Understanding user needs: a case study from the National Library of Scotland

Chris Fleet

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1. Introduction

This case study looks at the approaches to user engagement with National Library of Scotland (NLS) maps website users, and how this informs digital preservation decisions. After a brief description of the NLS maps website structure, it examines user expectations of the NLS maps website, how these have developed over time, and the main purposes users have for visiting the website. The main research methods which have been employed to consult with users are then outlined, including user surveys, web-analytics, mystery visitor reports, and enquiries. Some of the significant findings and value of these different methods are discussed, along with their limitations. The implications of these user research methods for geospatial access and preservation decisions are then summarized.

2. NLS maps website

The National Library of Scotland's maps website (https://maps.nls.uk) was created in 2010 as a dedicated site for map images, growing out of the former NLS Digital Library. Active scanning of maps began in the 1990s (Fleet, 2000), focusing on early maps of Scotland, with the pace expanding through external funding from 2011. The website currently makes available over 250,000 historical maps, dating from the 16th to the 20th centuries (Figure 1). The geographic focus is on Scotland, with good coverage of Ordnance Survey maps of England and Wales. During 2022, on average each day the website received around 5,000 users, 10,000 user sessions, and 40,000 page views. The central aim of the website is to make available images of the NLS map collections, and this has been realised through dedicated viewers for search and retrieval, for displaying zoomable images and georeferenced images, as well as related pages and viewers on specialist topics.
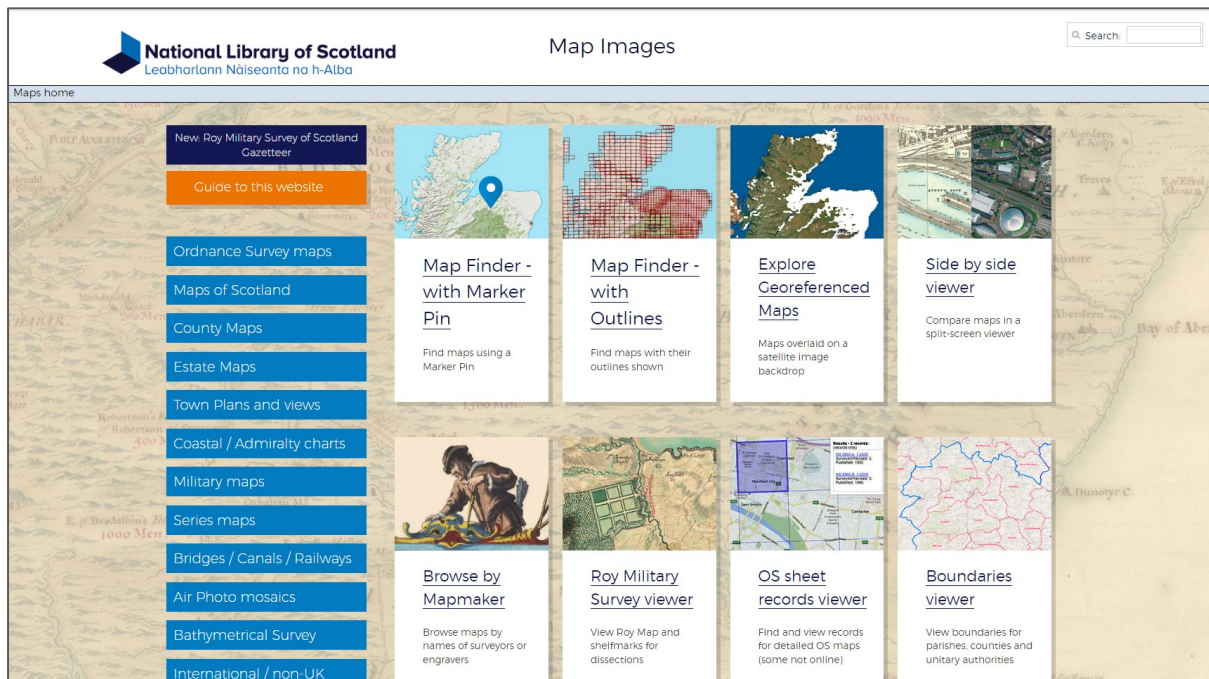

Figure 1. The NLS maps website home page

A structural model of the NLS maps website (Figure 2), with users at the top, and paper maps at the bottom, has guided development for several years and also informs preservation decisions. The website essentially makes digitized paper maps available to online users. Although the NLS as a legal deposit library receives born-digital publications, these are held in a separate shared system with the other UK Legal Deposit Libraries (Fleet and Hatfield, 2017), and are not part of the maps website.

