User-Centred Design to Support Exploration and Path Creation in Cultural Heritage Collections

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ABSTRACT

In this paper, we present the results of the user requirements and interface design phase for a prototype system, designed to enhance interaction with cultural heritage collections online through means of a pathway metaphor. We present a single user interaction model that supports various work and information seeking tasks undertaken by both expert and non-expert users within the context of collection exploration and path creation. The user interaction model is shown to enable seamless movement between interaction modes, with the potential over time to encourage deeper engagement and learning.

Categories and Subject Descriptors

H.5.m [Miscellaneous]: Interaction framework

General Terms

Design, Human Factors, Theory.

Keywords

Cultural Heritage, Paths, Information Access, User Requirements, Interaction Model, Exploration.

1. INTRODUCTION

Large-scale projects for the digitisation of cultural heritage (CH) have become commonplace in recent years, and yet complex issues arise with regard to information access. Specialist metadata and the often variable quantity and quality of object descriptions make it difficult for users to navigate vast, structured and often very scholarly collections. It is therefore difficult to locate resources of interest, especially for those without advanced levels of subject and domain knowledge [6]. User experience online is thus far removed from that of visiting a museum or gallery in person, where guidance through a much smaller selection of carefully curated objects is the norm, for example, via the medium of visitor-friendly object labels, guide books, audio tours and activity trails. Exhibit information is designed for general rather than academic audiences, with additional materials tailored for family groups and learners, amongst others.

Guided tours and activity trails are commonplace offerings to aid visitor orientation at physical cultural heritage sites, and offer a

range of opportunities for immersive and more highly engaged visitor experiences [4], often utilising technological solutions, and even extending to the latest mobile devices [15]. They are though much less in evidence online, despite the fact that the idea of documents or other items linked together in the form of hypertext trails is considerably older than the web itself [3].

Online paths and trails are seen as a means of aiding navigation, exploration and learning [10] in general and educational online environments, and there are many examples of research [11] [12] [13] and commercial activity in offering tools to develop paths from web pages (e.g. www.trailmeme.com) and social media content (e.g. www.storify.com). However, very few examples are domain-specific and/or pertain to digital library collections, and in consequence, it is rare for all of the associated exploration, authoring and use activities to be integrated within the same space. Through our current research we therefore aim to exploit opportunities to utilize paths to support diverse groups of users in the complete cycle of information seeking, exploration, path creation and interaction within CH digital collections, opening up their use to more widespread educational and leisure audiences.

2. RELATED WORK

Research on information user behavior in CH digital collections is scarce, especially when considering the needs on non-expert users, i.e. those without detailed subject and domain knowledge. Expert users regularly engage in both simple fact-finding and more complex information gathering tasks, amongst others, with the latter having multiple variations and components such as topic searches, exploration, collecting/combining [1], all of which are relevant to our current study. Similarly, non-expert users [14] also engage in known-item searching and exploration. Visual representations of artefacts are highly important in this context, and the process of meaning-making through contextual information and the derivation of personal inferences and connections is also strongly evidenced [14].

For known-item or fact-finding searches, some knowledge of the metadata and collection structure is imperative, but such knowledge is much less likely to be used effectively, if at all by non-expert users than expert users [7]. In addition, information retrieval tools in CH collections, and the web more generally, are much less likely to effectively support the needs of users more in more open-ended exploratory tasks.

Exploratory search extends the idea of basic lookup into the areas of learning and investigation, which in turn incorporate extended information processing, evaluation and annotation [9]. Aligned with these variations of exploratory search are the concepts of

serendipity [5], where the user encounters information that they were not actively looking for, and berry-picking [2], which is an extended, iterative and adaptive search process that also incorporates the idea of collecting information objects as the search progresses over time. Solutions for these more complex user needs are yet to fully exploited, with greatest potential in adaptive systems that take account of patterns of user behaviour [8] [9], and the use of paths or trails as a means of capturing items of interest [11].

3. METHODS

In the absence of an existing system, extensive requirements gathering [6] was conducted with *potential* users, as the first stage in a user-centered design process. The goals of this research were to:

- Develop a detailed understanding of the characteristics and needs of potential users across four primary domains: heritage, education, professional/commercial, and general/leisure.

- Explore the meanings and potential applications of the path metaphor in the context of digital CH.

- Gain an understanding of the path-creation process and the types of paths that might be created.

- Determine the current availability and functionality of path-creation tools in CH collections.

In order to achieve these goals, mixed methods were employed, gathering a variety of complementary qualitative and quantitative data. First, an online user survey was used to collect data from 79 expert and non-expert users, comprising questions about their personal and cultural participation characteristics, and information behavior and use in the CH context. This was complemented by in-depth semi-structured interviews conducted with 22 expert users, which focused on exploring the meaning of the path metaphor in CH environments, and understanding the process of development and use of paths in this context.

Secondary data was used to scrutinise the features of published paths from various sources, to ascertain their core elements. Similarly, a comparative analysis of general and cultural-heritage specific systems offering path-creation functionality was conducted, to identify common features and standard approaches to the proposed core functionality. These findings were validated via user participation in path-creation tasks, utilsing low- and medium-fidelity techniques.

