Memory Mapper

Routes to Commercialisation

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Abstract

This white paper presents findings from a six-month project funded by the AHRC into the prospect of offering Memory Mapper, an open-source web application for mapping cultural heritage developed at UCL, as a paid-for service. It is based on user and market research conducted on behalf of Memory Mapper by Sabina Dewfield. This document situates Memory Mapper in relation to broader trends within spatial humanities research, positioning the software as potentially offering a route to widening access to digital research methods within the humanities. In so doing, we propose, this would lower some of the disciplinary boundaries between digital and hermeneutic methods, and provide new routes for humanities academics to engage with public audiences. We then explore the conditions in which research software is produced and our motivation for commercialising the software. We argue that commercialising research software outputs which can serve the needs of a range of research projects offers one way of tackling the perennial problem of maintaining digital outputs. Memory Mapper, based on the now relatively mature and stable technology of web GIS, is a potential example of this; we hope by sharing these insights we can prompt thinking within the sector around using this strategy in other areas. The document then details our proposed route to commercialising the software, including a discussion of possible payment models and phases of service expansion, identifying goals and risks at each stage. The document concludes with a detailed development roadmap, breaking the tasks into four work packages: ‘From Maps to Projects’; ‘Map Authoring’; ‘Collaboration’; and ‘Map Linkage’.

1. Introduction and Context

Memory Mapper is an open source web application for creating interactive maps of cultural heritage developed by the Bartlett Centre for Advanced Spatial Analysis and the Bartlett School of Architecture, University College London. Memory Mapper is a secondary output of the AHRC-funded the Survey of London Whitechapel historical crowdsourcing initiative. At UCL, it is currently being used for several high-profile public history projects, and has been used outside UCL by local authorities, grassroots organisations, and academics at other research organisations within the UK and internationally. In its current form, Memory Mapper must be installed by a user on their own web server, which can present a barrier both in terms of the technical knowledge and skills required and in terms of the institutional requirements for provisioning digital services in different organisations. Nonetheless, the high demand for the tool despite these issues indicates the potential for developing a more sustainable, scalable and mature product which could be offered to the sector as service on a commercial or revenue-generating model. We believe that doing so would give the software the financial footing it would need to be offered in the medium- to long term.

This white paper presents findings from a six-month scoping exercise to identify commercialisation opportunities for Memory Mapper, funded by the AHRC, and complements the User Engagement report produced by Sabina Dewfield. The following discussion outlines the context in which the tool has emerged, the wider market context, and discusses some of the issues with the tool that have arisen through existing case studies. We then present a phased model of commercialisation, discussing risks at each stage, and a development roadmap for the proposed service aligned with this model.

1.1 The Spatial Turn in the Humanities

Recent years have seen an increasing use of Geographic Information Systems (GIS) for conducting humanities research. GIS involves the integration of different spatial data sources (that is, data which can be given geographic coordinates) within the frame of a

digital map. Though it has its origins in geography and planning, GIS is inherently cross-disciplinary in application and has uses across the social sciences, public health, epidemiology and many other fields. Despite this, historically at least GIS has found less use within the arts and humanities than in other fields. This is in part due to the quantitative biases of GIS, but also due to an inherent suspicion in these disciplines towards the epistemic and ontological underpinnings of cartography. As Wood *et al*. have pointed out, mapmaking as a practice is inherently bound up with the development of the modern state (Wood, Fels, and Krygier 2010). As such, maps have both military and colonial applications and underpinnings, and, as Griffiths and Vaughan point out, are frequently understood in the humanities as bearers of the ideologies and power structures of the societies which made them rather than as sources of empirical knowledge (Griffiths and Vaughan 2020). Moreover, GIS tools were primarily developed for the analysis of quantitative data, and as such are often ill-suited to the textual and visual objects which are the traditional objects of humanities research. These factors have contributed to a situation in which, at least until comparatively recently, where GIS has found application in the humanities it has been in quantitatively oriented subdisciplines such as historical geography or historical economics (Gregory and Geddes 2014).

The integration of GIS methods with internet technologies has significantly changed this picture. As Crampton and Krygier point out, the development of tools such as Google Maps, Google Earth and OpenStreetMap in the mid 2000s has allowed for the dissemination, recombination, and creation of maps by a much broader public than that enabled by traditional cartography and pre-internet GIS (Crampton and Krygier 2005). Through the development of what they term 'critical cartography', mapmaking expanded from being solely the preserve of state agencies and multinational corporations, and grew to include practices such as artistic reappropriation, mapping as resistance to power, *detournement*, and the mapping of everyday life. Whilst the map data and technologies (GPS, remote sensing) for critical cartographic practice are still mostly created by states or state-sponsored agencies (Kurgan 2013), it is nonetheless true that the spectrum of people creating and distributing maps for their own purposes dramatically widened in this moment.

