Tagging, Folksonomy and Art Museums: Early Experiments and Ongoing Research

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Abstract

Tagging has proven attractive to art museums as a means of enhancing the indexing of on-line collections. This paper examines the state of the art in tagging within museums and introduces the steve.museum research project, and its study of tagging behaviour and the relationship of the resulting folksonomy to professionally created museum documentation. A variety of research questions are proposed and methods for answering them discussed. Experiments implemented in the steve.museum research collaboration are discussed, preliminary results suggested, and further work described.

Keywords: Tagging, folksonomy, art museums, vocabulary analysis, research agenda, user generated content

1. Introduction

This paper reviews current implementations of tagging in museums and in the context of research about access to art museum collections. The challenge of creating and organizing personal collections of networked information resources is not unique to the users of on-line art museum information. Others who actively use Web-based resources have developed tools to enable the creation of personal collections of ‘bookmarks’ or pointers to networked resources, that are described or ‘tagged’ with words that identify and categorize them (Golder & Huberman, 2005; Hammond et al., 2005; Lund et al., 2005; Mathes, 2004; Quintarelli, 2005) (Pennsylvania State University Library, 2005-). “Social
Tagging” is the public labeling or categorizing of resources in a shared environment. The resulting aggregation of tags form a “folksonomy”: a conflation of the worlds ‘folk’ and ‘taxonomy’ used to refer to an informal, organic assemblage of related terminology (Vander Wal, 2005). When shared with others, or viewed in the context of what others have tagged, these collections of resource identifiers, tags and people may take on additional value through network effects. It has been theorized that searching tags could enable the discovery of relevant resources, and the social relationships that develop among taggers become a means of information discovery in and of themselves (Marlow et al., 2006). Museums have been interested in social tagging, in part because of the success of tagging environments such as the ESPgame [http://www.espgame.org] (Ahn & Dabbish, 2004; Bearman & Trant, 2005).

2. The State of Research

2.1 Tagging, Folksonomy and Museums

A general survey of the social tagging and folksonomy literature (published separately) points to a number of ways that social tagging and folksonomy could enhance access to museum collections on-line. Preliminary studies within museums – discussed here in detail (section 2.1) – have framed issues in tagging and folksonomy within a museological context, and modeled methods for their exploration. These studies provide direct context for the research described in Section 3.

2.1.1 A Model of Tagging Works of Art

We have developed a model that positions tagging between users and objects (Figure 1), in contrast to museum documentation, which sits between museums and objects. When museums document objects they compile records according to internal standards and guidelines. Curatorial involvement ensures that works of art are researched and information is presented in a scholarly manner. A single, authoritative record is created describing the works of art, and this record represents the work in a collections database. However, when users tag works of art, they respond to
different aspects of it, often influenced by personal interests. Their tags may be highly idiosyncratic, or may overlap with those of other users.

Figure 1. Differing views on object documentation: while users tag from multiple perspectives, the museum documents from a single, institutional point of view.

Further study is needed to understand the differences between tags and museum documentation.

2.1.2 Enhancing Curatorial Documentation

User tags could provide additional points of view to that in existing museums records. Museum documentation is known to address works of art from a perspective different than that of the public. Within the context of art museums, user contributed tags might help reflect the breadth of approaches to works of art, and offer access to alternative points of view. Tags could offer another layer that supplements and complements the documentation provided by professional cataloguers. Proof-of-concept studies at The Metropolitan Museum of Art solicited tags for works of art, and showed the potential contribution that social tagging
might make to improving access to art collections, through an analysis of the contributed tags and their comparison to documentation created by the museum (Trant, 2006a). Curatorial staff may not be able to provide access points of relevance to the public. As a curator at The Metropolitan Museum of Art said, “everything I know is not in the picture” (Jenkins, 2006).

In a study of tags contributed during prototype steve.museum data collection, tags for works of art were compared to museum documentation, to explore the actual contributions made by naive users. Surprisingly large proportions (in one case > 90%) of tags represented terms not found in museum records. A comparison of tags assigned to the four most-tagged works in the steve.museum tagger prototype, with their documentation on the Web site of The Metropolitan Museum of Art, confirmed the distinction between public and professional vocabularies pointed to by the Proof of Concept studies (Trant, 2006b). For example, the subject matter of a work of art is often taken as given – unless it is problematic – as the work is assumed to be present and visible. [As a point of reference, genres of curatorial discourse are explored in the templates created for the Pachyderm project (Samis & Johnson, 2005).] When the role of these texts is changed from their original purpose of offering interpretation to the support of information retrieval, they may not be as effective. Social tagging seems a promising way to supplement museum records with terminology to support some kinds of queries, but a large scale, multi-museum study comparing tags and terms found in museum documentation is needed to determine this.

In a somewhat related study, van Hooland reports a content analysis of comments made about a digital collection in the National Archive of the Netherlands (~500,000 photographs a core of news photography). The study was premised on the idea that comments provided more value than simple tags: “as comments are not restrained to a chain of one-word descriptors, they can offer a higher semantic value and have more potential use for implementation within cultural heritage databases” (p. 4). Van Hooland uses what he calls Shatford's classifications (that is a combination of Panofsky's pre-iconography, iconography and iconology and a Ranganathan-inspired who, what, where, when) to characterise
queries, and user comments [also used by (Armitage & Enser, 1997)], to assist in evaluating the quality [his word] of user comments. Queries were collected from 5/4/2004 – 1/3/2006 (465,124 searches), and a sample (384) was analysed (confidence interval of 5% and confidence level of 95%). Distribution was: 57% iconography/where; 17.5% iconography/who; 9% pre-iconography/who; 8.5% pre-iconography/what; 5.5% iconography/what; 2.5% iconography/when. No queries were made for pre-iconography/where, pre-iconography/when, or any iconological (who/what/when/where) terms. User comments analysed were from a set of 4,647 comments from between April 4, 2004 and March 1 2006; a sample of 355 comments was selected (interval of 5% and level of 95%, but the interval was really too large for the size of some small categories). Comments broke down into “metadata corrections: 34.13%, storytelling: 18.87%, personal biography: 4.29%, image quality (accuracy): 3.14%, opinions/judgments: 2.86%, and queries/questions: 1.15% (p. 8-9) (van Hooland, 2006). While related, through its content analysis of user contributions, this study does not address questions of access per se. Nor does it provide insight into the possible role of tagging or folksonomy.

