



FEATURES

Towards user-centered indexing in digital image collections

Towards
user-centered
indexing

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Krystyna K. Matusiak

University of Wisconsin-Milwaukee Libraries, Milwaukee, Wisconsin, USA

Abstract

Purpose – User-created metadata, often referred to as folksonomy or social classification, has received a considerable amount of attention in the digital library world. Social tagging is perceived as a tool for enhancing description of digital objects and providing a venue for user input and greater user engagement. This article seeks to examine the pros and cons of user-generated metadata in the context of digital image collections and compares it to professionally created metadata schema and controlled vocabulary tools.

Design/methodology/approach – The article provides an overview of challenges to concept-based image indexing. It analyzes the characteristics of social classification and compares images described by users to a set of images indexed in a digital collection.

Findings – The article finds that user-generated metadata vary in the level of description, accuracy, and consistency and do not provide a solution to the challenges of image indexing. On the other hand, they reflect user's language and can lead toward user-centered indexing and greater user engagement.

Practical implications – Social tagging can be implemented as a supplement to professionally created metadata records to provide an opportunity for users to comment on images.

Originality/value – The article introduces the idea of user-centered image indexing in digital collections.

Keywords Digital storage, Collections management, Image processing, Indexing

Paper type Viewpoint

Introduction

The expansion of digital technologies has enabled wider access to visual resources held by museums and libraries. In the last decade cultural institutions have undertaken large-scale digitization projects to convert their collections of historical photographs and art slides to digital format. Digitized images are presented to users on the web through digital collections that offer enhanced image manipulation and multiple search options. Advances in digital technologies and an increase in the number of digital image collections, however, have not been supported by comparable advances in image retrieval, indexing systems, and options for user interaction (Armitage and Enser, 1997; Choi and Rasmussen, 2002; Trant, 2003).

Digitization has created a need for more extensive image description to facilitate image discovery in the digital environment. A considerable amount of indexing work accompanies image digitization in library and museum settings. Archivists and catalogers transcribe existing image captions, assign subject terms, and create other descriptive metadata to provide access points for image retrieval. Many archival collections have little or no accompanying textual descriptions, so image indexing also requires original research and verification of data. Descriptive metadata are created in



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museums and libraries by professional catalogers following standards and using controlled vocabulary tools. This approach represents traditional document-oriented indexing where items are classified a priori by professional catalogers with little or no input from end-users (Fidel, 1994).

The web, however, challenges this world of clear boundaries and distinct authority roles. With the introduction of blogs, wikis, newsfeeds, and bookmarking tools, the web provides an environment for collaborative knowledge construction and social networking (Hammond *et al.*, 2005). It also creates new opportunities for sharing digital images and classifying them by user-generated keywords. Photo sharing sites, like Flickr (www.flickr.com), allow users to upload images and categorize them using their own terms. User-created indexing, often referred to as folksonomy or social classification, has received a considerable amount of attention, with some enthusiasts calling it “a revolution in the art and science of categorization” (Sterling, 2005).

It is probably premature to talk about “a revolution” and call for an abandonment of cataloging standards and controlled vocabulary tools. On the other hand, the social classification movement has initiated a discussion in the digital library community about the use of social networking applications, engaging users, and building virtual communities (Bearman and Trant, 2005). This article contributes to this discussion by reviewing the relevant literature on image indexing and providing an overview of social classification in relation to images. It examines the challenges and usefulness of social tagging and its potential implications for developing user-oriented indexing of digital image collections.

Image indexing in the digital environment

Purpose

A picture is worth 1,000 words – this old saying rings especially true for those who attempt to describe images for digital collections. As Roberts (2001) points out, it will take every one of these words to provide an adequate description of pictures included in image databases. Without comprehensive indexing, the images will remain buried in the database, never seen by the users. In the online environment images pose problems of access and retrieval more complicated than those of text documents. Visual information embedded in pictures is difficult to access without prior indexing. The primary purpose of indexing is to identify images and provide access to them. Layne (1994) identifies two goals for image indexing:

- (1) To provide access to images based on the attributes of those images.
- (2) To provide access to useful groupings of images.

These general goals refer to analog as well as digital image collections, but have become more critical in the digital environment where users access images without assistance of librarians or archivists.