In the wake of this, innovative work led by pioneers such as David Bodenheimer, Sally Bushell, Iain Gregory, Barbara Piatti, and many others has seen a broader application of geospatial methods within the humanities. Mapping allows humanities academics to understand the spatial dimensions of the objects of their research. This could be, for example, through attention to the ways in which the description of landscape has changed over time; or to deepen understandings of the relationship between fictional spaces and real-world geographies. It can be used to spatially situate and disseminate research. Moreover, digital mapping in the expanded sense advanced by Crampton and Krygier also allows the public to engage with this research in new ways. Rather than being confined to academic journals, interactive maps provide compelling, visual ways to engage audiences with academic research. Memory Mapper projects led by UCL such as City of Women London, a remixed map of the London Underground foregrounding the contributions of women and non-binary people to the history of the city; the two maps of Jewish history and heritage (https://jewisheastendmemorymap.org, https://jewishmanchestermemorymap.org/); and the map of European Literary London, all exemplify this. In the case of the Survey of London Whitechapel, the depth of engagement with the public facilitated by the use of interactive mapping created an expanded sense of what it means to conduct public history.

Yet, despite the widening application of GIS techniques, it remains the case that the software used to conduct geospatial research is largely the domain of specialists. The projects mentioned above have all been conducted in collaboration with researchers outside of the humanities or within departments which specialise in digital methods. Though GIS software, thanks largely to open source initiatives such as QGIS, is much more accessible than it once was, it is still complex, specialist, and often ill-suited to use by humanities researchers because of its quantitative biases. Conversely, free tools such as Google Maps, whilst sufficient for creating small-scale research outputs, are not sophisticated enough for use in serious research nor polished enough to be used for research dissemination. Moreover, where web GIS functionality is required within a project, a lack of a common set of tools frequently requires research projects to invest in the creation of bespoke software, which itself is difficult to keep online, expensive to

maintain, and consequently fragile and vulnerable to obsolescence (Holmes, Jenstad, and Huculak 2023). These factors have had concrete impacts on the reach of geospatial methods in the humanities beyond specific centres of expertise.

1.2 The Opportunity: Widening Access to Geospatial Methods

Memory Mapper sits as a component within this broader research landscape. As the popularity of the software amongst the current user groups and the high level of public engagement Memory Mapper projects have elicited there is evidence for an appetite for affordable, user-friendly tools in this space to facilitate and widen access to these methods. Moreover, with future changes to the Research Excellence Framework (REF) likely to emphasise the importance of impact and engagement in research, it is likely that demand for tools which enable academics to connect with broader publics will increase. Memory Mapper's strengths lie in the fact that it allows non-specialists to create interactive maps of their research data using a simple and familiar blog/content-management publishing paradigm. This allows both the creation of spatial research data and the public dissemination of this research. A more accessible version of Memory Mapper would meet the needs of a burgeoning audience of researchers who want to create digital maps or use GIS techniques in their research but have neither the expertise, budget, nor inclination to do so with current tools. Through meeting the needs of this potential user base, a number of secondary effects could be realised.

Enabling a broader range of researchers to engage in digital methods would enable these tools to be brought within and naturalised within the broader field of the humanities. Digital Humanities, whilst inherently interdisciplinary in nature, has evolved specialist vocabularies, concepts and tools which, whilst not necessarily at odds with more traditional humanities disciplines, are not central to them; as such it has evolved into a discipline in its own right (Luhmann and Burghardt 2022). Memory Mapper (and tools like it) provide user-friendly ways to engage with technologies and methods which are now very mature within Digital Humanities. As such, they lower barriers to methodological innovation, counteract the siloing effects of disciplinary formations, and facilitate cross-disciplinary collaboration and innovation. Researchers are also be

empowered to disseminate their research in public facing, accessible ways. As many of the Memory Mapper projects demonstrate, translating humanities research into public-facing digital maps provides a powerful vector for academics to participate in public discourse about the politics of space and place. In so doing, these interventions demonstrate the value of humanities scholarship to cultural dialogue and understanding, and by extension advocates for the sector more broadly.

In addition, there are a series of technical possibilities opened by offering the software as a service that are closed due to the current 'one instance one map' architecture. Firstly, hosting multiple memory map projects in a single software instance opens the possibility of linking between them. At its most straightforward, this could be spatial: data from several memory maps about the same location could be superimposed to build a picture of the history of a place which would exceed the scope of any single research project. More complex implementations might involve some sort of formal metadata ontology. This would allow an individual, an event, or object to be traced across multiple locations (or maps) over time and space.

Secondly, multiple linked projects on a single software instance would enable more sophisticated collaboration tools. Currently, though Memory Mapper projects by their nature foster collaboration, there is no concept of authorship built into the software. Individual posts and maps cannot be connected back to a particular user, which has the effect of creating a single authorial voice for a project. A service-oriented version of the software could facilitate an expanded model of authorship and collaboration. This could extend from the single-author model of stand-alone Memory Mapper sites or small-scale collaboratively-produced projects, to the moderated, crowdsourcing model of the Survey of London Whitechapel Initiative. This could extend from the single-author model of stand-alone Memory Mapper sites or small-scale collaboratively produced projects, to the moderated, crowdsourcing model of the Survey of London Whitechapel Initiative. At its most open, a fully peer-to-peer model would allow users to contribute to multiple projects and to create their own.