The Cleveland Museum of Art has been experimenting with tagging, soliciting terms with the invitation to “help others find this object” (Cleveland Museum of Art, 2005). They surfaced a distinction between user behaviour when commenting (in a large text box), and when tagging (in a small text box) (Chun et al., 2006). Any study of tagging must take care to distinguish it from user commenting.

User tags might help bridge the gap between professional and public discourse by providing a source of terms not in museum documentation (Trant, 2006b); empirical study of the nature of user tagging, and its comparison to documentation created in museums is needed to establish this.

2.1.3 Improved Access to Collections

User tags could enhance the number and kind of access points for works of art, and therefore improve recall through the presence of more index terms. The folksonomy derived from user tags might serve as another layer, augmenting existing
description and indexing tools, but not replacing them (Trant & Wyman, 2006). This broadens the scope of indexing vocabulary beyond that of professional cataloguers or indexers (Honigsbaum, 2005; Kipp, 2006a, 2007; Trant, 2006a, 2006b). This has certainly been the experience of the Library of Congress in their early experiments with the Commons on Flickr (Oates, 2008), echoed in that of the Powerhouse Museum (Chan, 2008a, 2008b) and was the motivation for tagging at the Philadelphia Museum of Art (Philadelphia Museum of Art, 2007) and Smithsonian Photography (Smithsonian Institution, 2006).

Searching based on tagging has been implemented in a number of on-line museum collections. The Powerhouse in Sydney is the best documented (Chan, 2006a, 2006b, 2007a, 2007b). Chan reports strong user participation in tagging and significant increases in use of the on-line public access catalogue. He also shows how tagging surfaced a popular object – a dress worn by Australian pop star Delta Goodrem – that had never been on display in the museum (Chan, 2007b). But the unique contribution of user contributed tags cannot be determined in this context, as a number of different system enhancements were deployed together, including tagging, the seeding of indexes with terms derived from collection documentation, and the creation of a Web of related objects derived from co-occurrence of index terms. Most recently, the Powerhouse has been experimenting with machine-generated tags, using Open Calais (Chan, 2008c), further exploring hybrid solutions to improved access to collections.

The relationship between user tags and searches of art museum collections remains un-determined. A preliminary study of art museum searching showed a broad range of searches, many of which were unsuccessful (Trant, 2006c). But the concordance between tagging and collections description has not been established. Larger comparisons of search terms to tags assigned to a broader range of objects from multiple museums are necessary to determine how user tags relate to searching of museum collections, and identify if including tags in search indexes might offer improved results. The relationship of user-assigned tags to user-provided search terms that produced no results when searching the same art collections would be of particular interest.
2.1.4 Understanding Audiences and Building Community

New perspectives in museum documentation might engage new communities of users and improve museums’ understanding of them. For example, specialist design and textile historians provided user descriptions of swatches in a series of electronic swatchbooks of fabrics in the collection of the Powerhouse Museum (Powerhouse Museum & Chan, 2005), both making this previously inaccessible content searchable, and supporting their specific uses of it. Tagging and folksonomy may also offer new ways for museums to engage user communities and assist them in their use of collections (Coldicutt & Streten, 2005). This could be the general public tagging works in the Powerhouse Collection (Chan, 2007b) or 19th century scholars as part of The NINES Consortium (2005). They could be geographically connected, as in the Taggin’ Tallinn project (Kaipainen & Pata, 2007). Or they could be in the context of a game, as at the McCord Museum of Canadian History (McCord Museum, 2007), or personal collections, as with Collection X at the Art Gallery of Ontario (Art Gallery of Ontario, 2007; Rubenzahl et al., 2008).

Krystyna (2006) looks at examples of social classification (primarily Flickr) as models of the ways that user generated tags could encourage user involvement with digital image collections. Museums might take advantage of the subjective nature of tags, particularly when tags become annotations, like they do in the PennTags application, an academic social bookmarking (annotation) tool for use on the Penn State campus (Pennsylvania State University Library, 2005–). Museum-related entries in tag-driven environments like Flickr (2006) and del.icio.us (2006), provide another window into audience interests, behaviours and attitudes that might help further understanding of how the museum and its collections are perceived. But the public tagging of museum content in Flickr and del.icio.us is now quite extensive, and difficult to sample and study.

The relationship between user tags and museum education and interpretation also remains to be established. Kellogg Smith (2006) tries to analyse on-line tagging from a frame of in-gallery visitor studies, confusing the goals and purposes of on-line information access and in-museum art education.
Tagging needs to be approached with a robust model of the museum, its social and educational objectives, and its many types of interactions with users. The tagging activity needs to be positioned within a context of on-line information retrieval and use, and distinguished from possible studies of in-gallery applications.

Tagging is a highly personal activity (Golder & Huberman, 2005). Tags exist in a liminal space between a user and an information resource, and as such represent a critical facet of personal meaning-making. The subjective nature of tagging might reveal something of how art collections are perceived by a broad public. As there are few tools to directly gather this kind of feedback from museum visitors, the social side of social tagging merits exploration within the context of other museum-based community development and user-contributed content initiatives (Trant & Wyman, 2006). As museums strive to be more relevant to their communities, comparison of results obtained by different methods of encouraging engagement with collections should be systematically analysed. Studies of tagging behaviour could make a contribution here.

As these preliminary studies show, there are many outstanding questions about how social tagging and folksonomy might function in the museum context. Further research is dependent upon developing a basic understanding of how users tag works of art, the kinds of terminology they use, and how that relates to documentation created in museums.