Approaches to image indexing

Research literature identifies two distinct approaches to image indexing (Goodrum, 2000; Enser, 2000; Rasmussen, 1997; Trant, 2003):

- (1) Concept-based, where image attributes and semantic content are identified and described verbally by human indexers.

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- (2) Content-based, where features of images, such as color, shape, or texture are automatically identified and extracted by computer software.

Goodrum (2000) points out that very little research has been conducted on the relative effectiveness of these approaches to image indexing in the digital environment. Chu (2001), examining the research literature on image indexing and retrieval, observes that there is very little collaboration between researchers of these two approaches. Content-based research, although very vibrant in the information science community, is not transferred into practice in digital libraries where most systems are built with concept-based approach.

In “seeking the alliance of concept-based and content-based paradigms” Enser (2000) looks at visual image retrieval from the user’s perspective and examines several user studies. He concludes that within archival image collections users tend to rely more on concept-based rather than content-based image retrieval techniques. Subject access to visual resources is particularly important. His findings are confirmed by other studies of user queries in image databases. Choi and Rasmussen (2002) find subject description a very important factor assisting users in judging image relevance for their research needs.

Challenges to concept-based image indexing

Concept-based indexing provides intellectual access to the visual content of an image. It involves translating the visual information into textual description to express what the image is about and what it represents. In addition to subject description, metadata associated with an image can also contain information about image authorship and provenance. Descriptive metadata are created based on standardized metadata schema, such as Dublin Core or VRA Core, using controlled vocabulary tools or natural language for metadata values. Concept-based indexing requires human indexers to interpret the meaning of the picture, assign subject headings, and transcribe image captions and textual annotations.

The process of translating the content of an image into verbal expressions poses significant challenges to concept-based indexing. Several researchers provide an overview of the problem and generally agree that even extensive text-based indexing is usually inadequate to meet user needs and provide effective image retrieval (Besser, 1990; Chen and Rasmussen, 1999; Enser, 2000; Jorgensen *et al.*, 2001; Layne, 1994). The literature is quite extensive and the following lists just summarize the major points.

Some challenges are due to the complexity and richness of visual medium:

- Images are rich and often contain information useful to researchers from many disciplines (Besser, 1990).
- Image is often used for a purpose not anticipated by the original creator (Besser, 1990).
- The same image can mean different things to different people (Chen and Rasmussen, 1999; Enser, 2000).
- Images can have several layers of meaning from specific to more abstract (Enser, 2000; Jorgensen *et al.*, 2001; Layne, 1994).
- Unlike text document, image does not contain information about its authorship.

Other challenges are associated with language ambiguities and limitations of human indexing:

- Lack of general agreement on what attributes of an image should be indexed (Chen and Rasmussen, 1999).
- Difficulty in determining the appropriate level of indexing (Enser, 2000).
- Subjectivity and lack of consistency - indexers cannot apply indexing terms with any degree of consistency (Rasmussen, 1997).
- Problem in matching the terms that users type to describe their information needs with the controlled vocabulary used in indexing (Gordon, 2001; Hastings, 1999; Jorgensen, 1998; Roberts, 2001).
- Difficulty in mapping a user's mental model of what a picture is about with the indexer's mental model (Heidorn, 1999).

User studies

Although the success of a user finding images on a topic of interest depends on the quality of image indexing and matching of indexer vocabulary with user language, there are few studies evaluating the effectiveness of image indexing from the user perspective (Goodrum, 2000; Stephenson, 1999; Trant, 2003). User studies primarily focus on specific group of users and examine queries within particular collections or subject domains. Armitage and Enser (1997) analyze requests from seven image archives and categorize them according to a facet-based matrix and three levels of abstraction. They observe similarities in image query formulation across a range of different libraries. Choi and Rasmussen (2003) examine queries formulated by faculty and graduate students searching for visual information on American history in the Library of Congress American Memory collection. Their study demonstrates that most of user needs fall into general/nameable needs, while only a small percentage belong to abstract categories. The researchers also find that date, title, and subject descriptors are important factors representing images.