Analysis of these various complementary data enabled the development of detailed domain and role-specific information user profiles; a user interaction model supporting four key modes of interaction; and, use cases illustrating some of the primary user interaction scenarios. From these we extrapolated detailed user requirements, and in turn, interface designs and functionality for the first PATHS prototype. The resulting system is intended to support all elements of the interaction model, allowing users to move seamlessly between modes of use.

4. RESULTS

Given the breadth and depth of data, this paper focuses on the findings relating to paths and their uses in CH, and in turn, how related user tasks are incorporated within a single user interaction model, to be implemented in the prototype system.

4.1 Existing Path Forms

Analysis of existing paths and trails found that online and offline paths both have similar characteristics. *Nodes* are the essential building blocks of all paths, representing collection objects. Each node has associated metadata and primary content (e.g. descriptions, images) relating to the object. *Connections* between nodes enable navigation through the path and often represent meaningful relationships between objects. In the online environment, additional features of paths included *navigation tools* (e.g. path overviews and back/forward arrows), *annotations* added by the path creator to give context and guidance for use, and occasionally *links* to other related content, both within the same collection, and/or in external web sites. These findings largely support the initial vision for PATHS and can all be seen in the first prototype design.

In addition, it was found that most existing online paths are *static* and pre-published by an author, *linear* in form, rather than a more complex map or network structure, and *standalone*, without inter-connections with other paths. These findings fall somewhat short of the PATHS vision, limiting the possibilities for exploration and discovery, although for pragmatic reasons, they form the core functionality of the first prototype, with more advanced variations of paths coming later.

4.2 The Path Metaphor in Cultural Heritage

Interviews with potential expert users in the heritage, education and professional domains found a strong affinity with the path metaphor, revealing a range of different interpretations of what it means in the CH context, and similarly about what form paths might take, and how they could be employed in an online environment to engage with key audiences. Eight interpretations of the path metaphor emerged:

1. Path as search history
2. Path as information seeking journey
3. Path as linked metadata
4. Path as a starting point or way in
5. Path as a route through
6. Path as augmented reality
7. Path as information literacy journey / learning process
8. Path as transaction process

The first three of these are closest to the idea of hypertext trails [3], with trails defined by user interaction in 1 and 2, and trails defined automatically, by the system in 3. Variations 4-6 are more creative interpretations, all suggesting opportunities for guiding the user into and through collections, encouraging exploration and/or offering an immersive experience. In addition to expert-defined routes, 5 also incorporates the idea of users being able to see and follow "well-trodden paths" defined by the cumulative interactions of other users, thus extending the opportunities for utilizing search histories. Lastly, 7 and 8 are both process oriented, although 7 is experiential, user-defined, learning-oriented, typified by trial and error and unique to the individual, whilst 8 is a rigid process designed to escort all users consistently through a standard process of pre-defined steps.

4.3 Desired Characteristics of Paths

Expected characteristics of paths were explored, and views contrasted markedly with the existing path formats enabled by

path-creation tools currently available. Linearity is rarely seen as the best option for maximizing the potential of paths as exploration devices. Allied to this is the belief that starting and end points for paths should be mutable rather than fixed, allowing different users to explore a path in different ways according to their preferences and needs.

In the absence of linearity, some form of organization is still required to aid the accessibility and navigation of the path. The most popular option is for path content to be aligned to themes, with other alternatives including date, location, narrative and author, where the latter might present multi-layered paths offering the differing perspectives of several path-creators on the same topic. An over-arching conceptual framework for the path is also desirable, in order to tie together the themes and other ideas.

As a way-finding or navigational aid, paths are seen to support both guided and exploratory behavior, with the latter seen as the more desirable goal for user interaction. Features that are needed to enable way-finding include path overviews, navigational context in the form of next/last and nearby nodes, branching opportunities where paths converge and diverge, visualization, e.g. in the form of timelines or maps, and some degree of object level information at the node and overview display.

Path content must be carefully selected or 'curated' by the path-creator, with the addition of context and interpretation so that the objects within the path convey a narrative or meaning. Content may be derived from one collection, but there are significant benefits from including objects from diverse collections, along with other materials from external web sites. It may also be beneficial for interpretation of the path content to be extended by user-generated content and/or annotations of various kinds.

Many of these characteristics are seen in existing path systems, but limitations arise from the linearity that is commonplace. Exploration and deeper levels of engagement within collections requires more complex path structures, carefully curated content, interpretation and narrative, and interconnectedness of paths and other content within and outside of the system. The fact that most of these more advanced characteristics are rare, and that linearity prevails also suggests that these are complex issues yet to be adequately resolved.

4.4 Potential Applications of Paths

Many opportunities for the use of paths in CH were suggested. Two major themes emerging from these are the use of paths to achieve learning, and to support exploration and browsing. For learning to occur there needs to be strong contextual information, along with questions and other exercises to structure the learning process. Exploration and browsing activities implicitly enable meaning making and learning to take place, as users become more familiar with a topic and select or interpret the objects they encounter.

