User Categories for Digital Cultural Heritage

David Walsh
University of Sheffield
Sheffield
United Kingdom
djwalsh1@sheffield.ac.uk

Paul Clough [*]
University of Sheffield
Sheffield
United Kingdom
p.d.clough@sheffield.ac.uk

Jonathan Foster
University of Sheffield
Sheffield
United Kingdom
j.j.foster@sheffield.ac.uk

ABSTRACT

Increasingly information systems and services are being tailored to the needs of individuals and groups through the use of user-centred design techniques. In this paper we consider the ways in which the users of digital cultural heritage have been previously characterised and grouped. Despite recognising the importance of adopting user-centred techniques, there appears to be little prior work that has compared user groupings across user studies. Through a preliminary review of previous literature we compare ways in which users have been categorised and provide points for open discussion. The dimensions of domain knowledge, technical experience and motivation provide a way of distinguishing previously identified groups. We believe discussions about user categories and models is warranted and will help in the future design of digital cultural heritage services.

Keywords

Digital Cultural Heritage, User Modelling, User Studies

1. INTRODUCTION

As far back as the 1980's Robert Taylor highlighted the importance of developing information systems from the perspective of human actors and their environment [1]. Taylor argued that only by understanding the user's environment could the value of information within specific contexts be determined. Over the years many studies have sought to determine the information behaviour of users with various demographics, domains, professions and roles [2, 3]. Such studies have highlighted the diversity of users with respect to age, gender, personality, interests, expertise, profession, role, socio-economic background, motivation, intent and task. Understanding and categorising users can help to develop, adapt and evaluate information systems from the perspective of the user and their environment. For example, users with a lack of archival expertise may find formulating search requests and interpreting and contextualising search results difficult [4]. Knowing this would allow specific search aids to be designed and implemented to support these users.

Similarly, users from diverse backgrounds come to Digital Cultural Heritage (DCH) collections with varying goals,

[*]This is the primary contact author.

tasks and information needs [5]. A consequence of this is the wide variety of requirements that service providers and content creators have to consider when designing methods of information access [6, 7]. Increasingly, cultural heritage services are being tailored to individuals and groups (i.e., via personalisation and adaptive systems) and therefore require some kind of differentiation between user groups [8]. However, despite the wealth of studies carried out to identify and characterise users, many of the categories appear general (e.g., historian vs. student; novice vs. expert), often without precise definition and therefore making comparisons between studies difficult. An examination of the literature suggests a lack of agreement on the appropriate terminology for categorising users of digital cultural heritage and their characteristics and needs (e.g., exactly who are the "general public"?). Also, within groups users and their characteristics may vary widely and types of user are often abstract and generic. Similarly to the view of Normore [9] with respect to digital library users, we propose to better understand differences between user communities to provide a more "nuanced view of the user".

In this paper we discuss and compare user categories across studies. With this in mind a review of relevant literature is undertaken to identify the ways in which the users of digital cultural heritage systems and services have been categorised in past studies. We believe this may aid both practitioners and academics alike with the design of future digital cultural heritage systems. The following objectives were addressed: [OB1:] To gather relevant literature describing different types of user within digital cultural heritage; [OB2:] To analyse types of user commonly discussed in the literature; and [OB3:] To compare types of user based on generic dimensions, such as level of domain knowledge and technical skill. The remainder of the paper is organised as follows: Section 2 discusses related work with respect to categorising users; Section 3 describes an approach to identifying relevant literature, in which different categories of users are mentioned; Section 4 provides an analysis of the past work and provides a summary of user groups; Section 5 compares user groups and provides areas of discussion; finally Section 6 concludes the paper.

2. RELATED WORK

The access to and discovery of cultural heritage materials has been long studied. However, similar to perspectives on information seeking and behaviour [10], the access to cultural heritage is no longer just about the physical visit, but rather the entire visitor experience that begins prior to the

actual visit and after the visit has ended [11]. Such activities are usually initiated by some interaction with a museum/library/archive website made available by a plethora of technological devices. Alternatively, virtual collections are being visited by users who never physically visit the museum [12]. An enduring effort has been to study and categorise users or visitors. The diversity in users of digital cultural heritage has resulted in a strategy that simplifies the virtually unlimited possibilities of user profiles by creating generic groups or categories of users - 'stereotypes' [13]. These groups are sometimes as abstract as *novice* or *expert* [6], but more commonly user groups are created based on profession (e.g., curator, librarian, researcher, teacher or student). Alternative groups have been based on user interest or motivations (e.g., tourist, explorer, general user), or age group (e.g., adult, child). These archetypal users are often described using *personas* [14].