The NLS hold around 1.5 million paper maps, so even with active scanning over a period of 25 years, slightly under 20% of the whole collection is so far available online.

The intention is that with the right metadata and image formats, preservation images and data about them can endure for the long-term, if appropriately maintained and migrated, whilst the intermediate components and the front-end interfaces will undergo much more rapid change. The arrows in the diagram (Figure 2) reflect the digitization workflow, and the main routes through which images and metadata (red) are made available to users through intermediate components (purple) and interfaces (blue). Item level metadata, for example, held in the *Digital Asset Management System* to the lower left, is primarily made available through *GeoServer* ([Geoserver](), n.d.) and *SQLServer* ([Microsoft](), n.d.) intermediate components, and visible to users in the *Map Finder* and *Map Images* (for example the basic non-georeferenced zoom and pan viewer for accessing all zoomable map images) viewers ([National Library of Scotland](), n.d.a). The preservation images to the lower right, are processed into web-ready formats for delivery online through the *Map Images* and *Explore Georeferenced Maps* viewers ([National Library of Scotland](), n.d.b), as well as the *Historic Maps API* web-services ([National Library of Scotland](), n.d.c). This provides an essential background for what follows, as most user needs and the responses to these relate to the interfaces at the top of the model, which continue to undergo rapid change, but the preservation images and metadata at the base of the model can endure for the longer term.
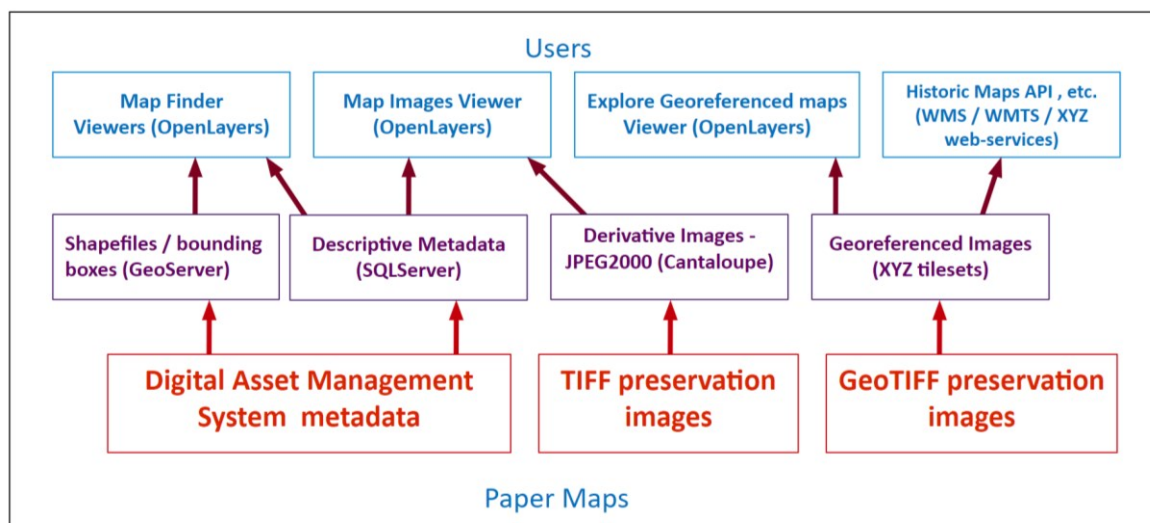

Figure 2. A structural model of the main NLS maps website components

Some of the preservation principles that provide context to this model are:

- Preservation images at the bottom of the model are stored as TIFF and GeoTIFF in replicated, archival storage - currently Scality and Amazon Glacier cloud platforms.