Specific instances of learning activities that may be delivered via paths are collection or subject familiarization, story-telling, individual or collaborative inquiry-based learning utilising path creation, modeling the research process, and comparative analysis of differing view-points on a topic of interest.

In addition to learning,, paths may also serve to deliver entertainment and an enjoyable interaction experience for more general audiences. In practical terms, paths may simply be used as a means of introducing people to a collection and its stories, and in due course, encouraging them to venture further in a more independent fashion. Paths facilitate topic-based information retrieval typified by the berry-picking mode of interaction [2], rather than known item searching. Furthermore, paths may be a useful tool for personal information management in both formal and informal research scenarios, enabling the user to record, reuse and share their research activity, or helping them to organize their ideas. Creativity is also encouraged, as user-generated paths provide the means to repurpose CH objects into users' own narratives for private or public consumption.

5. USER INTERACTIONS WITH PATHS

By consolidating findings across the various data collection methods, we were able to discern five core elements of interaction with CH collections relating to activities that encompass creating, using and sharing paths as a means of exploration and engagement.

Findings from the qualitative data collected via interviews and path-creation tasks revealed a set of five core activities relating to the creation, use and sharing of paths; developing a concept for a path; collecting items in include in a path; creating a path from items collected; communicating about paths found and about paths created; and, consuming (following or exploring) paths created by others. All elements of the model may be undertaken by expert and non-expert users, in any sequence, and with varying degrees of iteration, according to the user's preferences and behavioural traits.
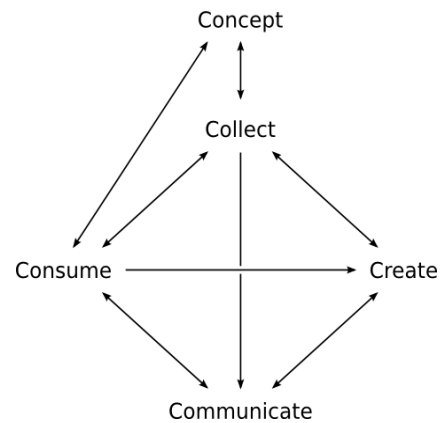

Figure 1. PATHS user interaction model.

Initially, we expect users to begin by *Consuming* paths created by others, using them as a means of exploration and familiarization with the collection and the system. *Collecting* items of interest when exploring a collection is a natural behaviour in berry-picking mode, and is implicit in the process of creating a path, or as a by-product of a user's information seeking history. When the path creation activity is purposeful, it is likely that an over-arching *Concept* is devised, which may come from activities undertaken outside of the system, but also may be developed via a process of exploration within the collection and any pre-existing paths. The concept may also evolve alongside the collection and path creation activities, through a process of iteration and meaning-making. A path is *Created* once a number of appropriate items have been collected, and this activity may include ordering the items into a narrative, and adding contextual information and/or metadata. In a web 2.0 environment, it is also important to allow for *Communication* activities in support of the interaction experience. These may include sharing paths that have been

created or discovered, both within and outside of the system (e.g. via social media), commenting on and rating content, and adding narrative to personal paths as a means of making meaning.

It is imperative in an adaptive web environment that systems do not prescribe modes of interaction or enforce sequences of activities. During the design of PATHS we have uncovered four primary interaction modes, all of which are supported by the user interaction model, but each with a somewhat different typical interaction flow.

Path consumers are the most passive users, and likely to be in the majority. By using paths as a guided tour or means of simple exploration of the collection and its content, we expect users to become more interested in communicating their discoveries with others and exploring further within the main collection. Over time we would expect some of them to move onto collecting and creating paths of their own, as they develop into more independent and active users of the system.

Path creators will likely be in a minority in the early stages, and primarily expert users such as curators and educators, and perhaps a few more independent non-expert users. In *expert* path-creation mode we believe interaction will be purposeful and systematic, with a goal of creating a path about a defined topic. Topics and styles of paths may vary by domain, and we expect that educators are more likely to adapt ideas from existing paths, whilst CH experts will try to develop something novel, showcasing elements of a collection or subject expertise. In contrast, *non-expert* path creators are more likely to develop their concept as they explore the collection, and their paths may be more idiosyncratic, evolving over time, or in the education domain, may even be directed in the task by an expert in a path facilitator role.

Path facilitators are most likely to be found within educational settings, where inquiry-based learning is prevalent. These users may not create paths themselves, but may curate a broad collection of objects from which a group of non-expert users are encouraged to create their own paths. (for instance, as a homework project). Facilitators are more interested in enabling deeper engagement with CH materials, and in fostering communication and reflection on the activity and the content of the paths created in this way.

6. CONCLUSIONS

We have presented the findings of our user requirements study on the creation and use of paths as a means of aiding information access and exploration in CH digital collections. It has been shown that paths support many of the needs for exploratory information behavior, and have applications for diverse users across multiple domains. Users interactions with paths comprise five core elements, integrated into a single user interaction model and can be used in varying sequences, illustrated by four primary modes of interaction.. An initial prototype has been developed from the user interaction model, which is currently being evaluated within a task-based user-centred evaluation setting.

7. ACKNOWLEDGMENTS

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