More widely, users have commonly been categorised and modelled within the fields of information seeking and context-aware systems. For example, Russell-Rose & Tate [15] consider the behavioural differences of search system users and focus on two dimensions: domain expertise and technical expertise. They focus on *expertise* as this can have significant effects on how people find and use information. Domain expertise reflects familiarity (or experience) with a subject; technical expertise captures proficiency with using computers, search systems and the internet. Users are mapped to these two dimensions as novices or expert. The authors also highlight how *experience* can move users from novices to experts over time. Aspects of users that are less likely to change over time include their psychological attributes, such as *cognitive style*. Such aspects of the user constitute their personal context. Modelling the user's *context* allows systems to personalise and adapt to the user's situation and will also attribute to variations in their information behaviour [16]. User modelling is also a widely researched and important topic in its own right[1] [13]. Within the scope of this paper it is therefore pertinent to consider to what extent categorisations of users in digital cultural heritage should take into account users' individual differences, as well as their group attributes, and broader contexts, e.g. geographical, social, cultural [1].

In this paper we consider how categories of user are distinguished by the dimensions of domain and technical expertise, as well as user motivation. These dimensions have been widely used in past studies [15] and we posit are able to help distinguish and compare types of user in cultural heritage. We review past literature in which the users of (mainly digital) cultural heritage are identified to help categorise types of user and their distinguishing characteristics. We believe that such a review will provide useful insights and offer a basis for future discussions.

3. METHODOLOGY

A review of existing studies of digital cultural heritage was conducted to identify and compare how users had been identified and categorised (addressing Objective 1). Once relevant articles were gathered they were analysed to identify themes, such as user group and characteristics, methodology used to study users, etc. The articles gathered provide a dataset for subsequent analysis (see, Section 4). More specifically, the following approach was used in conducting this review [17, 18]: (1) identify studies relevant to the scope and purpose of the review; (2) develop inclusion and exclusion criteria to guide the selection of articles; and (3) analyse each study and synthesise the results. These steps are further described below:

Step 1: Relevant articles were identified using a search strategy based upon keyword search and Google Scholar [19]. A separate search on the ACM Digital Library[2] and Museums and the Web[3] was not conducted as both are indexed by Google Scholar [20]. Keywords used to identify potentially relevant articles included: 'virtual museum visitors', 'cultural heritage users', 'museum website users', 'museum personas', 'digital cultural heritage user studies' and 'CH website professionals'. Types of articles included studies of museum websites and online digital collections, digital cultural heritage users and user behaviour, and search patterns and visitor journeys. Also included were whitepapers (often unpublished) from funded projects, such as Europeana, and the PATHS[4] and CULTURA[5] projects. This step resulted in 86 papers for review.

Step 2: Articles were included if: (i) a user category, role or group was identified, together with users' motivations within a group; or (ii) user categories were identifiable even though motivations were less clear, but the boundaries of the groups were apparent; or (iii) user motivations were identified for groups of users accessing DCH websites. Papers that did not meet the inclusion criteria were excluded, along with studies identifying user groups only in physical cultural heritage settings. Also reviewed were articles cited in digital cultural heritage referring to prior categories, such as those used in healthcare [21]. Papers in which a user group could be identified resulted in 34 papers to analyse.

Step 3: Identified articles were analysed and user groups compared. For every category a low, medium, or high rating for domain knowledge and technical skills was assigned. We did this as Russell-Rose & Tate [15] used these dimensions to categorise users and we found these often mentioned in the DCH literature. In some cases the dimensions and rating was clearly identifiable ("Casual users are not domain or system experts" [22] and "a novice user may become confused and give up using them [interfaces]" [23]). But occasionally the dimensions and rating were interpreted from the textual content in the article ("Since novice end-user searchers typically do not possess much search experience, subject knowledge is their only asset" [24] where the subject knowledge was interpreted as medium). At the same time any motivations for the user's engagement were also identified as this was found to be another common attribute used to distinguish users [25]. The results of the findings and analysis are shown in Table 2. The coding was carried out by the first author, and to improve coding reliability 10% of articles were checked by another author.