3. A Research Question: Can Social Tagging and Folksonomy Improve On-line Access to Art Museum Collections?

While early studies point to the possibilities, a number of outstanding questions remain. Understanding the contribution that social tagging and folksonomy might make to on-line access to art museum collections requires a empirical study of real tags applied to different works of art by a broad range of users: i.e. a larger, longer duration study than the prototypes mentioned, that involves multiple museums, and gathers thousand of tags from a large number of users over many months.
This section proposes methods to address a set of related research questions, each of which contributes to an understanding of the broader contribution of social tagging and folksonomy to on-line access to art museum collections. Three of these narrower questions are tag-related, and one relates to the social tagging system environment:

Tag-Related Questions:
- **Do user tags differ from terms in professional museum documentation? If so, how?**
  If user tags differ from terms in professional museum documentation they can be said to provide additional access points and thus improve recall when collections are searched.
- **Do museum staff find user tags useful for searching art collections?**
  The usefulness of user tags for searching – i.e. the ability of naïve users to provide helpful descriptions – has been called into question by professionals. If museum staff review tags assigned to works of art, and find them useful for searching, this criticism of user tagging can be addressed.
- **Do user tags correspond to terms used to search on-line art museum collections, i.e. could their presence in indices improve retrieval?**
  It has been widely hypothesized in the tagging literature that tags will improve searching. This assertion can be tested by comparing tags to the terms used to search museum collections. If the tags and search terms match, then tagging could improve searching. How much tagging could improve searching cannot be established without also comparing search terms to museum documentation. The match between search terms and museum documentation reflects the status quo. Any increase in matching when tags are introduced can be considered an improvement.

Tagging Environment Question:
- **Does the tagging interface influence tags assigned?**
  The literature on vocabulary normalization suggests that variations in the tagging interface might influence the tags assigned. Museums interested in maximizing the utility of tags for searching might wish to tailor interfaces for certain circumstances

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(to produce more, varied tags for instance, rather than to validate particular tags already assigned).
A series of controlled interfaces to the tagging software makes it possible to test the effect of simple variations.

A pragmatic approach to this research is proposed, employing a variety of methods to describe the tags collected, compare them to documentation created for works of art, review them in conjunction with museum staff, compare tags with evidence of searching (found in search logs), and compare tags assigned across interfaces.

3.1 Introducing steve.museum

The rest of this paper reports on how these research questions are being addressed within the steve.museum collaboration. Steve.museum is a group of art museums (and the professionals who support them) formed in 2006 to explore the role user-contributed descriptions can play in improving on-line access to works of art. Participants include: Denver Art Museum; Guggenheim Museum; The Cleveland Museum of Art; Indianapolis Museum of Art; Los Angeles County Museum of Art; The Metropolitan Museum of Art; Minneapolis Institute of Arts; The Rubin Museum of Art; San Francisco Museum of Modern Art, Archives & Museum Informatics; and Think Design (Bearman & Trant, 2005; Chun et al., 2006; Trant et al., 2007; Trant & Wyman, 2006). The group is funded in part by the U.S. Institute of Museum and Library Services through a National Leadership Grant that runs from October 2006 through September 2008 (The Metropolitan Museum of Art et al., 2006).

Linking the research proposed here with the activities of steve.museum also satisfies Markey’s recommendation for ‘real world’ studies (Markey, 2007).

3.1.1 Test collection for tagging

Any study of tagging art museum collections requires a test collection of digital representations of museum objects that can be made available for users to tag. In order to be reflective of the actual documentation available in art museums, such a collection should be drawn from readily
accessible, existing digital materials, created and used by art museums. The data set for tagging should not be artificially created. New documentation should not be compiled for this research. Nor should new digitization take place.

Images used for the study should be gathered from existing collections, and be of the size and resolution that museum professionals have actually made available, or are comfortable releasing freely on the Web for broad use. They should be captured according to procedures in-use in participating museums. Textual documentation should reflect standards in-place, and content readily available. New research should not be conducted in order to improve museum documentation prior to release of works for tagging. In this way, the information about works of art encountered in an experimental tagging environment will be representative of that encountered on a museum Web site.

A limited range of subject matter is important in order to limit the number of variables at play in a tagging study. Tagging of art museum collections might differ from tagging of other kinds of museum collections. However, there is already a large range of variation in the informational content of different kinds of works of art. Prototypical tests (reported in Trant, 2006a) showed that tagging activity differed depending on the type of work presented – e.g. a medieval manuscript vs. an Impressionist painting – so the test collection should include a broad range of works, and strive to avoid over-concentration in particular areas (beyond what is reflective of art museum collections generally).

But if all the works presented to tag could be said to belong to the same ‘discipline’, then this defined subject scope will facilitate analysis. For example, discipline-specific content standards, such as the Categories for the Description of Works of Art (Art Information Task Force (AITF), 1995; Baca & Harpring, 2006), and vocabulary sources, such as the Art and Architecture Thesaurus (J. Paul Getty Trust, 2000a) and the Union List of Artists’ Names (ULAN) (J. Paul Getty Trust, 2000b) could be used as benchmarks of professional vocabulary. For the purposes of this study, it is assumed that the language of the
documentation and tagging will be English, though some specialist terminology of foreign derivation, such as “chiaroscuro” is likely to be present.

Steve.museum has assembled a test set of works of 1,784 works of art, with contributions from all participating museums, and a number of interested, but less active museums. The breakdown between institutions is shown in Table 1.

![Table 1. Final number of works in the steve.museum test data set, by institution](image)

<table>
<thead>
<tr>
<th>Institution</th>
<th>count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston Museum of Fine Arts</td>
<td>237</td>
</tr>
<tr>
<td>Cleveland Museum of Art</td>
<td>117</td>
</tr>
<tr>
<td>Denver Art Museum</td>
<td>20</td>
</tr>
<tr>
<td>Indianapolis Museum of Art</td>
<td>250</td>
</tr>
<tr>
<td>Los Angeles County Museum of Art</td>
<td>191</td>
</tr>
<tr>
<td>The Metropolitan Museum of Art</td>
<td>251</td>
</tr>
<tr>
<td>Minneapolis Institute of Arts</td>
<td>249</td>
</tr>
<tr>
<td>Rubin</td>
<td>111</td>
</tr>
<tr>
<td>San Francisco Museum of Modern Art</td>
<td>161</td>
</tr>
<tr>
<td>Skirball</td>
<td>153</td>
</tr>
<tr>
<td>Tate Modern</td>
<td>50</td>
</tr>
</tbody>
</table>