- Technical, legal and administrative metadata are stored in an internal database (currently a SQLServer database, in the process of migration to a new Digital Asset Management System).

- Open-source map technologies have been adopted for many of the components in the intermediate and upper tiers in the last decade, including *OpenLayers* ([OpenLayers](), n.d.), *GeoServer*, *Cantaloupe* ([Cantaloupe](), n.d.) and *PostGIS ([PostGIS](), n.d.)/PostgreSQL*, which in turn have encouraged the wider adoption of open geospatial formats and standards ([Fleet](), 2019a).

- There has been a desire to try to maintain some separation of data and images from the systems that use and build on them, to try to avoid any lock-in to any particular component. The model allows individual components to be updated or replaced independently of each other and the whole website.

3. User expectations

What expectations do map users have? As for all libraries, users have a need to search and view collection items through simple, intuitive web-based interfaces. Those searching for maps have a primary interest in spatial searching, using place names or map interfaces to locate items covering a particular area. Map user expectations have continued to expand over time, with an increasing requirement for georeferenced map images (where non-map parts of the image are cropped out and geographic coordinates are assigned) and the presentation of maps as georeferenced layers. At the same time, many users have difficulty reading and understanding maps, requiring more assistance with things like abbreviations, legends and symbols, as well as things like surveying, revision, printing and dating content. Whilst some users are keen to exploit georeferenced web-services with map layers and features, there has been a consistent demand to create simpler, clearer interfaces, especially for first time visitors who may well not know what type of map they may need nor how to find it.

Through georeferencing, a growing range of spatial datasets from other providers (for example gazetteers of names, modern map or satellite imagery, LiDAR layers, or administrative jurisdictions) can be presented alongside historic maps, allowing new ways of searching and displaying information. In addition, through georeferencing, other user requirements can be met, such as the ability to measure distances or areas, tracing and exporting geographic features, finding or capturing geographic coordinates, or showing real-world heights (Fleet, 2019b). A growing proportion of users also expect the availability of web-services (for example delivering georeferenced layers as Open Geospatial Consortium WMS/WMTS/XYZ services for use on other websites or within desktop GIS (Open Geospatial Consortium, n.d.a, Open Geospatial Consortium, n.d.b, Wikipedia, n.d.)), and NLS has continued to build on these, following the launch of the Historic Maps API in 2010 (Fleet and Pridal, 2012). In terms of map content, as the NLS maps website has grown in usage and popularity, an increasing number of other institutions or people have been keen for their maps to be hosted on the NLS maps website, and there is a growing assumption that NLS should also have responsibilities for the digital preservation of this content. Historic maps are required for a very broad range of purposes which can include:

- family history
- local history
- landscape history
- archaeology
- metal detecting
- environmental risk
- house history
- woodland history
- railway history

- military history
- legal and boundary disputes
- history of cartography
- digital humanities
- machine-learning / feature recognition
- design and display
- television and media

Any user needs analysis needs to be aware of these diverse and overlapping user communities and purposes.

4. Researching user needs

[McMeekin](#) (2021) provides a helpful overview of the importance and methods for researching user needs in order to guide digital preservation activities. The main ways of researching user needs discussed include surveys, web-analytics, focus groups/workshops, and usability testing. There has been a considerable overlap at NLS with these methods, including the use of surveys and web-analytics, which have been supplemented by mystery visit reports, and enquiries. Resource constraints have tended to favour free or cheaper methods like web-analytics and enquiries, over more costly surveys, workshops or usability testing. However, there have been clear benefits to applying several methods to create a richer and more complete picture of user feedback which can then be acted upon.

4.1 Surveys

In early 2019, an online questionnaire was posted on the main NLS map interfaces, and heavily promoted through social and other media. Over two months, there were 727 questionnaire responses, supplemented by 21 telephone interviews. Given that the maps website was then receiving over 8,000 users every day, the vast majority of our users did not participate, but the results were still useful for gathering information about users, visitor behaviour, and their priorities for improvement:

User profile

- In summary: 70% male; 30% female; generally older age groups, 47% retired; 28% working full-time.