4. ANALYSIS OF LITERATURE

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[1]For example, see: http://www.um.org/

[2]http://dl.acm.org/

[3]http://www.museumsandtheweb.com/

[4]http://www.paths-project.eu/

[5]http://www.cultura-strep.eu/

The collection of relevant articles were then analysed, in order to identify the different labels used by studies to identify distinct user types (addressing Objective 2). Overall, we identified 58 distinct labels. On average, each study studied 2 user types. The number of user types ranged from 2 to 6. Studies in which the user types studied was quite large in number, e.g. 5 user types, all closely aligned with one another; covering the full spectrum from Professional to Novice. The labels most frequently used were *Lay User* (7 uses) and *Professional User* (3 uses). 3 studies contained a 'facilitator' type group, where the characteristics are centred around planning a visit or creating a virtual tour for others to use; 2 studies contain a group catering for personal curiosity, as opposed to any other information need; and 2 studies contained a 'hobbyist' user type. .

As mentioned earlier, if the user groups are considered to be part of a spectrum, with professional at one extreme and novice user at the other, we find that studies which identify more than 4 groups appear to deal with the full spectrum, i.e. from end to end. When more groups are added, this increases the number of levels in between the poles [21, 26, 27, 24, 28]. Studies with less than 4 groups tend to focus on a group of users, from only one pole of the spectrum, e.g. all professionals [29] or all novices [22]. From the 58 labels originally identified in the literature, only 19 (identified in Table 2) met all 3 areas of the inclusion criteria (methodology Step 2), by identifying levels of domain knowledge and technical expertise, as well as users' motivations. We use these dimensions to help compare and aggregate groups (see Section 5).

4.1 Broad Categories of User

Within the literature user groups were described in varying levels of detail. One clear distinction that emerges repeatedly are the broad classes of expert/professional, semi-expert/hobbyist and novice/non-expert. Cifter et al. [21] focus on two user groups: the *lay user* category borrowed from Hogg et al. [30], and Ludvall's [31] *professional* user category. Johnson [6] identifies three categories of user, later refined to just two: the *expert/professional* and the *lay/novice* user. The criteria or dimensions against which users are categorised as novice or expert are discussed in Section 5, but broadly fall into domain knowledge, technical expertise and motivation, similar to [15].

4.1.1 Professionals and experts

Much of the literature considers those employed by cultural heritage organisations (e.g., curator or librarian) or trained scholars (e.g., historian) as *professional* or *expert* users. Vilar et al. [32] define professional users as "those who act within the formal part of a profession, having good knowledge of the task, being trained and usually having experience with it and deep understanding of its context". In addition, Pantano [27] uses this definition for experts: "specialists in the field of cultural heritage." Marty [33] uses the notion of *Museum Information Professional* (MIP), someone working with information resources and a desire for meeting user needs by ensuring that the right information resources are available at the right time and place, whether users are inside or outside the museum. This categorisation was adopted by Amin et al. [34] who focussed only on cultural heritage experts and the actions they were required to undertake in relation to more complex searches and the

strategies and workarounds employed to overcome deficiencies in existing tools.

4.1.2 Semi-experts and hobbyists

As institutions open their collections to the world via the internet, attention is being paid to differences of domain knowledge and domain system expertise. There are essentially many groups of users who interact with collections alongside the museum/heritage expert [6]. Consideration of other user categories which are not specifically job related, but can be considered as expert in a particular field, are also beginning to be incorporated into the research relating to the user. A number of recently completed studies have focused on *hobbyists* [35, 5, 29, 36, 37], highlighting a group of specialists undertaking research for personal reasons. Stebbins [38] describes hobbyists within the context of serious leisure: "hobbyists are serious about and committed to their endeavors, even though they frequently feel no necessity or obligation to engage in them. In other words, they are not dabblers or people aimlessly doing something as a temporary diversion. A hobby is a specialized pursuit beyond one's occupation, a pursuit one finds particularly interesting and enjoys doing because of its durable benefits."