3.1.2 Tagging environment

To enable broad tagging of these works of art, a tagging tool – or tagger – needs to be made available on the Web, and the tags recorded in a structured way. Steve.museum has created an open source tagging tool, available at http://tagger.steve.museum, and downloadable from sourceforge.net. The tagger tracks detailed data about registered and anonymous taggers and the tags they assign, linking tags both to works and to the system environment in which they were given. Data is recorded in a MySql database, and is readily available for analysis. See Figure 2 for a simplified schematic of the data structure.
3.1.3 Recruiting taggers

Taggers need to be recruited from the broad Internet community, and asked to tag works of art. Within steve.museum, taggers have been recruited through general museum electronic mailing list requests (e.g. MUSEUM-L), subject-specific lists (such as H-ArtHistory and CAAH), the popular press (including coverage in The New York Times (Pink, 2005); (O’Connell, 2007) and local press in cities like Indianapolis (Elig, 2007)), blog postings (149 tracked to the end of March 2008), and volunteer requests on craigslist.org.

This varied strategy has been successful. Between March 2007 and March 2008, 931 users have registered at tagger.steve.museum and there have been an additional 3,949 sessions by unregistered / anonymous users. A large volume of terms has been entered: 42,622; 25,182 from registered users and 17,256 from unregistered users [these figures are as of March 27, 2008 and will change].

3.1.4 Search log data available

The literature of tagging assumes that tags assigned are similar to the terms used to search. However, this has not been proven. A comparison of tags assigned to works of art and the terms used to search for them in on-line museum catalogues should help answer this question. A sample of search log data from some of the same museums that provided the test works of art for tagging is required to conduct this analysis.
To date, steve.museum has assembled search log data from the Guggenheim Museum, The Metropolitan Museum of Art, the Minneapolis Institute of Arts and San Francisco Museum of Modern Art as outlined in Table 2.

<table>
<thead>
<tr>
<th>Museum</th>
<th>Start Date</th>
<th>End Date</th>
<th>No. of Searches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guggenheim Museum</td>
<td>01-Sep-05</td>
<td>31-Aug-06</td>
<td>126,999</td>
</tr>
<tr>
<td>The Metropolitan Museum of Art</td>
<td>02-Aug-05</td>
<td>19-Mar-06</td>
<td>2,514,063</td>
</tr>
<tr>
<td>Minneapolis Institute of Arts</td>
<td>01-Sep-05</td>
<td>31-Aug-06</td>
<td>251,918</td>
</tr>
<tr>
<td>San Francisco Museum of Modern Art</td>
<td>01-Jan-04</td>
<td>31-Dec-05</td>
<td>151,102</td>
</tr>
</tbody>
</table>

*top 10,000 search terms for each year

Table 2. Search log data available as of March 2008 from steve.museum participants

For each museum, the date and time of the search, and term searched is available. Only the Guggenheim reports whether the search was successful. While search volume varies (as some museums’ catalogues are searched more than others), breadth of coverage and a similar representation of institutions are important. It is not going to be possible, however, to include log data from all museums that contribute works to be tagged, as not all at museums have searchable databases of their collections on-line.

3.1.5 Museum collaboration

The close involvement of museum staff in the research ensures access to documentation, images of works from museum collections, and logs of searches made of museum Web sites. In addition, assessment of the contribution of tags requires museum input. As many barriers to change in institutions are cultural, museum staff involvement is essential to assess cultural barriers to the inclusion of user-contributed index terms in museum on-line documentation. Museum staff involvement also helps place the research in an appropriate museological content.

3.2 Tag-Related Questions

The first set of research questions about the role of tagging and folksonomy in enabling access to art museum collections can be answered by studying the tags assigned to the test collection of works of art. Tags will be compared to documentation of works of art to see if they add new terms (or represent new concepts), in a multi-faceted
analysis of tag vocabulary. Tags will be compared to search terms to see if their presence in indexes would have improved the results of simple searches of on-line collections - in a quantitative assessment of their contribution. Tags will be reviewed by museum professionals to see if they accurately reflect the work of art - a qualitative judgment of their efficacy. The results of all these reviews will be compared, quantitatively, to see if there are areas where tagging makes a particular contribution. Each of these studies is discussed in more detail below.

3.2.1 Do user tags differ from museum documentation?

User-supplied tags may differ from museum documentation. The reflection of a different point of view - of the individual perspective of the tagger rather than the institutional perspective of the museum - is hypothesized to be one of the critical contributions of social tagging in the museum context (Chun et al., 2006). But this can only be established with a broad study of tags assigned to works of art. Prototypical tests at The Metropolitan Museum of Art (reported in Trant, 2006a) defined a methodology for establishing the contribution of tagging to the description of works of art. Tags collected from a range of users for a number of works were compared to museum documentation for those same works. Analysis of data gathered in this prototype showed a strong difference between user tags and curatorial documentation (Chun et al., 2006; Trant, 2006a; Trant & Wyman, 2006). This approach to tag analysis is also used by Kipp in her studies comparing user tags with professionally created metadata (Kipp, 2006a, 2006b).

Tags assigned to all works will be described in basic descriptive statistics, by calculating and plotting a range of characteristics shown in Table 3, including the total number of tags assigned for each work, the total number of distinct tags, the number of taggers, and the number of tags per tagger (high, low, average [mean] and standard deviation [to show the range in tagging activity]). Tagger Velocity (the number of tags per tagger assigned per work) and Tag Variation (the diversity of tags assigned per work) will be compared across object type.
Tags will then be compared to the documentation supplied by museums, listed in Table 4 and chosen because of its ready availability and its use for in deployed on-line search systems.

![Table 3. Simple descriptive statistics profile the number of tags assigned to each work.](image)

<table>
<thead>
<tr>
<th>Total tags</th>
<th>Distinct total</th>
<th>High</th>
<th>Low</th>
<th>Average</th>
<th>Std dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>all works</td>
<td>work 1</td>
<td>work 2</td>
<td>work 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. steve.museum Guidelines. Documentation for works of art submitted to be tagged was requested from participating museums in a format comparable to that of CDWA lite. A simple CSV format was used for

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data transfer, and files were accompanied by a digital image file (1024 x 768 pixels) for each work.

