any differences in the search behaviour between these two groups. 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.

2.2 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 imposed during the COVID-19 pandemic in UK. Both tasks were performed on Mural[3] with task one consisting of an item categorization process, where participants assigned search phrases to items from NGS and NMS before grouping them together to form 'collections', similar to [10]. 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 [11].

Table 1: Profiles of study participants

ID	Gender	Age	Education	Profession	Regular user	English as a first 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

For task one, NGS and NMS selected one regularly accessed item and one less popular item from five of their collection departments. This was to ensure that consideration was also placed on harder to find items, which may have less impactful meta-data. Digital flashcards were then developed for each of these items, which included the

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

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available metadata and an associated image; see Appendix A[4] for some examples. These flashcards were pooled into a Mural worksheet (Figure 1 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 NMS, the characteristics of collection items that are most important to them when searching. A comparison between these characteristics and the data management standards employed by NGS and NMS were made.
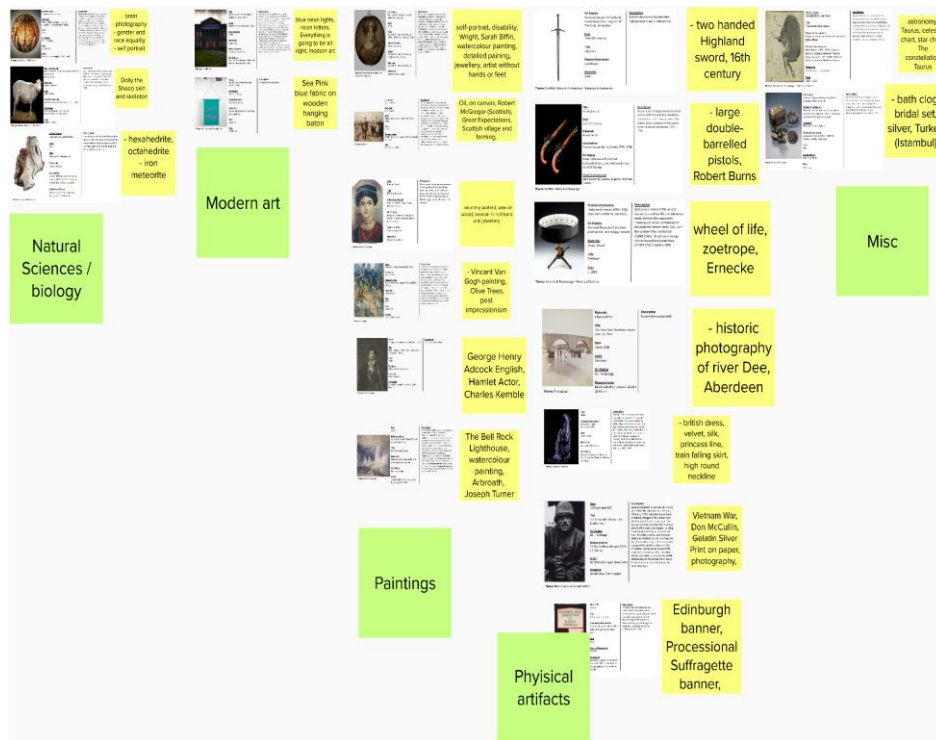

Fig. 1: A completed Mural Worksheet demonstrating some of the search tags assigned to the collection items.

It was also important to consider the search strategies of users when fulfilling their information needs within the real digital infrastructures of NGS and NMS, including the search terms employed. Therefore, task two involved a search observation process, with each participant being required to locate various items across each site. Based on

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[4]https://docs.google.com/document/d/1hQPm75YXN_PhfEEUBpOCv6tV3CsoDGCvoqhajzma7xk/edit?usp=sharing

Borlund's evaluation framework [12] for interactive retrieval systems, 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[5] 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' [13]: 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.