4.1.3 Lay users and non-experts

Hogg et al. [30] define *lay users* as "those who have not gone through the training or socialisation in a particular profession". The professional user is identified as having good knowledge of the task and the system they are using, usually based on prior training or previous experience. Subcategories of lay user are also discussed: the *experienced lay user* and the *novice lay user* [32]. The experienced lay user is identified as having some previous experience with the system/task, but in comparison to the professional user their knowledge of the task and system experience is limited. In contrast, the novice lay user is someone new to the entire environment and usually unable to perform the task requirements successfully. The main factors separating these two groups, according to Cifter et al. [21] are: knowledge of the task, information needs and expectations from the system. Similarly, Pantano (cited in Ibrahim [22]) describe the *general user* as those who usually visit the website more for some passing curiosity rather than to retrieve information to improve their knowledge of cultural heritage. Skov [39] identifies that further work on the novice user group would provide interesting improvements to the understanding of this main group and its sub-groups.

4.2 Other Groups of User

Beyond the broad groups of users based upon their expertise, categories have also been used to reflect other aspects, such as information need, motivation or purpose of engagement and role. Further examples of user category for specific case studies are provided in Section 4.4.

4.2.1 Groups based on information need

Booth [40] undertook an extensive analysis of visitors to the London Science Museum, including virtual visitors, and formed groups based on their *information need*:

- **General visitors**: users who require general information, e.g., opening hours, prices, facilities, and what's on.

- **Educational visitors**: users who required additional information to that of the general visitor, e.g., more detailed information to plan a visit and project based information.

- **Specialist visitors**: also recognised by Skov [39] as those who require further information in addition to the general visitor in terms of more detailed information on museum collections and also access to expertise in the museum via additional links.

4.2.2 Groups based on motivation and role

Fantoni et al. [25] describe five reasons for users engaging with the Indianapolis Museum of Art (IMA) website: (i) plan a visit to the museum; (ii) find specific information for research or professional purposes; (iii) find specific information for personal interest; (iv) engage in casual browsing without looking for something specific; and (v) make a transaction on the website. Fantoni et al. [25] state that many museums and other cultural organisations have adopted Falk's [26] user classifications as a means of segmenting online audiences, even though these classifications were devised for the physical museum. Falk believed that user classifications should not be based on demographics only and devised five groups of users based on their *motivations* for visiting:

1. **Explorer**: motivated by a need to satisfy personal curiosity and interest in an intellectually challenging environment.

2. **Facilitator**: motivated by the wish to engage in a meaningful social experience with someone whom they care about in an educationally supported environment.

3. **Experience seeker**: aspires to be exposed to the things and ideas that exemplify what is best and intellectually most important within a culture or community.

4. **Professional/Hobbyist**: possess the desire to further specific intellectual needs in a setting with a specific subject-matter focus.

5. **Recharger**: motivated by the yearning to physically, emotionally, and intellectually recharge in a beautiful and refreshing environment.

Similarly, users are commonly categorised by their *role*, such as tourist or teacher. For example, Pantano (cited in Ibrahim [22]) use the following:

1. **General users**: are those who usually visit the website more for some passing curiosity rather than to retrieve information to improve their knowledge of cultural heritage.

2. **Enjoyers**: are those who appreciate the virtual exploration of the cultural heritage for personal pleasure.

3. **Informationalists**: are those who have the intent of improving their knowledge.