Searching in museum on-line catalogues is supported on basic data fields, often prosaically referred to as ‘tombstone data’, that are likely to be present for most works.

- Artist (nationality birthdate-deathdate)
- Title, date
- medium, support
- dimensions
- Acquisition details (accession number).

These are the data that are commonly used to identify and describe the work of art inside the museum, and are presented on in-gallery labels ("label copy"). This data is present for all works in the steve.museum data set. Extended Curatorial Notes may or may not be available.

The first comparison between tags and museum object data will be a simple truncated character-string compare, with all data shifted into lower case. Table 5 shows a subset of the terms that match the example given in Table 4 above).

<table>
<thead>
<tr>
<th>Count of term_id</th>
<th>TermInObjectData</th>
<th>term</th>
<th>Total</th>
<th>Unique</th>
</tr>
</thead>
<tbody>
<tr>
<td>filename_orig</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>sea</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ship</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>winslow homer</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>see</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>painting</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
<td>dramatic</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>nature</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>boat</td>
<td>52</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>storm</td>
<td>45</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>sharks</td>
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<td></td>
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<td></td>
<td>ocean</td>
<td>24</td>
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<td></td>
<td>blue</td>
<td>15</td>
<td></td>
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<td></td>
<td>waves</td>
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<td></td>
<td>water</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>shark</td>
<td>8</td>
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<td>fisherman</td>
<td>8</td>
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<td>seascape</td>
<td>6</td>
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<td></td>
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<tr>
<td></td>
<td>men</td>
<td>5</td>
<td></td>
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<td></td>
<td>danger</td>
<td>4</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>tornado</td>
<td>3</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>mussle</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Tags and Museum Documentation: Prototype data analysis

This simple match will be employed because it reflects the way in which the majority of museum catalogues are searched on-line: single term is entered, and matched against a keyword index. The results of this matching will identify -
at a basic level – if tagging contributes new terms and where it duplicates museum documentation (Figure 3).

In preliminary analyses (through March 2008) about 70% of tags do not match any part of museum documentation.

Results will be presented as a percentage. In prototype tests, between 86.9% and 92.4% of tags where not found in museum documentation (Trant, 2006b); the overlap between the two data sets was very small. Results of the larger test will be compared to those of the prototype analysis, and to those from other studies (such Kipp’s) that compare tagging vocabulary to professional cataloguing.

In addition, a sample of works will be studied in more detail, using qualitative methods. A sub-set of 50 highly tagged works will be selected at random from the broader steve.museum experimental tag data set. This selection will be balanced to reflect different object types and time periods.

The frequency with which tags were assigned to this sub-set of works will be studied in further depth. Tag frequencies will be calculated and plotted for each work in this sample, as shown in Figure 4. A Zipf distribution with a long tail is expected (the tail is cropped on this graph), showing a strong inter-tagger agreement on a small number of terms, with a long tail of divergence. This inter-tagger agreement is evidence of vocabulary stabilization, one of the characteristics of all tagging systems. This curve will be compared across works, to see if there is more agreement on particular kinds of works.
Figure 4. Terms assigned to the fourth most tagged object in the steve tagger prototype: Pieter Bruegel the Elder (Netherlandish, active by 1551, died 1569) The Harvesters, 1565. The Metropolitan Museum of Art, New York, Rogers Fund, 1919 (19.164) (First published in Trant, 2006b).

The relationship between frequently assigned tags and presence in museum documentation will be explored. Are the most commonly occurring tags redundant? Or do common tags represent new terminology not found in museum documentation? This analysis will add to our understanding of the contribution of tagging. For example, if, as is the case in Figure 4 above, many of the more common terms are not found in museum documentation, then the contribution of tagging may be more immediately noticeable than if the new terms were predominantly found in the ‘long tail’.

A smaller sample will also make it possible to explore some of the criticisms of folksonomy in the information retrieval focused literature (for example Spiteri, 2007). Tags will be reviewed on a work-by-work basis to identify the presence of:

- Synonomy (multiple words for the same concept)
- Polysemy or Homography (use of same word for different meanings)
- Orthography (spelling and multi-word concatenation conventions, use of the singular or plural; homophones; variations in part of speech)
- Ambiguity (uncertain meaning)
• Hierarchy (inconsistent granularity in concept identification)

By studying the set of tags assigned to a smaller group of works it will be possible to determine how widespread these problems are. The impact of this analysis on the results of matching against museum documentation will also be assessed. For example, identifying the presence of synonyms and variations in orthography will determine if tags often represent alternative forms of terminology already present in the museum documentation.

Nuance could be added by further studying tags that are – or are not – represented in museum documentation for this subset of works. Tags that are represented in museum documentation could be profiled based on the part of the museum record where they were found. For example, it could be established if users do or do not offer tags related to the major AITF Categories (Baca & Harpring, 2006), such as Creator, Nationality, Object Type, Date, or Subject Matter. This parallels the methods of the Catechism project and the CIMI Access Points work (Janney & Sledge, 1995a, 1995b; McCorry & Morrison, 1993, 1995; Sledge, 1995).

Tags could also be compared to common vocabulary sources, such as the Art and Architecture Thesaurus (AAT) (J. Paul Getty Trust, 2000a) and the Union List of Artists Names (ULAN) (J. Paul Getty Trust, 2000b) to identify if they reflect the professional vocabulary of the museum or a different vernacular vocabulary of the user. AAT hierarchies could be noted, and compared to the AITF/CDWA category analysis.

Visualizations will be developed to illustrate interrelationships between these analyses and compare results across type of work and time period. For example, when frequency of use of a tag is plotted with its relation to museum documentation it is possible to see whether popular tags are also new tags. Figure 5 shows an example from prototype data analysis, with blue terms representing tags that were also found in the museum documentation. When compared with the curve on Figure 4 above, we can see from prototype data that some works attract more terms, and that the distribution of terms that match museum documentation is
not identical. It may be possible to determine patterns in a larger study with more tags and more works.

Figure 5. Terms assigned to the second most tagged object in the steve tagger prototype: John Singer Sargent (1856–1925), Madame X (Madame Pierre Gautreau), 1883–84, Oil on canvas; 82 1/8 x 43 1/4 in. (208.6 x 109.9 cm), The Metropolitan Museum of Art, New York, Arthur Hoppock Hearn Fund, 1916 (16.53). Overlap between tags and museum documentation are terms shown in blue. (First published in Trant, 2006b).