2. Commercialisation in the Digital Humanities

The above summarises the field within which Memory Mapper sits and outlines some of the opportunities presented by scaling the software. It does not sufficiently address why we are considering a commercial model to do so. In short, our primary motivation is sustainability. It has long been acknowledged within Digital Humanities scholarship that digital outputs, and especially software, are brittle and difficult to maintain. This is bound up with the nature of software, the software development process, and the way that these sit in relation to the institutional organisational and funding structures of universities and cultural heritage organisations. Traditional academic outputs, which in the humanities are principally journal articles and books are, at a certain point, 'finished'. Once they are published they can be archived either in physical or digital form, and in this sense do not need further funding (on an individual level at least) to remain viable. Software, by comparison, is never (and can never) be complete; indeed, without continued effort, it can only become obsolete. As Otis puts it, 'like a newly-purchased car, DH projects tend to run well for five to seven years with minimal recurring costs for server space or domain name renewal, only to begin to suffer increasingly dramatic breakdowns that require hefty "mechanics bills" to fix' (Otis 2023).

This is a problem because most digital humanities software outputs are funded through time-bound research projects. Whilst there is an expectation that software outputs are maintained for a set period after a project has ended (usually five years), the reality is that there is often no-one to do this work. The outputs produced are generally created by researchers on temporary contracts who move on, and in the absence of formal structures (and funding) to support maintenance, software outputs rapidly become obsolete. A number of approaches have been suggested to mitigate this issue. For example, Holmes and Takeda suggest a strategy of radical simplification of the technologies used in digital projects, eschewing server-side infrastructure and external dependencies (Holmes and Takeda 2023). A less radical, but still challenging suggestion is that there needs to be a distinction between 'bloom and fade' experimental work which pushes forward research agendas, but which are not expected

to have a long lifespan, and more conservative projects which require longer-term support (Varela 2021).

The first of these options is not viable for Memory Mapper: by its nature it requires the use of server-side infrastructure (databases for content) and external dependencies (JavaScript libraries for creating interactive maps). Yet, as the range of Memory Mapper projects demonstrates, collaborative mapmaking tools are an established need in the humanities. Moreover, at the level Memory Mapper serves, from a technical and scholarly perspective they are a solved problem. Scaled to support a range of research projects, then, Memory Mapper does fit within the scope of the second. However, the question of how to resource this requires a reappraisal of what a research output is in a software context. As Smithies *et al*. put it in their description of the processes in place to maintain a suite of software outputs at Kings College London's Digital Lab, software is better conceptualised as an infrastructure rather than as a research output. Infrastructure here is understood in an expanded sense which 'move(s) beyond material technical necessities, templates and process documents [...] towards one that acknowledges the centrality of people, funding, ethics, technology strategy, software engineering method, and data management' (Smithies et al. 2019).

The King's Digital Lab has, over several decades, built the institutional support and depth of experience to support a department dedicated to research software engineering in the humanities. Memory Mapper, though originating within a highly technically oriented department, is at the beginning of this process and is led (at present) by a team of two with a range of other commitments as part of their roles. To meet the market need and opportunities discussed above, Memory Mapper needs to become infrastructure in the expanded sense described above. To do so will require resources. Grant funding, whilst likely to be part of the next stages of the project, is not well-suited to maintaining long-term outputs, and it is unlikely that internal funding will be forthcoming to cover the cost of staff. Another model is therefore needed, and an income-generating or commercial model is one possibility.

Comparable tools such as Arches, Recogito Studio, the Open Library of Humanities and Omeka indicate that focussing development efforts on tools and standards which serve the purposes of a range of research projects is a viable way forward. In this model, an

open-source version of the software is developed which meets the needs of multiple researchers, whilst money is paid by clients (universities and third sector organisations) on a project-by-project basis to maintain it. By providing a service that meets a wide pool of users, income streams which are less contingent on risky, high-stakes individual grant applications can be secured, ensuring greater stability for research software engineering staff. This strategy results in software which can be maintained over longer lifecycles than individual research projects. It is this thinking which provides our primary motivation for commercialising Memory Mapper, and we hope by sharing these reflections we can prompt discussion around pursuing this strategy in related research domains.

3. Routes to Commercialisation

The remainder of this white paper outlines our planned commercialisation strategy and development roadmap. In this section we outline possible payment models, as well as the goals and risks entailed at each stage of growth. The development roadmap outlines and the work packages we anticipate will be needed to develop the proposed software, including a discussion of the different moderation implications of the options for integrating collaboration capabilities to it.