3   Analysis

Both tasks were recorded and transcribed verbatim with participant consent for further analysis. The first task was primarily subjected to a deductive content analysis, using the *Spectrum* data management standard 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." [14]

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 [15]. During task two, participants employed a range of search strategies and therefore encountered a variety of barriers. Consequently, an inductive framework analysis [16] 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.

In addition, quantitative measures (such as time to completion, success rates, number of pages accessed etc.) were recorded for task two. Nevertheless, there were several

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[5]https://docs.google.com/document/d/1hQPm75YXN_PhfEEUBpOCv6tV3CsoDGCvoqhajzma7xk/edit?usp=sharing

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factors that skewed the results for certain participants, including: poor internet connectivity that made if difficult to converse via Zoom; and a more limited proficiency of the English language. Since the n-size of the study was relatively small, we decided to omit these results and focus exclusively on the richer qualitative data.

3.1   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 [20]. For example, in Ian Hamilton Finlay's 'Sea Pink' (see Appendix A[6]), most of the less familiar 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, in 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

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[6]https://docs.google.com/document/d/1hQPm75YXN_PhfEEUBpOCv6tV3CsoDGCvoqhajzma7xk/edit?usp=sharing

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 relies 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 six: *"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, less knowledgeable participants tended not to tag more scientific terms and opted for terms that were used on a more general basis: participant eight: *"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."*

3.2 Spectrum Fields

This section provides a discussion some of the interesting tags assigned by the participants and how they relate to *Spectrum* fields. Note that *Spectrum* has a far wider catalogue and not all fields were referenced by the participants.

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, particularly with the less experienced participants where other more general descriptors were applied such as 'miniature'. On the other hand, the more knowledgeable 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 seven: *"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 frequent visitors of NGS and NMS were interested in the exact rooms items were held, yet others cared more about whether they were on display to support their decision for an in person visit: participant one: *"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 for both experienced and inexperienced users, particularly when an unusual or defining substance was utilised by an artist: participant four: *"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 the physical characteristic of items if they lacked knowledge on an artefact, participant eight: *"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 diverse 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, 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. Both sets of participants also felt such information was important, and suggested emphasising Scottish and non-Scottish objects for tourists who may want to prioritise local artefacts: participant nine *"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 certain sub-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, as also found in [20], where expert users were searched for more characteristics than novice: participant eight *"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 ten *"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 ten: *"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 two: *"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 five: *"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 one: *"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 literature (e.g. Burke et al., [17]) 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.

3.3 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 two: *"It would be dreadful if you type in something and it turns out you've missed your spelling slightly. Instead of archaeology I put archaeologists 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

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broad, or the participant was new to the NGS or NMS websites, then they would prefer to use the site-wide search box: participant four: *"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 seven: *"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.