Visitor behaviour and interests
- Regular/Unique: 75% of visitors were repeat users, visiting the website more than 20 times per year.
- Purposes: 78% visited for personal research; 8% for business; 6% academic.
- Subjects: Personal researchers were primarily interested in local history (80%), the history of the landscape (53%), urban history (45%) and genealogy (42%).

Website improvement
- Although 57% said the website was in no need of improvement, for the remainder, the most important areas suggested for improvement were with search and navigation, functionality, content and infrastructure. Further detailed questions on these areas were able to draw out more specific requirements for improvements.

4.2 Web Analytics

NLS has used Google Analytics for many years, providing useful quantitative information about the most popular pages viewed, typical lengths of time spent on the website, countries of origin, preferred browsers, technology (for example desktop, mobile, tablet) and acquisition methods. One of the main conclusions from Google Analytics is that the top landing page statistics make it clear how popular and important georeferenced maps are. The two most popular pages, for the *Explore Georeferenced Maps viewer* ([National Library of Scotland](#), n.d.b) and *Side-by-side viewer* ([National Library of Scotland](#), n.d.d)*,* are more frequently visited than the home page. Seven of the top twenty

landing pages are for viewing georeferenced maps in different ways. That said, it should be recognised that Google Analytics does not provide a full picture. Over time, it has become steadily easier for users to block Google Analytics, allowing many users to reject all Google Analytics cookies.

For a more complete picture, we have supplemented Google Analytics statistics with website logs. From May 2018 to May 2019, usage of the standard *Map Images* viewer was also logged, and the results were categorised by map group. A number of useful conclusions were made based on twelve million map views over the year. These statistics were helpful in demonstrating which types of map were most frequently used. For example, maps of England and Wales were much more popular than maps of Scotland, detailed (larger scale) maps were more popular than less detailed (smaller-scale) maps, and maps of urban areas more popular than maps of rural areas. This has been used to prioritise digitization and web page work. It may be that future planned moves to use Google Analytics 4 and server-side tracking could deliver improved analytics information. As well as providing a way of avoiding cookies and therefore gathering more complete usage data, this will hopefully provide better modelling of the user journey, whilst the use of event-based data rather than session-based data will better capture real activity.

4.3 Mystery visit reports

The NLS has run an annual programme of mystery visit reports from 2014, aiming to provide independent information on how well the Library is performing against customer service standards, as well as identifying areas for development. The visits have included both onsite and offsite visitors, with offsite visitors testing and rating particular web interfaces and activities. The results have been useful in highlighting particular problems as well as pages which are causing confusion or difficulties. Mystery visits can be useful in providing an insight into the perspectives of first-time visitors, who have no prior experience of using the NLS maps website. However, as there is no direct interaction between the mystery visitor and library staff, it can sometimes be difficult to understand particular comments or suggestions, or gather information on what the mystery visitor may have expected or preferred to see.

Every few years, mystery visit report suggestions relating to the maps website have been summarised. Suggestions or problems have been categorised into those relating to interfaces, search and retrieval, content, and functionality, and specific developments have been implemented to address these. These have included:
- redesigning the home page.
- renaming the main search viewers.
- creating a new footer panel on all pages to help navigation.
- significantly improving help and advice, as well as developing better help videos.
- creating new dedicated help pages for particular user communities.
- making map ordering simpler.
- developing more mobile-friendly interfaces.

4.4 Enquiries

Every year, on average, the NLS receives 2,500-3,000 e-mail enquiries which relate to maps. The vast majority of these are requests for advice, assistance over permission to re-use maps, as well as help

with ordering printouts, images or custom orders. A small but significant proportion are requests for advice about the website, and a proportion of these are specific requests for improvement or enhancement. These user requests are supplemented by those received by telephone, social media, and reader workshops, and have been particularly important in suggesting new requirements for access and website enhancements, including:

- reprocessing and adding new LiDAR layers.
- creating new help pages for re-using georeferenced maps.
- adding draw functionality with the ability to export drawn features.
- adding an ability to dynamically show height for georeferenced maps.
- creating help pages for re-using spatial data.