3.1 Payment Models

User and market research conducted through this project has identified several possible payment/hosting models: 1) subscriptions; 2) one-off payments/licensing agreements/consultancy; 3) Self-hosted.

3.1.1 Subscriptions

The primary income stream for Memory Mapper will be through a tiered subscription model. Under this model, institutions will pay on a sliding scale dependent on the number of maps and users they wish to create. This could be paid at an institutional level or by individual departments/research projects, with discounts available for scale. To ensure accessibility and to realise the network effects described in section 1, a free tier would always be available for individual users which would enable a single user to make a limited number of maps for free. This is designed to meet the needs of community groups and students. All maps and projects would be hosted at memorymapper.org.

3.1.2 One-off payments/Consultancy

This income would be supplemented by a 'bespoke' service through which individual, high-profile map projects (perhaps those associated with a large AHRC grant) could be hosted by Memory Mapper, though with custom domains and potentially custom features. This would be more expensive than a subscription payment but would give high-profile projects the opportunity to have custom design, functionality, and web

presence for their digital outputs. Memory Mapper would host these customised versions of the software for a fee.

3.1.3 Self-Hosted

Memory Mapper is committed to open-source software, and all of the software outputs created under the memory mapper banner would always be available under a permissive licence. Users would therefore always be able to host their own instances. We do not believe that this would threaten the commercial viability of the service as this requires technical expertise which is often not possessed by the target market, and secondly because the costs of doing so for an individual institution are likely more expensive than hosting with Memory Mapper as they would not be able to replicate the economies of scale. We are also exploring how the self-hosted version could be supplemented by a simplified, single-author version of the software which could enable the creation of maps using GitHub (for example) as a hosting platform.

3.2 Strategy

This project has indicated that further development work is needed before Memory Mapper is ready to be offered on a paid-for basis. We will therefore engage in a phased process of development and exploration of payment models, outlined below. This should be read in tandem with the Development Roadmap in Section 4 of this document.

3.2.1 Stage 1: Pre-Commercialisation

At the time of writing, Memory Mapper is in the pre-commercialisation phase. Through a combination of internal and external funding, we are currently working with a range of partners to develop additional functionality for Memory Mapper and to widen the user base for the tool. These include, at UCL: the European Institute; the Department of History; the Bartlett School of Architecture; and the Institute of Education. Externally, we are working with the Open University (through Elton Barker and the Pelagios Network; Lancaster University (English and Creative Writing); Queen Mary University of London (History) and Northeastern University (English and Creative Writing). We are

also engaged with a number of organisations outside of the sector, most notably The Soho Society, who are exploring using Memory Mapper as part of their heritage audit; and Passa Porta, a literary magazine and residency organisation based in Brussels.

3.2.1.1 Goals

- To refactor Memory Mapper as a Software-as-a-Service (SaaS) offering, enabling non-specialist users in the universities sector to set up and populate a memory map with minimal (or without) intervention or support from the Memory Mapper team.
- To develop a refined, collaborative editing interface for the tool.
- To develop a prototype, semi-automated metadata generation interface and workflow to enable linkage between projects.
- To explore data interchange formats and standards to enable data portability between Memory Mapper and related tools.
- To extend the portfolio of Memory Mapper projects.
- To ensure compliance with university and legal requirements surrounding issues such as accessibility, data protection, and moderation requirements.
- To finalise a funding model and institutional form for the service (i.e. does it remain part of UCL, or does it become a separate entity?)
- To submit a major grant application to an external funding body to allow an intensive period of development work.

3.2.1.2 Risks

- Systematic fragility. Memory Mapper is currently led by two academics, one of whom is the developer of the software. This is an inherently fragile structure. By engaging in a pre-commercialisation phase, we will be better placed to attract the funding necessary to hire the staff that would ensure the stability of the proposed service. In addition, this will allow effort to be put into comprehensively documenting the codebase to more easily allow external contributions, and to facilitate handover should the core team change.
- Inability to attract funding. This stage of work will involve an application to an external funding. As these are highly competitive, we are pursuing a parallel strategy of working with partner projects to target smaller funding pots to

incrementally develop features and to contribute to the wider ecosystem of humanities research tools. In this way, we will be able to continue to develop the tool without placing all of our efforts on a single high-risk grant application.

3.2.2 Stage 2: Early Commercialisation

The first stage of commercialisation would be to offer the tool to a wider academic community on a paid-for basis. This transition away from a select few collaborators to a wider market of users presents a significant shift in usage requirements of Memory Mapper. The most significant issue raised at this stage relates to content moderation, which we discuss in detail below in the development roadmap. Of the payment models discussed above, whilst some interviewees indicated that they would be willing to pay for the service from their personal research budgets, almost all interviewees indicated that it would be best if the cost was carried at an institutional level. The key principle here is that individual research users, students or community users should not be disincentivised from using the software, for Memory Mapper's strength as an engagement and research tool is dependent on ease of access.