Few studies mention user participation in the indexing process or engage users in describing images as part of an evaluation of indexing systems (Hastings, 1999; Jorgensen, 1998, Jorgensen *et al.*, 2001). Hastings (1999) compares user queries, user-supplied access terms and retrieval tasks in the online collection of Contemporary Caribbean Paintings. In addition to supplying their own keywords, users were also asked to rate the assigned index terms. Hastings's study indicates the need for users to add their own descriptors and index terms in the search process. It also poses several important questions for future research about user interaction with image databases and the role of user feedback. Jorgensen's research also engages non-specialist users performing image description. It focuses on the types of image attributes and levels of image indexing. In her 1998 study, Jorgensen observes a disjunction between a variety of image attributes that users describe and those attributes typically addressed in traditional image indexing systems. She recommends testing the assumptions underlying controlled vocabularies and newer descriptive tools, such as metadata schema.

The need for a new approach

The reviewed research literature echoes Hastings's (1999) statement that the problem of intellectual access to images in digital collections remains largely unsolved. It also

indicates the need for greater user involvement in the indexing process and an evaluation of traditional indexing techniques from the user perspective.

In practice, digital librarians struggle with an increasing number of digital images that need to be indexed for online delivery. Traditional indexing techniques are costly and labor-intensive and even practitioners are not sure whether they provide the only or best way to meet user needs. Trant (2003) notices that there is a sense among librarians that much could be done to improve access to visual collections, both in the use of existing indexing and in the applications of new technologies. Bearman and Trant (2005) recognize that “we may be alienating a user community by not speaking their language.” Many practitioners feel that traditional document-oriented indexing techniques are insufficient for image indexing in the web environment and search for a new approach.

The museum community discussed the potential of user-generated tagging in image indexing at the “Cataloguing by Crowd” forum at the 2005 Museum and the Web Conference. Following the conference, the Metropolitan Museum of Art and the Cleveland Museum of Art conducted a series of exploratory tests. The Guggenheim Museum began a preliminary exploration through a prototype application, where users are encouraged to annotate a collection of images. An overview of this project is presented in Bearman and Trant’s (2005) paper. As indicated by the discussion on CONTENTdm listserv (Archives of CONTENTDM-L@OCLC.ORG, 2005), digital librarians also see social networking applications as tools that can involve users and enhance image description.

Social classification

Social classification represents a new approach to organizing content in the web environment where users create their own textual descriptors using natural language terms (tags) and share them with a community of users. This new organically emerging system of organization with users assigning keywords to their own or shared content has been referred to by several terms, including social classification, distributed classification, social tagging, ethnoclassification, and folksonomy (Hammond *et al.*, 2005). The term folksonomy, combining the words folk and taxonomy, has been attributed to Thomas Vander Wal. It has gained a considerable popularity, but as Merholz (2004a) points out in one of his blogs, the term folksonomy is actually inaccurate. Taxonomy implies a hierarchical relationship, while tagging applied in social networking software is characterized by a flat, non-hierarchical structure. The term social classification is used here to emphasize the collaborative nature of user-generated tags and their use in social context.

Social tagging has been introduced in a number of web services. Users can assign their own tags to web site bookmarks (del.icio.us or Furl), weblog posts (Technorati), and photos (Flickr). CiteULike and Connotea provide an opportunity to tag academic publications. The purpose of tagging in this collaborative environment is not only to organize the web content for an individual user, but also to share the categories with other users, so they can easily browse and retrieve the information classified by others. Golder and Huberman (2005) observe that collaborative tagging is most useful when there is nobody in the role of “librarian” to classify information or there is simply too much content.

Social classification of digital images

There are a number of web sites that provide users with space to store digital photos. What makes Flickr unique and popular is its classification and networking application that allows assigning tags, commenting, and sharing images and associated tags with a community of users. The site was launched in February 2004. Flickr's images are also part of Yahoo image search as a result of the recent partnership with Yahoo! Eric Costello, one of Flickr's developers, indicates in an interview with Jesse Garrett (2005) that initially Flickr was envisioned as a tool for an individual to organize collections of photos and share them with friends and family using a simple tagging functionality modeled on the bookmarking site del.icio.us. The push for broader classification and social interaction came from the community of users, who were interested in sharing their pictures and tags with a wider audience, not just a small collection of friends.