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 five: "*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 earlier, 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 2 highlights the differences in the advanced search features of NGS and NMS.
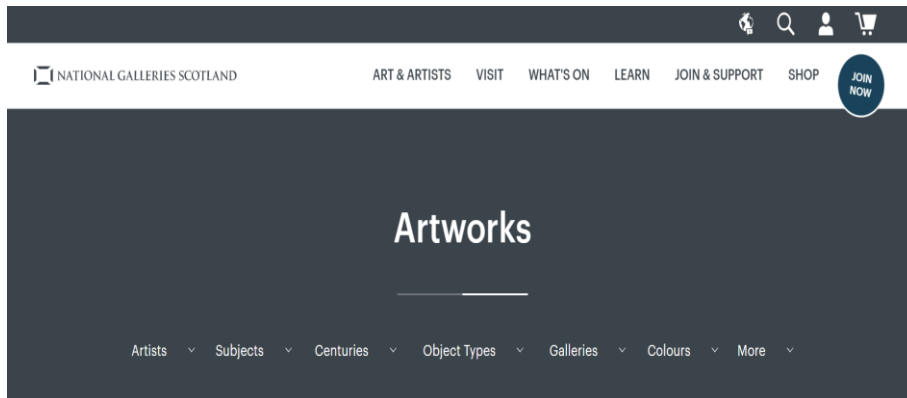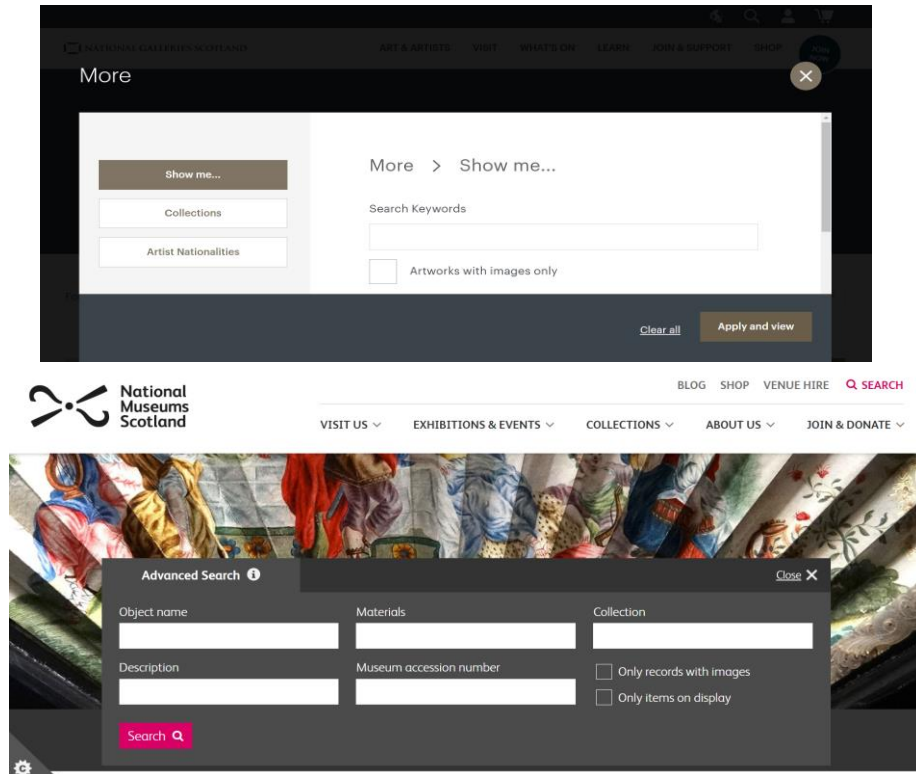
Fig. 2: NGS and NMS advanced search bars.

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 five *"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 one: *"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 two *"I think something that pops up with recommendations of tags that do exist…I think that would help."*

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 biography - 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 at NGS site: 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 at NGS site: 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 six: *"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 seven: *"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 eight *"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 across both sites. First, participants found the collection search results to be difficult to navigate when the items were presented with the same, basic tags: participant five *"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 three *"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.

Conclusion

The 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. Professional and highly educated people form the majority of users of cultural heritage [18], and hence our selected user group 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.

Overall, 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. Existing collection management standards like *Spectrum*[7] 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 shows promising prospects for the use of AI (artificial intelligence) and ML (machine learning) to support more timely and wide-reaching metadata tagging [19]. However, this would require items to have a standard of existing data that neither NMS nor NGS currently have across their collections, which could be true for most cultural

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[7] https://collectionstrust.org.uk/spectrum/

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heritage institutions. Future investigations into this approach 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 entire collections.

Results from the first experiment 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 beneficial in ensuring the aspects considered most important by consumers are indexed, whilst AI and ML techniques can expand on the resulting descriptions, thereby producing more relevant search results based on user profiles and access patterns.

Results from the second experiment 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.