3.2.2.1 Goals

- Establish the primary payment model for the service
- Grow the business to the point where the service is self-sustaining
- Grow the team. At minimum Memory Mapper likely needs a full-time senior software engineer; ideally, we would also recruit a project manager, and would need support for moderation, user research, design, and marketing.
- Capital investment for dedicated hardware or cloud provision, beyond existing infrastructures to prepare for further growth.
- Establish a dedicated community of open-source software developers contributing to the software
- Establish a paid internship programme, giving PhD or Masters-level students hands-on experience in commercial software development and service provision.

3.2.2.2 Risks

- Too rapid growth, leading to outgrowing existing technical infrastructure and ability to manage and moderate content. Mitigation: actively targeting core academic partnerships to grow the service incrementally.
- Inadequate take-up, leading to insufficient income. Mitigation: invest in relationship building in the pre-commercialisation stage and launch as a commercial interest once these partnerships are secured; ensure that we continue to deliver on the core offers of ease of use, collaboration, and accessibility; take a reflexive approach to iterate product and market development.
- Unexpected legal and governance issues brought on by commercialisation. Mitigation: draw on the knowledge and support UCL's commercialisation and consultancy services and seek legal advice; conduct research during pre-commercialisation to anticipate these issues.
- Technical challenges brought on by growth. Mitigation: research potential issues at the pre-commercialisation stage; employ a full-time senior software engineer to handle issues as they arise; seek advice from comparable projects.
- Market competition impacting potential growth. Mitigation: focus on the core offer of ease of use, collaboration, and cross-project research; be responsive to the needs of core partners.

3.2.3 Stage 3: Service Expansion

Should Memory Mapper be successful at the early commercialisation stage, and the model established prove to be viable, the service would be positioned to expand to meet a larger market. Whilst we cannot with any certainty say what this would look like at the time of writing, goals for expanding the service would likely include:

- Transition to an independent spinout (if this has not already occurred)
- Internationalisation of the service, including translation, legal and financial compliance

- Growth of staff, particularly in areas around moderation, compliance, sales, in addition to product development.
- Significant growth of the user base.

4. Development Roadmap

On the basis of the evidence presented in this white paper and the associated user engagement report produced by Sabina Dewfield, we have identified the following priorities for development of Memory Mapper.

4.1 Work Package 1: From Standalone Maps to Projects

Memory Mapper currently supports a single map per instance, with this map being the main digital presence for the research project that produced it. Our user research indicates that this only works for use cases that are oriented around a 'flagship' digital map output of this type. Where this is not the case, issues include:

- Research projects often create multiple maps, not just one.
- Research projects often already have a web presence. Users therefore often want to embed maps within other websites such as university CMS pages. This is possible with Memory Mapper, but it is not optimised for this use case.
- The tools which memory mapper provides for managing contextual content (blog posts, about pages and so on) detract from Memory Mapper's core purpose.

The first priority for redeveloping Memory Mapper is therefore to move from a single-map ontology to a 'projects-and-maps' data structure. In this model, a **project** is a collection of multiple related **maps** with an associated **content library** which is owned and administered by a **user** (or group of users) (figure 1).

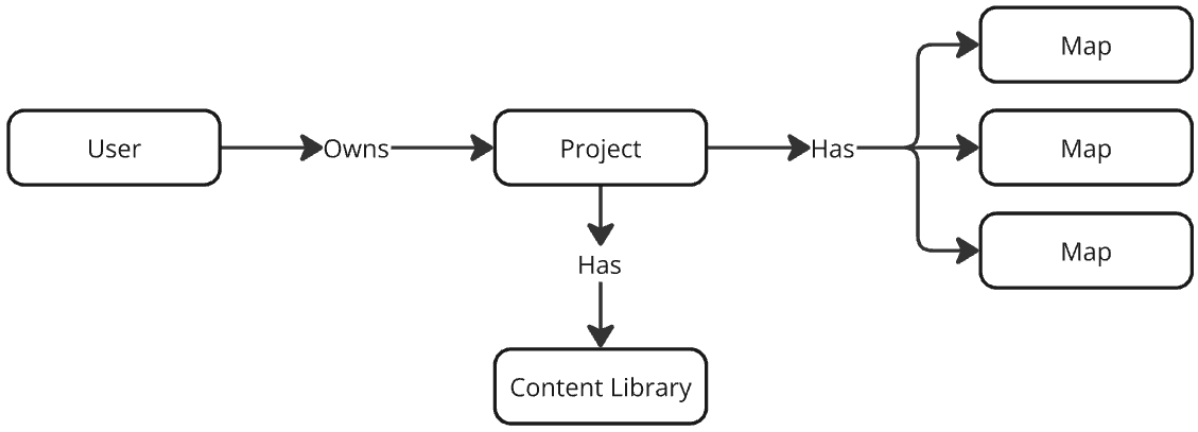

Figure 1: Projects and Maps

This revised structure would make Memory Mapper considerably more flexible:

- A single Memory Mapper instance could support multiple projects created and managed by multiple users.
- Users could create research projects for different purposes.
- More than one map could be associated with a single project, allowing related locations, perspectives, themes and so on to be visualized separately.
- Gathering media items into a single content library per project would enable them to be re-used in a single project and will simplify content, copyright, and metadata management.