Flickr provides a simple and unrestricted tagging system. Users can assign as many tags as they wish using keywords that they deem to be the most appropriate for their photos. They also have an opportunity to see how other users apply the tags in the context of other images. This aspect of communal verification or immediate feedback is what makes social classification different from traditional indexing that is usually conducted by a single authority in isolation from users. Mathes (2004) points out, "this tight feedback loop leads to a form of asymmetrical communication between users through metadata". In social networking applications, such as Flickr, the meaning is created and negotiated by a community of users in the context of use.

Flickr displays "hot tags" added in the last 24 hours and a set of the most popular tags (Figure 1). A brief analysis of the popular tags demonstrates several characteristics of this approach to organizing content:

All time most popular tags

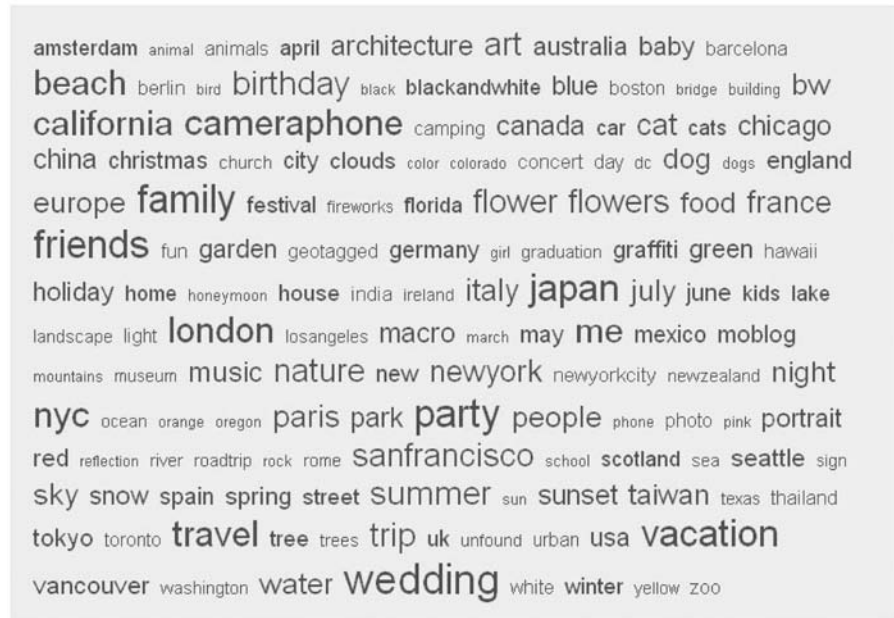


Figure 1.
Flickr's most popular tags
as of January 10, 2006

- Proper names indicating geographic location (boston) are listed along topical terms, such as bridge and building.
- There are no explicit or hierarchical relationships – europe is on the same level as italy or rome.
- Singular nouns, such as animal, flower, dog are accompanied by their plural equivalents, animals, flowers, and dogs.
- There is no control for synonyms – new york, newyorkcity, and nyc are listed in the same set.
- Specific terms, e.g. river or rock are mixed with more abstract, such as reflection.
- There are several compound tags that combine two or more words, e.g. geotagging, blackandwhite, roadtrip.
- Modifiers, e.g. blue or urban, or pronouns (me) are listed in the mix of nouns.
- New terms, such as cameraphone or moblog, are added quickly to the list of tags.

Some of these features, such as the lack of synonym control or use of singular and plural indicate the limitations of social classification for retrieval purposes. Several researchers point out the messy, “jumbled,” or “sloppy” nature of social tagging, especially when compared with formal classification systems (Guy and Tonkin, 2006; Hammond *et al.*, 2005; Mathes, 2004). Guy and Tonkin, in a recent article, analyze the major flaws of folksonomy including misspellings, badly encoded word groupings, singular and plural forms, personal tags, and single use tags. The authors suggest some strategies for improving “sloppy tags,” but also observe that such practices may discourage users. Shirky (2005) sees tagging as an organic way of organizing information that “seems like a recipe for disaster, but as the Web has shown us, you can extract a surprising amount of value from big messy data sets.”