3.2.2 Do museum professional staff find folksonomic terminology useful?

Skepticism exists in the professional cataloguing community about the value of social tagging. In a survey of attitudes conducted within steve.museum, one respondent noted: “if well managed, this could be useful. if not, utter chaos” (Trant et al., 2007). In order to establish if user-contributed tags are relevant to the work of art tagged, tags need to be reviewed by professional museum staff and compared to the works of art themselves. Tag by tag review is the only way to establish whether – in the minds of the museum staff responsible for implementing on-line access to collections – tagging could improve searching.
Using a method similar to that of Von Ahn and Dabbish (2004), museum staff will review all tags collected in the experimental data set and assess whether they would find the term helpful in finding the work. They will be asked to consider the question:

*if you found this work using this term in a query, would you be surprised?*

If you are not surprised, then the term can be considered useful. If you are surprised, then the term would be flagged as not useful.

Reviews are taking place at each of the museums, conducted by one or more people (depending on available staff and resources). The circumstances of the review is documented in a questionnaire. Each museum group will review all tags assigned to works from their collection according to common guidelines (steve.museum, 2007 / 2008).

Results of the review are being collected using an on-line tool. Museum staff can approach the review either from a display of works that have been tagged (which shows the number of unique terms assigned and reviewed for each work) or from a display of terms assigned (which then displays the works which have been tagged with that term). They then see an image of the work of art, and a list of the terms assigned to it (Figure 6).
Museum staff are indicating – based on the above question – whether the tags could be *Useful* or *Not-Useful*.

In addition, based on discussions of the steve project team, nuance has been built into the review of tags. They may be optionally identified as *judgmental*, representing a personal assessment of the work in a *positive* or *negative* way, e.g. “fantastic” or “ugly”; as the result of a *mis-perception*, e.g. a mis-identification of iconography; as a *misspelling* or *typo*, e.g. “gilrs”; as a reflection of a *personal point of view* or category that the museum can’t judge, e.g. “mg2x”; and as a *foreign language* term, e.g. “vert”. With this input, it will be possible to determine not only the utility of tags assigned to works of art – as seen from the perspective of a museum staff person – but to qualify the places where tags might be seen to be not useful. The goal here is not censorship, but to develop understanding of the nature of tags and the role they could play in improving accessibility of on-line collections.

The results of this qualitative review will be analysed quantitatively, and summarized in a number of ways. Raw numbers and percentages of tags found *Useful* and *Not-Useful* will be presented. *Not-Useful* tags will be described with a...
breakdown of the reasons tags where seen as Not-Useful (in percentages and with examples discussed). The Not-Useful list will also be supplemented with the tags that matched the blacklist in place in the tag-collection environment. This will ensure we have a comprehensive number of spurious, malicious or obscene tags identified, and can then assess the risk of misbehaviour in this kind of environment. So far, this is minimal: of the 42,622 tags collected to the end of March, 2008, 26 matched the blacklist.

Finally, tags seen as Useful and Not-Useful will be compared to the Found in Museum Documentation analysis. Are any terms found in museum documentation judged “not useful”? Why?

The assessment of terms by museum staff may not be fully consistent across institutions. The overall results of each institution will be profiled to see if some groups were ‘harder’ in their assessments of usefulness than others. If necessary, institutional results could be weighted, but some difference between museums is to be expected, given their distinct corporate cultures.

This qualitative analysis is designed to address museum-based concerns about the appropriateness of tags assigned by the general public, and contribute to understanding the contribution of tagging.

3.2.3 Could tagging improve on-line searching of works of art?

The third tag-based study examines whether tags might improve searching: would including tagging terms in indexes improve search results? It may be possible to get better results when searching on-line for works of art, if folksonomic terminology was included in search systems. To determine this, search terms (gathered from logs of searches of museum Web sites) will be compared to tags to determine if there is an overlap from between terms assigned when tagging and terms used when searching (Figure 7).
Figure 7. What are the relationships between the terms used for searching (found in logs), the tags assigned to works of art, and the words in museum documentation?

A preliminary study of art museum search logs has been conducted; this method draws upon that experience (Trant, 2006c). Search logs have been collected from the same museums that supplied works of art for tagging and museum documentation for comparative analysis as described above in section 3.1.4.

The prototype analysis showed that searching of a contemporary museum collection may have some particular characteristics, including a strong reliance on artists’ names. However, it is not known if these are shared with other types of art museums. Search log data will be described by institution: time period, number of searches, number of distinct terms, and number of searches per term. If necessary, frequency of search will be weighted by institution, and calculated as the number of times a term was searched divided by the number of searches of that institution. This weighting would ensure that the large number of searches from The Metropolitan Museum of Art does not skew the results. Other weightings, or samplings might be necessary to ensure parity between these data sets before comparison takes place.
The tags assigned to the test collection will be compared to the terms used to search on-line collections (recorded in the logs). Again, because most on-line collections catalogues use simple, truncated, character-string matching, the comparison will be made by matching lower-case character-strings, truncated at the end. Punctuation will be removed.

A high degree of overlap between tags assigned and search terms will indicate that tags could be useful for searching collections. A low degree of overlap will question whether the same terms are used to search as tag. Nuance in the analysis could come from seeing if tags match search terms that are used more or less frequently.

The results of the comparison of search terms to tags will be compared with results of the previous two analyses, comparing tags to museum documentation and assessing their usefulness:

• Were search terms also in museum documentation (in which case more effective indexing could be a solution, as well as tagging)?
• What percentage of search terms was only in museum documentation and not in tags, i.e. what percentage of searches could only be met by professional cataloguing?
• What percentage of search terms was in both tags and documentation, i.e. how redundant was tagging to professional documentation?
• Were search terms that were also tags found to be 'useful' in museum review? If not, can a reason be determined for the difference between museum attitudes to utility, and public assertions of interest (as reflected in their search terms)? It is possible, for example, that misspellings will be judged as not useful, but be found in search terms.