4. **Tourists**: are those who visit the site to help organise their personal tours.
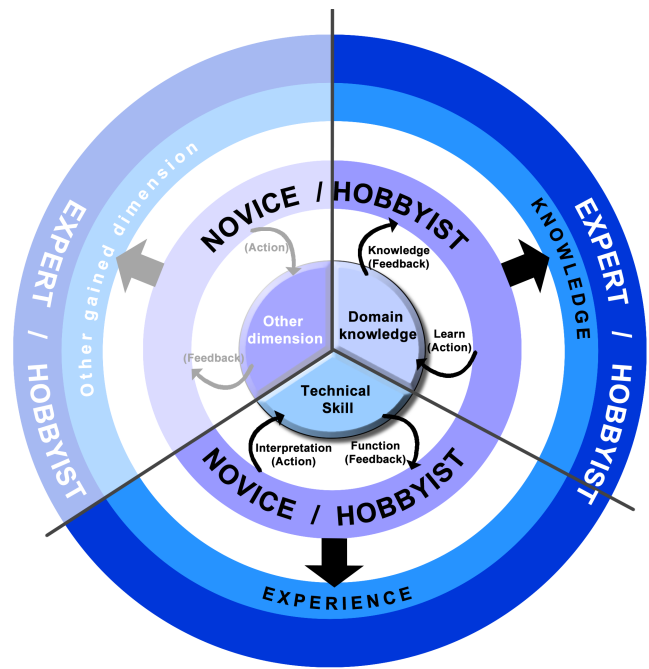
Figure 1: Adapted version of Cifter et al.'s [21] process of gaining experience to accommodate for multiple dimensions

5. **Experts**: are specialists in the field of cultural heritage.

Whilst these categories and motivations have been used for virtual museums, they were never designed to be used in this way. Goldman and Schaller [41] and Peacock and Brownbill [42] had begun to undertake similar studies and provide classifications for the motivations of online museum users. Sweetenham et al.'s [7] work on the CULTURA project presented a system that was specifically designed to work for and with a range of the user groups: professional researchers, apprentice investigators, informed users and general public.

4.3 Moving between Roles and Expertise

Prior studies have shown how people can play multiple roles in relation to a single system [43] and that roles can change over time depending on age, personal/social circumstances and motivations, as well as users' relationship with technology [44]. This change in needs and expectations can also occur either because interest in the domain and domain knowledge has increased, or that once the initial experience has been satisfied, users look for what else is on offer [45].

As mentioned by Russell-Rose & Tate [15], users move from novice to expert through *experience*. This is described more fully in Cifter et al's 'process of gaining experience' [21]. In the case of subject or domain knowledge this may occur through *learning*. Figure 1 shows this process of gaining experience in a graphical form based on Cifter et al. We include multiple dimensions (including subject knowledge and technical skill) where users can advance in one or multiple dimensions, all the time moving towards becoming an expert. The diagram includes an element of iterative feedback. For example, in the case of domain knowledge the knowledge gained in turn leads to insight and action as users

develop (and apply) their knowledge (see [1]). Note that a hobbyist can be either a novice hobbyist or an expert hobbyist. This is because in literature hobbyists are sometimes highlighted as being as knowledgeable, if not more so than professionals [38, 26, 29].

4.4 Example User Groups

4.4.1 Europeana

Chowdhury [46] considers the challenge set by the European Commission to Europeana, Europe's largest aggregated collection of cultural heritage, to create a platform for the European citizen to view heritage artefacts. She highlights the vastness of user cultures, ages, academic levels and behaviours in order to highlight the frailty of attempting to standardise a European user. However, the creation of archetypal users has been necessary in the development and evaluation of Europeana. Users have been characterised using personas whereby "each persona represents many users and a set of personas represents a spectrum of the target user groups" [14]. The use of a persona provides characteristics such as: names, jobs, feelings, interests, goals they wish to fulfil, turning the abstract and very short descriptive role category into a 'real' person [47].

Personas can provide detailed knowledge on the users domain knowledge as they are always written with a scenario in mind where the user performs a task on the system they are being used for. Their technical knowledge is often indicated by nothing more than a few words "Tech-Savy" or "some web usage". To date the development of personas has undergone 3 revisions [48] that are derived from various forms of data: user studies, transaction log analyses and demographic data. The Europeana Persona Catalogue v3 comprises of 5 personas (previously 7). The personas are developed around the broad dimensions of search literacy (e.g., IT knowledge, task knowledge and language), and information seeking behaviour (e.g., search strategy and personality). An example persona is the following: *"Jukka: PhD in music and professor at a university. Very confident about technology and always on the look-out for new stuff and new ways of communicating, on the computer as well as on his iPhone. Very confident about searching and finding useful and relevant results."*

4.4.2 Library of Congress NDL

Marchionini et al. [49] describe users and their needs within the context of the Library of Congress (LC) National Digital Library (NDL) Program. The authors provide detailed discussions around user categories, which are derived from users' motivations (related to specific information seeking task), domain knowledge, library system knowledge, focus of the task (e.g. amount of information needed) and time allocated to task. This resulted in the following categories:

1. **LC staff**: high motivation, medium domain knowledge, high library system knowledge, high focus, and limited time allocations.