Social classification also demonstrates a number of strengths, particularly for description and retrieval of images. The interlinked system of tags supports browsing activities and serendipitous discovery of images in the digital environment. The most important strength of social tagging, however, is its close connection with users and their language. Mathes (2004) points out that it directly reflects user “choices in diction, terminology, and precision.” The vocabulary is current and flexible as it quickly absorbs newly-created terms and neologisms invented by web users. The chaotic mixture of synonyms, abbreviations, singulars, and plurals represents the actual language of users – the terms they use to describe their images and the words they will more likely type while searching for images in other digital collections.

Comparison of the two approaches to image indexing

To examine the differences between traditional indexing and social classification and evaluate a potential usefulness of social tagging in digital collections, the author compared two sets of images: one featured in the Flickr site (Figures 2 and 3), the other indexed in a digital collection created at the University of Wisconsin-Milwaukee Libraries (Figures 4 and 5). The Flickr’s photos have been recently added to the site by two different users. The digital image collection “Cities Around the World,” (<http://collections.lib.uwm.edu/cgi-bin/browseresults.exe?CISOROOT=%2Fcatw>) currently being constructed at the University of Wisconsin-Milwaukee Libraries, features



Tags

- new york
- brooklyn bridge

Additional Information

- © All rights reserved
- Taken with an Olympus C3000Z.
- More properties
- Taken on January 10, 2006
- See different sizes
- Viewed 5 times.

Note: Used with permission

Figure 2.
Brooklyn Bridge, a photo
on the Flickr's site posted
by Rachelle Yankelevitz

photographs from the collection of the American Geographical Society. The collection, built in CONTENTdm digital media management system, uses Dublin Core metadata schema and a number of controlled vocabulary tools, such as Library of Congress Thesaurus for Graphic Materials for topical subject headings and the Getty Thesaurus of Geographic Names for geographic location.

The first set of photos (Figures 2 and 4) features the Brooklyn Bridge in New York. Although the images are similar, the level of description is quite different. The description provided by the user consists of only two tags, while the indexing in the Cities collection includes several topical subject terms and headings depicting the



Tags

- 🌐 Deutschland
- 🌐 Germany
- 🌐 Köln
- 🌐 Cologne
- 🌐 Dom
- 🌐 Kirche
- 🌐 Cathedral
- 🌐 Rhein
- 🌐 Rhine
- 🌐 Nacht
- 🌐 Night
- 🌐 Hohenzollern
- 🌐 Brücke
- 🌐 Bridge

Additional Information

- 📄 © All rights reserved
- 🕒 Taken on December 1, 2005
- 📏 See [different sizes](#)
- 👁️ Viewed 14 times.

Note: Used with permission

Figure 3.
Cologne Night2 – a photo
posted on the Flickr's site
by Ilhan Aksoy.



Digital Image © 2005 University of Wisconsin-Milwaukee Libraries

Title:	New York, Manhattan, Brooklyn Bridge and Lower Manhattan skyline
Photographer's Note/Description:	New York City, Brooklyn Bridge and lower Manhattan skyline
Photographer:	Forman, Harrison
Date of Photograph:	1970
Site:	Brooklyn Bridge (New York, N.Y., United States)
Subject:	Transportation Suspension bridges Rivers Cityscapes Skyscrapers
Continent:	North and Central America
Country/Region:	United States
State/Province:	New York
City/Place:	New York
Geographic Feature:	East River (river)
Type:	Image
Original Collection:	Harrison Forman Collection
Original Item Size:	35 mm
Original Item Medium:	Color slide
Original Item ID:	6a, 152,2-12
Provenance:	Donated by Sandra Forman, Harrison Forman's wife
Repository:	American Geographical Society Library, University of Wisconsin-Milwaukee Libraries
Rights:	The Board of Regents of the University of Wisconsin System
Publisher:	University of Wisconsin-Milwaukee Libraries
Digital ID:	fr003276
Date Digital:	2005/05/20
Digital Collection:	Cities Around the World