It is likely that some Search Terms will not be found in either Museum Documentation or Tags. But, because the universe of museum documentation is not complete in this study, we cannot make any inferences about search terms that do not match tags or museum documentation.
3.2.4 Summary: Tag-Related Questions

Study of multiple aspects of the relationship between tags, searches, and museum documentation is necessary to determine how the parts inter-relate (Figure 8). Studies of the tags assigned make it possible to determine if tags add to the professional documentation of works of art, answering the question “Do user tags differ from terms in professional museum documentation?” A study of the kinds of tags assigned helps provide further detail. An tag-by-tag review by museum staff will answer the question “Do museum staff find user tags useful for searching art collections?”, and establish if the contribution of the public can improve on-line searching. A comparison of tags assigned to searches of on-line collections, can answer the question, “Do user tags differ from terms used to search on-line art museum collections?”. If there is correspondence between tags and search terms, and those tags that match search terms are not found in museum documentation, then their presence could improve retrieval.

Figure 8. Studying social tagging and folksonomy in art museums: Interactions between Users, Tags, Tagging Environments and Institutional Perspectives
3.3 Tagging Environment Questions

User interfaces differ in popular tagging tools, such as Flickr and del.icio.us. Before decisions can be made about deploying tagging on museum sites, the impact of interface variables on tagger behaviour should be established. The steve.museum research project is also exploring the questions: How does the tagging interface influence tags assigned? (Trant et al., 2007)

The literature of vocabulary evolution (see the author’s separate study of folksonomy research) suggests that variations in the tagging interface should influence tagging behaviour and the tags assigned. As a number of different user tagging scenarios can be envisioned, understanding the variables at play in an art museum tagger would increase the likelihood of a successful implementation. For example, if a museum’s goal was to collect as many tags as possible for a work of art, then reducing factors that might limit the number of tags assigned would be important. But if an institution would like to gather new terms, then an environment that reduces tag redundancy would be more desirable. This section explores three questions:

• What are the interface variables at play in tagging systems?
• How does the tagger interface influence tagging (as shown by tags assigned)?
• What interface characteristics facilitate certain kinds tagging?

A series of experimental interfaces to the steve tagger will be deployed, each with the same content to be tagged (as outlined in section 3.1.1 above). In discussion the steve team agreed that the most basic interface variables related to whether or not the tagger had seen museum metadata or other tags (Cataloguing by Crowd Working Group & Bearman, 2005). It might also be useful to explore how showing groups of works or allowing users to choosing works to tag effects tagging (these concepts are explored in Trant et al., 2007). Each collection of variables could be considered a tagging environment.
The following interfaces are being tested in the steve.museum tagging experiments, and will provide data for analysis in this study. Test interfaces show:

- No Tags, No Metadata
- Metadata Only
- Tags Only
- Metadata and Tags

Tags assigned by users are linked to a record of environment variables, so that it is possible to analyze accumulated tag data on a per-environment basis and determine the influences, if any, of seeing metadata and existing tags on users’ tagging behaviour.

The analyses of the influence of interface take advantage of the tag analyses discussed previously, particularly measures of tagger velocity (the number of tags per work), tag variation (the range of tags per work), correspondence with museum documentation, and usefulness as judged by museum review.

3.3.1 No Tags, No Metadata

The simplest environment, one that could be considered a baseline against which to measure others, would be a simple configuration, showing only an image of a work and a box to collect tags (Figure 9). No other data is shown on the screen.
Figure 9. steve tagger: Do users tag differently when they don’t see others' tags or museum metadata?

3.3.2 Metadata Only

The second test environment (Figure 10) shows only museum-supplied metadata. Does the display of museum documentation for a work of art influence the tags assigned? Do users mimic a museum label, or do they contribute new, different tags? An environment that adds museum metadata, formatted as ‘traditional label copy’ to the tagger interface, enables comparison of tags assigned to the same work with and without metadata showing.
Questions that can be answered by studying tags assigned in this interface include:

- Do users duplicate museum documentation in their tags? Are more tags assigned in the ‘show metadata’ environment found in museum documentation?
- Inversely, are users prompted to contribute new tags when museum documentation is shown? (Fewer tags assigned in the ‘show metadata’ environment are found in museum documentation.)
- Are more useful tags assigned when museum documentation is shown?
3.3.3 Tags Only

Does user behaviour change when they see the tags that others assign? We can hypothesize two possibilities: that users mimic what is presented to them, or that they strive to be different. Understanding this is critical to future deployments of tagging on museum sites, particularly if statistical thresholding is considered as a way of assessing tags contributed. If a tag is considered useful after it has been assigned $n$ times, then an interface that impedes the assignment of tags perturbs this equation.

An experimental interface that shows tags previously assigned (Figure 11) makes it possible to assess if user tagging is encouraged, dissuaded or otherwise influenced by the presence or absence of pre-existing tags for works of art.
Questions that can be answered by studying tags assigned in this interface include:

- Do users assign different tags when they are shown tags assigned by others?
- Do users assign tags that are not in museum documentation when they are shown others tags? Does this differ from when they are not shown tags or metadata?
- Do users assign more useful tags when they are shown tags assigned by others?
- Do users mimic what others have already said (enter duplicate tags) when they can see others’ tags?

3.3.4 Metadata and Tags

Exploring the relationships between user-supplied tags, and the presence or absence of museum metadata and others’ tags raises questions about interaction effects between metadata and tags. Do tags vary when both museum metadata and user supplied tags are shown (Figure 12)? Users might just ‘give up’ at this point, thinking there was nothing else to say. It might also be possible that that tags contributed in this environment might be the most useful, as they may add the most to the description of the work of art.
Questions that can be answered by studying tags assigned in this interface include:

- Does the volume of tags decrease when users are shown both museum metadata and other’s tags?
- Do users assign different tags when they are shown tags assigned by others and museum metadata?
- Do users assign unique tags that are not in others tags or in museum documentation when they are shown both? Does this differ from when they are not shown tags or metadata or only shown one or the other?
- Do users assign more useful tags when they are shown tags assigned by others and metadata from the museum?
- Do users mimic what others have already said (enter duplicate tags) when they can see others’ tags? Are the tags entered already in the tag set?
3.3.5 Works In Sets

One final scenario for deploying tagging (Cataloguing by Crowd Working Group & Trant, 2005) envisioned users volunteering to tag works of art as their contribution to a museum. Here, creating an environment that effectively stimulates tagging would be important. It may be likely that users ‘get in the groove’ when tagging similar works, and that their tagging of sets of like-works might be more useful than tags assigned to randomly presented, diverse works (as in Figure 13). Grouping works in sets by medium - providing some continuity between one work and the next and preventing the jarring sense of seeing a non-representational contemporary painting right after a classical sculpture - would test this hypotheses.