2. **Hobbyists**: e.g., genealogy, Civil War, railroads, other examples), high motivation, typically high domain knowledge, a range of library system knowledge, high focus, and high time allocations.

3. **Scholars**: e.g., historians, sociologists, anthropologists, authors, high motivation, high domain knowl-

edge, high library system knowledge, high focus, and high time allocations.

4. **Professional researchers**: e.g., picture researchers, high motivation, medium domain knowledge, average to high library system knowledge, very high focus, and medium time allocations.

5. **Rummagers (browsers)**: e.g., PhD students looking for topics; scholars looking for new directions, topics, high motivation, medium domain knowledge, range of library system knowledge, low focus, and medium to high time allocations.

6. **Object seekers**: e.g., some authors, CD-ROM/ multimedia developers, TV/video producers, and instructional materials developers, high motivation, range of domain knowledge, low library system knowledge, high focus, and low to medium time allocations.

7. **Surfers** e.g., those who are curious, those who bump into the NDL, etc., low motivation, low domain knowledge, low library system knowledge (but may be high computing system knowledge), low focus, and very low time allocations.

8. **Teachers K-16**: medium motivation, medium to high domain knowledge, low to medium library system knowledge, medium focus, and low time allocations.

9. **Students K-16**: low to medium motivation, low domain knowledge, low library system knowledge, low to medium focus, and low to medium time allocations.

Consideration of personal attributes (e.g. age, gender and cognition), domain expertise and technical expertise is given in producing categories, along with consideration of information seeking task.

5. DISCUSSION

Analysis of how users are categorised shows a high degree of variation (58 distinct labels) and range in types of user identified. However, in many cases similarities between the user groups could be observed leading us to consider whether a smaller and more generic set of groups exist and could lead to a 'standard' set of user types. We aimed to identify commonalities between different user groups across studies (addressing Objective 3). To compare user groups we consider them based on the dimensions of users' domain expertise, technical skill and motivation or purpose for engagement. These are commonly used in fields beyond cultural heritage and were observed from reviewing the DCH literature. Values for domain expertise and technical skill were reduced to 'high', 'medium' and 'low' as these are often used. To compare motivations (or roles) we attempted to identify a common set of types (see Section 5.1). To allow comparison of user groups we used a subset of the studies in which the three dimensions were listed and findings are discussed in Section 5.2. A number of open questions have emerged from the analysis of user groups which we discuss in Section 5.3.

5.1 Common Motivations for Engagement

The motivations identified by Fantoni et al. [25] are commonly cited in the cultural heritage literature. Ham [50] identified two additional motivations related to learning "captive" and "noncaptive". Ibrahim [22] describes *captive* users as "those who learn something because they are required to (e.g., students or employees)"; in contrast *noncaptive* users have "the option to ignore the information without bearing any punishment or loss of potential reward. They are also free to walk away anytime they want to, and are driven to pay attention due to intrinsic satisfaction related to what they are hearing, seeing, or reading, and will continue to pay attention as long as the information they are receiving continues to be more interesting and engaging. Typical settings where we can find noncaptive users are museums and parks". We propose a generic set of motivations that we use to analyse user groups across studies (see Table 1).

Table 1: User motivations and DCH

Fantoni et al.'s [25] motivations	Our label
Find specific information for personal interest	Curiosity
Find specific information for research or professional purposes	Work
Plan a visit to the museum	Plan visit
Engage in casual browsing without looking for something specific	Pleasure
Ham's [50] motivations	
Find for educational (school) reasons	Learn captive
Find for personal reasons	Learn non-captive

5.2 Comparison of User Groups

To compare the groups across studies and enable us to identify generic groupings we mapped categories against domain expertise, technical skill and motivation. From this exercise, six main groupings of categories emerge (see Table 2). These six groups are based on similarities in level of domain knowledge and technical skill. We can observe, for example, that the 'general public' and 'casual user' are similar with respect to domain and technical expertise (low), even though they are referred to with different names. However, what may distinguish these are their motivations. Additionally, 'professionals' and 'scholars' may be considered similar with respect to domain and technical expertise (high).