In this model, Memory Mapper would no longer be the central web presence for a project (though we will continue to offer Memory Mapper 'classic' for this purpose). Instead, maps would be designed to be created on Memory Mapper and available to explore there, but also shared and embedded in many different web contexts, and in combination with other tools. Memory Mapper then becomes one tool amongst many others which might be used on a research project, much like data visualization tools such as Flourish, online whiteboards like Miro or Google Jamboard, or design tools like Figma. This work is currently underway.

4.2 Work Package 2: Map Authoring

The current iteration of Memory Mapper uses the default Django admin site to manage content. Whilst this has worked well for small scale projects, it will not work for larger numbers of users or with the proposed revised data model. A new authoring interface is currently under development, the repository for which is here https://github.com/memorymapper/memorymapper-editor. Further development of this will be aligned with the stages of commercialisation, outlined above.

4.2.2 Integrated Mapmaking and Content Management (Pre-Commercialisation)

The first iteration will replicate the functionality of the existing Django admin site, though with much improved user experience. Currently, map configuration, adding features to maps, editing content, and editing metadata are either partially or entirely separate actions. The revised authoring interface will bring these actions together into a single interface. Much as the revised viewing interface integrates map exploration with reading or viewing content, this revised interface will integrate mapmaking and content creation more tightly, integrating the two modes of thinking and streamlining the editing process.

At minimum, users should be able to:

- Log in to the service, log out, and manage their account using OAuth or Single Sign On
- Create and configure projects
- Create and configure maps (adding externally hosted historical map layers; map centre, extent, zoom, pitch and relief)
- Add and edit map features (points, lines, polygons)
- Add and edit map content
- Add and manage media content
- Manage feature metadata (tags, themes)
- Add collaborators to projects.

4.2.3 Enhanced Content Editing (Pre-commercialisation/Early Commercialisation)

The next stages for developing the authoring interface will be closely related to the Collaboration and Metadata work packages (below). However, scoping work will include:

- How to manage multiple collaborators working on a project simultaneously. At minimum, users should not be able to overwrite each other's work or edit the same feature at the same time. More advanced versions would include some form of real-time collaborative editing.
- Edit history for written entries; also for media content and map features.

4.3 Work Package 3: Collaboration (Mapmaking as Communal Sensemaking)

Our current users frequently mention collaboration as one of the things they like best about Memory Mapper. Though the software has few technical features to facilitate this, this research project and our experience of using the tool has indicated that mapmaking activities are collaborative endeavours. They bring people from different backgrounds together to work on what we term 'acts of communal sensemaking'. Any future iteration of the software needs to have this idea at its core. It is also the area which needs the most additional scoping and research to realise, as there are multiple possible implementations of this and significant ramifications which arise depending on the path chosen.

The biggest unknown here is less the technical implementation of collaboration features, but the legal, regulatory and organisational issues which could arise from them. The Online Safety Act 2023 places heavy restrictions on sites hosting user-generated content. Whilst there are exemptions for educational purposes, it remains the case that growing the user base for Memory Mapper would bring with it challenges around moderating the content that they produce. What capacity different users would have for content moderation, what software features would be needed for them to do this, the balance of legal responsibility between those users and Memory Mapper, and the level of risk entailed by different collaboration models, are currently unknown. A major component of the proposed pre-commercialisation stage will be to explore these questions with a view to implement a progressive model of enhanced collaboration tools, detailed below.

4.3.1 From Single-User to Multi-User (Pre-commercialisation)

The simplest implementation would be to extend the current user model to add authorship and granular permissions for different content types. This would enable maps to have multiple contributors, would allow content to be moderated, and would provide an audit trail of change over time. At the pre-commercialisation stage, access to the tool would be invite-only, with Memory Mapper staff (or their delegates from partner research projects) responsible for allocating accounts and setting user permissions. In this scenario, users would likely be known to Memory Mapper already (either directly or through known partners), and the size of the user base controlled so that the issues surrounding content moderation sketched above can be explored and risks identified. In this model, we would be able to support many more research projects at present, though the scale of those projects would be limited and the corresponding growth of the service similarly so. It may be that an expanded version of this model in which individuals can sign up for Memory Mapper and conduct limited collaborative projects represents the best fit for the service.