Figure 4.
New York, Brooklyn
Bridge, an image from the
“Cities Around the World”
a digital collection created
at the University of
Wisconsin-Milwaukee
Libraries

geographic location. The image indexed in the library setting has not only a more detailed description, but also indicates the relationship between the terms, although the terms are not pre-coordinated. The level of indexing is also more consistent with other images of Brooklyn Bridge in the same digital collection. The search for “Brooklyn Bridge” on the Flickr site retrieves over 4,000 images. An examination of additional pictures on the first screen demonstrates a huge difference in the level of indexing and the choice of terms. Some users assign just two tags, while others add six or more. Not only the depth of indexing differs, but also users’ perspectives as they focus on



Digital image © 2004 University of Wisconsin-Milwaukee Libraries

Title:	Cologne, Cologne Cathedral and Hohenzollern Bridge
Photographer's Note/Description:	Germany - Cologne cathedral and the Rhine River
Photographer:	Forman, Harrison
Date of Photograph:	1972/12
Site:	Cologne Cathedral (Cologne, Germany)
Subject:	Views Rivers Bridges Religious facilities Churches Cathedrals Boats
Continent:	Europe
Country/Region:	Germany
State/Province:	North Rhine-Westphalia
City/Place:	Cologne
Geographic Feature:	Rhine (river)
Type:	Image
Original Collection:	Harrison Forman Collection
Original Item Size:	35 mm
Original Item Medium:	Color slide
Original Item ID:	21a6, 149-5-18
Provenance:	Donated by Sandra Forman, Harrison Forman's wife
Repository:	American Geographical Society Library, University of Wisconsin-Milwaukee Libraries
Rights:	The Board of Regents of the University of Wisconsin System
Publisher:	University of Wisconsin-Milwaukee Libraries
Digital ID:	fr001953
Date Digital:	2004/09/24
Digital Collection:	Cities Around the World

Figure 5.
Cologne, an image from
the “Cities Around the
World” a digital collection
created at the University
of Wisconsin-Milwaukee
Libraries

different aspects – the Manhattan skyline or financial district in the background. It seems that social tagging not only exemplifies many challenges in image indexing identified by the researchers in the field, but also multiplies them by the number of volunteer indexers on the web. Subjectivity and the lack of consistency between indexers, the differences in the level of indexing, and the variation of image attributes are more widespread in social classification due to the sheer number of people tagging their images.

The second set of photos (Figures 3 and 5) reveals another dimension of social classification that is missing in most traditionally indexed digital collections. Both photographs feature the Hohenzollern Bridge and the Cathedral in the city of Cologne, Germany. The level of indexing is not that much different, although the library indexing reflects a certain hierarchical structure in listing Religious facilities and cathedrals in the subject field and in the terms depicting geographic location. All terms are in the plural, while an image tagged on the Flickr site uses singular nouns. The major difference is, however in the language. All the indexing in the library-created digital collection is in English, while the tags selected by the user on the Flickr site are both in English and German. User-generated metadata reflect an increasingly multilingual and multicultural web audience.

This brief comparison confirms a basic difference between social classification and traditional indexing techniques that employ metadata schema and controlled vocabularies. The traditional approach provides a more consistent and detailed description of images in a hierarchical, structured manner. Social classification, on the other hand, lists tags without indicating relationships in flat name spaces, though it does reflect the language, or sometimes multiple languages of the users. Kwasnik (1999), exploring the role of classification in knowledge representation and discovery, observes that “classification is a way of seeing”. Unlike formal classification systems, social classification is not an artificial construct representing highly structured knowledge in a mature or a specific domain. It emerges organically and reflects individual user perceptions, observations, and impressions. It gives users an opportunity to describe the world the way they see it.

Discussion

Challenges to implementing social tagging in digital image collections

As demonstrated by the above comparison, social classification represents a significant shift and new possibilities in image indexing, but it does not offer a simple or miraculous solution to many complex issues inherent in image description. On the contrary, the challenges and problems of intellectual access to images seem to be multiplied in the social networking environment.