An additional two groups (Object seekers and Teacher K-12) are identified, but in the literature they are described as having varying levels of at least one dimension. It is not thought that these are separate groups, but would sit within one of the main six once the variation level has been set (e.g., if the Object Seekers' domain knowledge was low then this would belong to Group 1; if the domain knowledge was medium then it would belong to Group 3. If, however, the domain knowledge was high then this would form a separate Group 7).

Whilst the findings have shown these six high-level groups,

there is evidence that there are sub-groups within the groups. For example, Skov [39] demonstrates that, even in rather narrow groupings, there are sub-groups: e.g., hobbyist may have sub-groups of 'collectors' and 'liberal arts enthusiasts'. The number of differently named and motivated roles in the first group of Table 2 (novice/lay/casual user) also highlights that there are sub-groups with only minor differences. More work is needed to identify if these differences in motivation make these a unique group or if they should be grouped together. The 'lay experienced user' is an interesting group as this group could have a low or medium level of domain knowledge and an opposite low/ medium level of technical skill; which differentiates this into two possible separate groups (1 & 2) when considering the dimensions but the motivation is the same and it is appears as an intermediate level from 'lay novice' user and the 'professional' user.

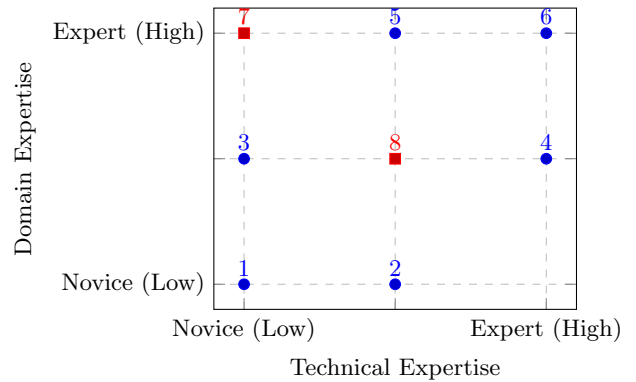**Figure 2: User Role groups mapped onto Russell-Rose & Tate's dimensions of experience grid [15]**

Figure 2 displays the broad categories identified in Table 2 mapped against the dimensions of experience, similar to [15]. From the Russell-Rose & Tate discussion of user groups, users could be categorised according to their position in the grid. For example, as double novices or double experts. Systems and services could then be developed and user behaviours categorised with respect to these users, e.g. double novices may exhibit search characteristics of frequent query reformulation, more time navigating back to the search page, and overall more time spent per session [15].

5.3 Open Questions

The aim of this review was to better understand the range of user categories being used in digital cultural heritage. As Taylor [1] advocates, information systems and services must seek to understand users and their environments to fully provide value-add. The use of fairly generic categories (i.e., stereotypes) allows tailoring cultural heritage to particular user groups, although personalisation would only be possible with a richer and more individual user profile. Reviewing previous literature has led us to consider the following open questions for discussion:

Stereotypes: it is unclear to what extent a standardised and generic set of user templates (i.e., stereotypes) for DCH can be developed. These would capture goals, information needs, behaviours, tasks and categories, and would aid in the provision of of digital cultural heritage services/systems, and aidcomparison across studies. It would be interesting to

Table 2: User categories mapped to domain and technical expertise, and motivation