4.5 Additional/future feedback mechanisms

The methods described above have been the main historical ways of gathering information on user needs. The range of methods used have helped build a more complete picture of user requirements and have been more effective than focusing on one method in isolation. During 2022, the NLS has more actively investigated users through geodemographic profiling, combining data from a range of sources to examine likely participation and engagement with the arts, culture and heritage. Related work is also underway to research current digital and social media audiences in order to improve engagement with users and the digital offer. These will improve and build on the information we have now on our users.

5. Implications for geospatial preservation

The main value and purpose of researching user needs is to gather information on website interfaces and content, but it can also provide useful information on preservation decisions:

- User needs and expectations change rapidly, especially for interfaces and functionality. Preferred data formats and standards, especially for preservation files, often endure for much longer however. There is still a widespread acceptance of TIFF and GeoTIFF images for both preservation and re-use by users, and the shapefile is still widely used for structured vector data, even if relatively newer vector formats such as GeoJSON have gained ground in recent years.
- Interfaces change rapidly, even if the technologies and standards they employ (such as IIIF, WFS, WMTS) endure for longer. As a result, it can be useful to separate out the front-end interfaces from back-end storage, and recognise that the interfaces, images and metadata that users see may need more regular refreshing over time than the preservation files.
- The widespread adoption of open-source mapping technologies in the last decade (for example for interfaces, middleware and databases, as well as desktop GIS software) has facilitated the broad adoption of open standards and formats for libraries and their users. That said, even if shared principles are understood, there is still much debate over best practices for publishing spatial data on the web based on different target audiences and assessments of their particular needs (W3C Working Group, 2017).
- There is less standardisation over the formats users prefer for vector data, and a growing range of options for georeferenced web-services. This can be seen with the changes to recommended geospatial preservation formats over the last decade. The ESRI shapefile is still widely used and supported, but there has been a growth of other preferred formats,

including KML and GML, the ESRI file geodatabase, OGC GeoPackage, GeoJSON, and JSON-LD formats ([McGarva, Morris and Janée](#), 2009; [Library of Congress](#), 2022). These newer formats can be created or recreated from the metadata or preservation images, but it can require quite significant work to do so.

- User expectations on required geospatial metadata have continued to grow over time. For geospatial search and retrieval, bounding box coordinates of map extents, as well as the scale of the map are essential. Many types of mapping also require quite sophisticated date metadata, including dates of survey, revision, printing, and stamping. Thematic mapping (such as geological, soil, land-use or administrative mapping) may well require metadata relating to underlying mapping as well as the overlaid thematic content. As a growing quantity of data can be extracted from maps using crowdsourced or machine-learning techniques, this data also needs to be managed and formatted appropriately.

Perhaps not surprisingly, the main implications of these points have been seen in the provision of images and metadata to users, rather than in changes to preservation formats or workflows. Our recent guides on *Re-using georeferenced maps* ([National Library of Scotland](#), n.d.e) and *Re-using map datasets* ([National Library of Scotland](#), n.d.f) focus on web-service provision and newer formats like GeoJSON, recognising these as being most useful for users. The images that NLS creates through digitization continue to use TIFF and GeoTIFF formats, given their stability and recognised preservation value.

6. Conclusions

This case study is not presented as a model or as guidance on how to gather user feedback, but rather as a real-world example of how this has been done at one institution, with constraints of time, expertise and resource. There is a rich seam of information that can be gathered through a variety of interactions with users, and although this only captures the thoughts or behaviours of a subset of these users, it can be helpful in gathering information that can inform future activities. Access is an important element of digital preservation workflows. Ultimately information is being preserved so it can be used, therefore, understanding what users need is a key aspect of digital preservation. As well as perhaps the more obvious outcomes of gathering feedback (such as helping to define how to make web interfaces more user-friendly) it can also provide information which could be used to inform other decisions on how to manage a collection, for example, which metadata to collect, create and make available, what should be prioritised for digitization, how images can be enhanced for access and which file migration paths to take to create content that best supports user needs. Though map users share similarities with other library users (and may sometimes be the same people), there are specific differences of purpose in their uses of these collections, as well as differences in the interfaces, formats and metadata that are made available. There is therefore clear value in user needs analysis to inform preservation and access strategies for a specific content type such as digital maps at NLS.

Acknowledgements

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