There is also a fundamental difference between social classification and traditional indexing in regard to motivation. Flickr users tag their own content – private digital photo collections that they want to manage and share with friends, family, and a wider community. In the social networking environment, users engage in the game of tagging for their own benefit. Hammond *et al.*(2005) refer to this approach to classification as “selfish tagging.” Although there are examples of altruistic contributions on the web with Wikipedia being a primary one, it is difficult to predict whether users will be willing to invest their effort and time into describing images held at museums and libraries. Bearman and Trant (2005) discuss the issues of motivation and rewards in the context of the prototype project at the Guggenheim Museum. The discussion about social classification in digital collections will remain theoretical, if not futile, unless we see an implementation of social networking applications in digital library systems on a larger scale. Librarians also need to create an encouraging environment, where users become interested in participating in the indexing process and in contributing their expertise.

Implications for digital image collections

Although social classification is not a universal solution and poses a set of old and new challenges, it does offer opportunities for enhancing image indexing and engaging users. Many librarians are probably wondering what will be the role of professional catalogers, if indexing goes into the hands of users? Interestingly, similar questions were posed by system designers when interface design moved towards a more user-centered approach (Henderson, 2000); however, iterative interface design with user participation and usability testing has not eliminated the jobs of system designers.

Social classification does not have to be seen as an alternative or replacement of traditional indexing, but rather as an enhancement. These two approaches can supplement each other. In the view of challenges to intellectual access to visual resources, traditional indexing, nevertheless, offers more consistency in indexing and relatively similar level of specificity in describing image attributes. Controlled vocabularies and standards enable uniform access and interoperability. Social classification, on the other hand, brings user language, perspective, expertise, and eventually may lead towards more user-oriented indexing. Above all, it offers great opportunities for user engagement.

In comparison with sites like Flickr, digital image collections appear rather static and monolithic. In the current digital library environment users have little or no opportunities for commenting on images or providing feedback on indexing, not to mention adding their own keywords. Heidorn (1999) views indexing as a form of communication between the indexer and the people who search for images in a collection. He mentions “shared cognitive heritage” and language as major factors in the communication between indexers and searchers. In traditional document-oriented indexing, however, this communication tends to go in one direction. With catalogers deciding a priori the structure and language of description and users remaining on the passive recipient end, it is difficult to determine how much knowledge and language is actually shared in this process. Social networking application, if implemented in digital collections may provide an opportunity for a communication model that works in both directions.

As demonstrated by the reviewed literature on concept-based indexing, the gap between user language and controlled vocabularies applied in indexing have been identified as a major problem in providing intellectual access to images. Controlled vocabularies do not reflect users’ language, and for the purpose of image indexing, are too rigid and often outdated. User-generated tags, although unstructured and “sloppy,” are richer, more current, and multilingual. There are several options for incorporating user language into digital collections:

- Users can add their own tags to the metadata in the records.
- Users can provide feedback on the terms assigned by indexers.
- User-supplied tags can be used to develop “a controlled vocabulary that truly speaks the users’ language” (Merholz, 2004b).

In addition, implementing social networking applications in digital collections can foster collaborative knowledge construction. Users can contribute to the depth of image description and enhance the intellectual content of digital collections. Their engagement can take many forms from assigning tags, to commenting on images,

and annotating them. Expertise in local history and language can be particularly valuable in cultural heritage collections, where users can help to identify images and enhance description with their unique knowledge and perspectives. Users' comments can also be a source of evaluation data indicating the relevance of collections to users' needs and provide directions for future development of digital image collections.

Conclusion

The phenomenon of social classification raises questions about an established pattern in the current library practice where image indexing is performed in isolation from users. User-centered interface design of digital libraries received a considerable amount of attention, but image indexing still follows traditional document-oriented principles. The discussion of social classification and "metadata for the masses" (Merholz, 2004b) might help to introduce user language and user views to digital collections creating a more interactive and user-oriented environment. Although social classification is not an answer in itself to many inherent problems in image description, nevertheless, it can lead towards more user-oriented indexing. From the perspective of a practitioner involved in building digital image collections, it offers an opportunity for greater user engagement and help in building virtual communities.

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About the author

Krystyna K. Matusiak works at the University of Wisconsin-Milwaukee Libraries as a Digital Collections Librarian. She has managed digitization at the UWM Libraries since the program was initiated in 2001. The list of the collections she has designed and managed is available at: www.uwm.edu/Library/digilib/ She is also a doctoral student at the University of Wisconsin-Milwaukee. Her research interests include image indexing, usability, and evaluation of digital libraries.