	User category	Domain expertise	Technical expertise	Motivation
1	Casual user / Tourist / Informationalist / Enjoyer / General user [22], Surfers [49]	Low	Low	Curiosity / Learn non-captive
1	General public / Lay person [51]	Low	Low	Learn non-captive / plan visit (public)
1	Novice user [6, 52, 23]/Lay novice user [21]	Low	Low	Learn non-captive
1	General visitor [40]	Low	Low	Pleasure
1	Student k-16 [49]	Low	Low	Learn captive
2	Lay experienced users [21]	Low	Med	Learn non-captive
3	Lay experienced users [21]	Med	Low	Learn non-captive
3	Novice end user searchers [24]	Med	Low	Learn captive / work
4	Professional searchers [24]	Med	High	Work
4	Professional researchers [49]	Med	High	Work
4	LC Staff (Library of Congress) [49]	Med	High	Work
5	Teacher [48, 53]	High	Med	Learn captive / Plan visit (educational) / Work
5	Hobbyist [39, 26, 38, 49], Collectors [39, 38]	High	Med	Learn non-captive / Pleasure / Plan visit (professional)
5	Rummagers(browsers) [49]	High	Med	Learn captive / Pleasure / Plan visit (professional)
6	Expert [22], MIP [45], Scholars [49]	High	High	Work
7	Object Seekers [49]	Low - High	Low	Work
8	Teacher K-16 [49]	Med - High	Low - Med	Learn - captive / Work

determine to what extent there exist generic profiles, independent of specific collections, systems and situations. On the one hand, the stereotypical or archetypal user is helpful since it provides a fairly abstract user profile, with which to categorise users. However, such an approach is less helpful for other purposes, e.g. personalisation.

User dimensions: typically the users of digital cultural heritage systems are categorised with respect to some aspect of their job or role. However, if the purpose of modelling users is to tailor services or systems then other aspects of the user's context may better categorise types of user, such as technical ability and subject knowledge. Mapping users to dimensions beyond job or role may help to better model and contextualise them and it would be interesting to explore the use of various aspects of context as described in [16]. It is also unclear which dimensions are likely to form a minimum set and to what extent the dimensions should be task independent.

Scales of measurement: for each of the dimensions used to categorise users, some kind of measurement scale must be to quantify and situate users on the dimensions. In many cases the measurement is often binary (e.g., novice vs. expert), but a more fine-grained scale could be used (e.g., a 5-point scale) that better captures nuances of the user.

Purposes of study: the selection of categories and dimensions will typically reflect the purposes of categorising users. For example, if the purpose is to help users learn then the use of personal attributes, such as cognitive style, or strategy, may help with developing suitable support tailored to individual users' learning needs. For developing IR support, then modelling users' subject knowledge may be important (e.g., subject novices may require help with for-

mulating suitable queries or interpreting search results).

User prediction: one purpose of user modelling is to make predictions. It is therefore an open question to what extent we could predict categories of user and what forms of evidence could be used for this. For example, Zhang & Kamps [54] use features derived from transaction logs to predict users as novice vs. expert. It would be interesting to investigate what features could be derived for which dimensions to predict users.

General users: who are 'general' users? The literature suggests this can be anyone from a novice to a professional with anything in between, and it appears this group is used more as a catch-all category for a user who does not fit within into any other category.

User visits: given that users can take on differing roles each visit (e.g., in one visit they could be an expert; another a novice), then it may be more pertinent to characterise users on a per-visit basis. In practice, this may be modelled as more stable characteristics (e.g., demographics) compared to more visit-specific characteristics (e.g., particular tasks or information needs).

Sub-categories: often users are grouped into broad categories, such as general public. We would suggest that these should be refined and further sub-divided into sub-groups. For example, users identified as 'the general public' or 'non-experts' may be divided into more fine-grained categories common across services/systems. However, it is unclear what sub-categories should be created and how.

Value of digital cultural heritage: To date emphasis has been mainly placed on the information provider's per-

spective, and the delivery of cultural heritage content to the user, albeit with an increased sense of who the user is, and what their group and individual differences are. Can cultural heritage services begin to see things more from the users' point of view; and via greater understanding of the uses of cultural heritage, "negotiate" the delivery and creation of more value-added services? [1].

6. CONCLUSIONS

The purpose of this paper has been to review the relevant literature in order to identify the ways in which users of DCH systems and services have been categorised. We demonstrate that, despite the wide variety of labels and user types discussed in previous studies, a comparison of these has been possible, based on the criteria of domain expertise and technical skill. In conclusion, it may be better to consider categorising users by expertise, than by label or user type. Alternatively some combination of both, since this would potentially enable the delivery and creation of more value-added services. This paper contains an initial review of the literature, and a comparison of the labels used and user types identified within digital cultural heritage. Future plans include: conducting a broader review, in order to further substantiate our comparison, and from which a set of generic labels and user types can be developed.

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