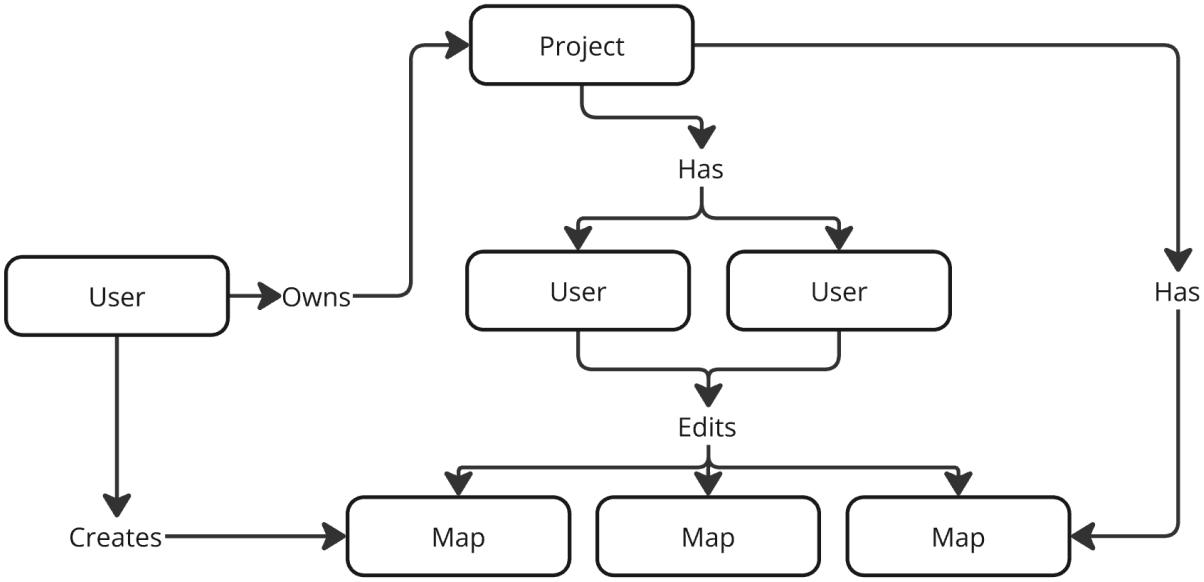

Figure 2: Multi-User Memory Mapper

4.3.2 Top-Down Crowdsourcing (Pre-commercialisation/Early Commercialisation)

An expansion of the above model would be to enable known research partners to conduct full-scale crowdsourcing projects using the tool. Our experience on Survey of London Whitechapel indicates that most content gathered through crowdsourcing projects comes through direct engagement with members of the public rather than through anonymous submissions, making content moderation less onerous than it might appear at first. However, this would still entail a large number of unknown (and possibly anonymous) users contributing content to Memory Mapper, and therefore a much larger volume of content. How this would be moderated, by whom, and with what tools would need to be established and scoped. Implementing this model would also bring the tool closer to existing services such as HuMap and HistoryPin, which would need to be handled with care. We are currently conducting a pilot study in collaboration with Open University to explore some of these issues.

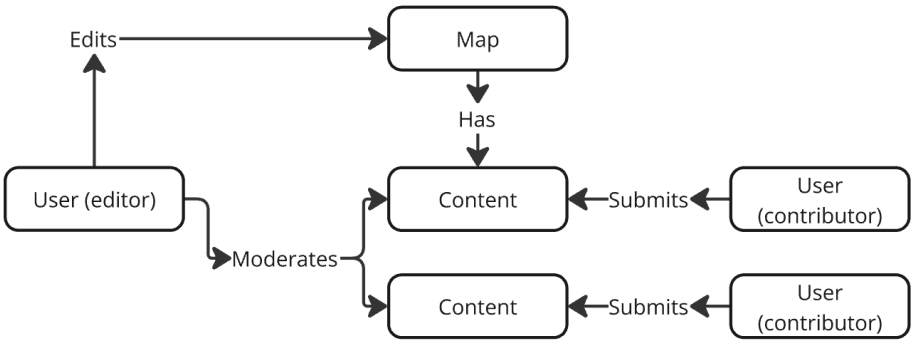

Figure 2: Crowdsourced Memory Map

4.3.3 A Flat Hierarchy (Service Expansion)

The most open (and radical) form for Memory Mapper would be a 'flat' user ontology. In this model, users would sign up to the service without necessarily having had contact with Memory Mapper or an associated research project, and would have the ability to create projects and maps and to invite other users to collaborate with them on these. These users in turn would have the same capabilities. From the perspective of democratising the production of spatial narratives, this model would be highly desirable, in that it would empower any person with internet access to use the tool as

they see fit. It would also allow the user base for the tool to grow most freely, and is potentially the pathway to realise the promise of what we have termed a ‘spatial knowledge commons’. However, it also brings with it the most challenges.

In the other models, growth of the user base would be managed through collaboration agreements with academic or other institutional partners, meaning that the number of users will not grow beyond the ability to moderate that content. Moreover, given the nature of these institutional users, we can assume a level of good faith and trust as they will not want their project outputs compromised by bad-faith actors, and therefore a willingness to moderate content submitted to those projects. Opening the platform fully potentially increases the number of users and therefore increases the likelihood of undesirable behaviours, whilst at the same time placing the moderation burden primarily on to Memory Mapper. Because of the extra resources required to moderate these, Memory Mapper would have to be assured of a corresponding growth of revenue to support this.