*Figure 13. steve tagger: show sets Does users 'get in the groove' when they tag groups of like works?*

Questions that can be answered by studying tags assigned in this interface include:
• Are more tags assigned when users are shown works in sets?
• Are more useful tags assigned when users are shown works in sets?
• Are users more likely to return for subsequent tagging sessions when they are shown works in sets?

3.3.5.1 Summary: Interface-Related Questions

Understanding the influence of the data shown to a tagger on the tags assigned is critical prior to implementing tagging on museum Web sites. Testing these simple variables – whether or not users see others’ tags, and the museum’s metadata – will provide insight into how live tagging environments might be optimized for particular effect.

There are many other choices to make when deploying a tagging system, including those around requiring user-registration, enabling user profiles and personal collections, including just one institution’s works or many institutions’ works, and using gaming or description metaphors. All of these build on the basic research questions outlined here.

3.4 User Affiliation Question

Motivations for tagging are often unclear. While the literature of tagging and folksonomy points initially to a selfish motivation for personal information management, the members of the steve.museum team have posited another, more altruistic motivation for tagging museum collections. People may just want to “help out” museums (Trant & Wyman, 2006). As well as distributing questionnaires to taggers to ask them about their motivations for tagging, we are testing the relationship of institutional ties to tagger activity.

The steve tagger has been implemented in two separate instances. The first, as described previously, is presents a collection of works drawn from a range of museums. It is branded with the name of the research project. Recruiting is being done broadly, and relatively anonymously.

A second instance of the steve tagger has been launched by The Metropolitan Museum of Art. It presents only works from
The Met’s collection, and access is by personal invitation only. Invitations are being distributed to people who have registered on the MMA’s site, or purchased something in their gift shop.

The differences in tagger behaviour in these two implementations – and differences in questionnaire responses from those who tagged in each context – may provide some insight into taggers’ motivations.

3.5 Future Studies

The dataset collected by steve.museum could provide material for many further studies. One, in planning now, is to look at the relationships between tagging vocabulary and the vocabularies of other genres of museum communication, including education-driven materials, publicity copy and press releases, exhibition catalogues, and other interpretive texts. We wish to see if tags are more like certain kinds of documents than others.

The data collected by steve.museum is to be deposited with ICPSR/CPANDA and will be available for further study.

4. Conclusions

Efforts to improve access to visual collections often focus on establishing vocabulary and authority control (Harpring, 2002; Shubert, 1996). But even when – or particularly when – terminology is rigorously controlled, the concepts represented by museums may not match the interests of museum users. Studies of questions asked of museums (Mccorry & Morrison, 1993) and queries of museum information resources (Janney & Sledge, 1995b) reveal gaps between the professional framework of museum documentation and the perspective of users of museum collections. Studies that begin with user needs (such as (Elinich, 2004; Reich & Lindgren-Streicher, 2006; Samis et al., 2005; Schaller et al., 2003; Stephenson & McClung, 1998) surface differences between what museums have available and what users expect or want.

Acknowledging that people are “searching for meaning, not just records” (Doolan et al., 2004), museums provide may
ways to encounter collections on-line, including exhibitions, in-depth features, publications, games, and educational materials for teachers (Reilly, 2000). There is an irony that for some kinds of users, making collections databases available on-line may not make collections themselves more accessible. This research will also build our understanding of the way that people search art museum collections, and show where the terminology used by non-specialists to describe works of art differs from that of professional cataloguers. The ‘semantic gap’ between these museum professionals and the general public appears to be a significant one that museums may not be able to bridge themselves (Trant, 2006a, 2006b). User-generated tags could serve as stepping stones across this chasm.

Museums are also increasingly interested in engaging their visitors in a dialogue, and encouraging community participation with collections (Anderson, 2004; H.S. Hein, 2000; Vergo, 1989). Tagging may have a role to play in institutions that are adopting individuated learning and constructivist educational philosophies that emphasize personal meaning-making and user-centered on-line and in-gallery experiences (G.E. Hein, 1998). Rather than being documentation written by and for museums, tagging is user-generated, user-initiated content, representative of points of engagement between people and collections. It has a role to play in a suite of on-line strategies that encourage user generated content (Bernstein, 2008; Farber & Radensky, 2008; Oates, 2008; Samis, 2008), offering a quick, low-investment, way for visitors to make contact with collections. These points of contact are critical for museums, for they offer a direct indication of visitor interests, visitor perceptions, and perhaps, mis-perceptions. Museums can learn from watching what and how people tag, perhaps surfacing points of interest or ‘teachable moments’ where additional interpretation is necessary. Just as search terms are a direct trace of a trajectory of interest, so too can tags offer a window into the objects that engage users.

The research described here looks at museum collections documentation and searching as a continuum. User tagging may form a bridge between two previously separate areas of activity. As there are no studies of information retrieval using on-line museum catalogues, this study will provide a
baseline for future work. Studying tags and their relationship to searching and documenting collections will help determine if tagging could indeed improve search results. Social tagging and folksonomy could make a positive contribution to the accessibility of on-line art museum collections.

Understanding social tagging and folksonomy in the context of the art museum will add to our understanding of their roles in information management and retrieval more broadly. The exploration of the relationships between public and professional vocabularies could prove useful in other disciplines – such as health information or horticultural information – where the language of the specialist differs from that of the general information user. Improved understanding of the relationships between tags and search terms could also prove useful for the design of information retrieval systems in any discipline. Discoveries about the relationships between tagging and interfaces should apply to interface design broadly. We hope to contribute to a growing, in-depth understanding of the many, diverse roles of user-generated content in a complex networked information landscape.

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