Acknowledgement

References

1. Hooper-Greenhill, E.: Museums and the Interpretation of Visual Culture. Abingdon: Routledge (2000)
2. Ruthven, I. and Chowdhury, G.: Cultural heritage information : access and management. London, Facet Publishing (2015)
3. Chowdhury, G.: Cultural heritage information services: sustainability issues. In: Ruthven, I. and Chowdhury, G. (eds). Cultural heritage information: access and management, pp. 221-245. London, Facet Publishing (2015)
4. Chowdhury, S. Cultural heritage information: users and usability. In: Ruthven, I. and Chowdhury, G. (eds). Cultural heritage information: access and management, pp. 135-151. London, Facet Publishing (2015)

5. Han, H.J., and Wolfram, D.: An exploration of search session patterns in an image-based digital library. *Journal of Information Science*, 42, 477 – 491 (2016)

6. Farrell, S.: Search-log analysis: the most overlooked opportunity in web UX research, (2017). https://www.nngroup.com/articles/search-log-analysis/(last accessed: 2022/07/16)

7. Eramian, M., Walia, E., Power, C., Cairns, P., and Lewis, A: Image-based search and retrieval for biface artefacts using features capturing archaeologically significant characteristics. *Machine Vision and Applications*, 28(1-2), 201-218 (2016).

8. Konstantakis, M., Aliprantis, J., Teneketzis, A., and Caridakis, G. : Understanding user experience aspects in cultural heritage interaction. PCI '18: Proceedings of the 22nd Pan-Hellenic Conference on Informatics. November 2018, pp 267–271 (2018) https://doi-org.proxy.lib.strath.ac.uk/10.1145/3291533.3291580 (last accessed: 2022/07/16)

9. Bailey-Ross, C.: Online user research literature review: UK gallery, library, archive and museum (GLAM) digital collections. Commissioned report. Towards a national collection (2021). https://doi.org/10.5281/zenodo.5779826 ((last accessed: 2022/07/16)

10. Rainbow, R., Morrison, A. and Morgan, M.: 'Providing accessible online collections', in Museums and the Web 2012: Proceedings (2012) https://www.museumsandtheweb.com/mw2012/papers/providing_accessible_online_collections.html (last accessed: 2022/09/27)

11. Skov, M., Ingwersen, P. Museum Web search behavior of special interest visitors. *Library & Information Science Research*, 36, 91-98 (2014).

12. Borlund. P.: Experimental components for the evaluation of interactive information retrieval systems. *Journal of Documentation*, 56, 71-90 (2000)

13. Nielsen, J., Clemmensen, T., Yssing, C.: Getting access to what goes on in people's heads? - Reflections on the think-aloud technique. NordiCHI'02 (2002).

14. Vaismoradi, M., Turunen, H., Bonda, T.: Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing and Health Sciences*, 14, 398-405 (2013).

15. Erlingsson, C., Brysiewicz, P.: A hands-on guide to doing content analysis. *African Journal of Emergency Medicine* 7(3), 93-99 (2017).

16. Gale, N.K., Heath, G., Cameron, E., Rashid, S., Redwood, S.: Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology*. 13, 117 (2013)

17. Burke, V., Jørgensen, D., Jørgensen, F.A.: Museums at Home: Digital Initiatives in Response to COVID-19. *Norsk museumstidsskrift* Vol.6 (2), p.117-123 (2020)

18. Walsh, D., Clough, P. and Foster, J.: User categories for digital cultural heritage. In Proceedings of 1st International Workshop on Accessing Cultural Heritage at Scale (ACHS'16). (2016) http://ceur-ws.org/Vol-1611/paper6.pdf. Last accessed 2022/07/20.

19. Bordoni, L., Mele, F. and Sorgente, A. (eds): Artificial intelligence for cultural heritage. Cambridge Scholars Publishing (2016). https://www.cambridgescholars.com/resources/pdfs/978-1-4438-9085-4-sample.pdf. Last accessed: 2022/07/22.

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20. Koolen, M., Kamps, J., de Keijzer, V. Information Retrieval in Cultural Heritage, *Interdisciplinary Science Reviews*, 34(2-3), 268-284, (2009) DOI: 10.1179/174327909X441153