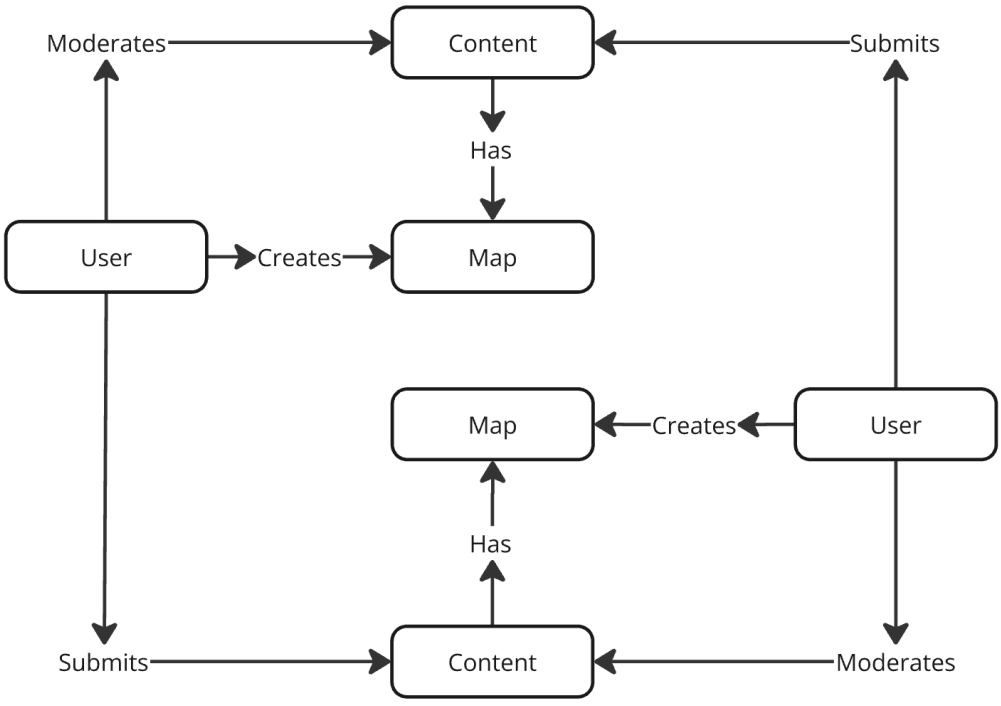

Figure 3: Flat Hierarchy

4.4 Work Package 4: Map Linkage, Metadata Alignment and Visualisation

The third major aspect of the proposed service is the implementation of features to facilitate linkage between different maps and projects. As with other components, this will follow a phased development process, described below.

4.4.1 Spatial Links (Pre-commercialisation)

The first, and most straightforward form of linkage would be to enable users to explore multiple maps of the same location, accessed through a dropdown menu on the main map interface. This would enable users to explore multiple perspectives on the same place, and could be relatively simply implemented though the use of a bounding box drawn around the features of every map.

4.4.2 Metadata Alignment (Pre-commercialisation)

Richer linkage between maps could be achieved with a shared metadata structure. Implementing this would enable users (for example) to track named individuals across multiple, spatially disjunct maps; to explore thematic similarities between different maps and projects; or to trace objects, organisations, or periods across projects. To enable this would require significant re-engineering of Memory Mapper's existing metadata capabilities. At present, Memory Mapper users can use a combination of top-level categorisations and key word lists to build a structured folksonomy of their research, bespoke to their project. This is flexible and easy to use, and provides a simple mechanism to allow users to explore map content. However, as each map effectively has its own taxonomy, this precludes the sort of linkage described above. A structured ontology, using technologies such as controlled vocabularies, authority files, and linked open data, would enable this. However, these technologies are often complex, cumbersome to implement, and difficult to use by non-specialists. We are currently engaged in a pilot project with the Open University to scope the use of these technologies and various types of automated metadata alignment to explore how they could be most usefully implemented. Particular questions include:

- What is the minimum level of metadata alignment which would allow useful linkage and comparison between different Memory Maps?
- What linked open data standards (if any) should Memory Mapper seek to implement?
- What technologies and services currently exist (for example Named Entity Recognition or Large Language Models) which could be used to automate the generation of aligned metadata? And what are the technical, financial, and social implications of these?
- How can this metadata and linkage be best presented to the user?

4.4.3 Visualisation Beyond the Map (Early Commercialisation)

Adding metadata alignment increases the ways in which different maps and projects can be linked together. At its most basic, this will allow for richer content discovery; however, this linkage could be used analytically. For example, network visualisation could show (for example) the relationship between people and places; time-series analysis could show movement or change over time. Whilst we will explore these questions at the pre-commercialisation stage, our current position is that whilst we acknowledge these features may be useful, we do not know whether they are needed by our community of users at this point.

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