Mobile Social Software for Cultural Heritage: A Reference Model

Paolo Coppola, Raffaella Lomuscio, Stefano Mizzaro,
Elena Nazzi, and Luca Vassena

Department of Mathematics and Computer Science
University of Udine
Via delle Scienze, 206 — 33100 Udine — Italy
{coppola,lomuscio,mizzaro,vassena,nazzi}@dimi.uniud.it

Abstract. Web 2.0, also known as the Social Web, marks a new philosophy where users are both the main actors and the content producers: users write blogs and comments, they tag, link, and upload photos, pictures, videos, and podcasts. As a step further, Mobile 2.0 adapts Web 2.0 technology to mobile users. We intend to study how Web 2.0 and Mobile 2.0 together can be applied to the cultural heritage sector.
Recently, a number of cultural institutions and museums are introducing in their projects some Web 2.0 applications, but the main knowledge source remains a small group of a few experts. Our approach is different: we plan to let all the users, the crowd, to be the main contents provider. We aim to the crowdsourcing, the long tail power, as fuel of cultural heritage system.
In this paper, we propose a reference model for cultural heritage system that lets users create, share, and use cultural contents including mobile context-aware features.

Key words: Web 2.0, Mobile 2.0, mashup, social, culture, collaboration, crowd, museum, cultural heritage, user-centered

1 Introduction

In this paper we intend to study how Web 2.0 [12] and Mobile 2.0 together can be applied to the cultural heritage sector. With Web 2.0 and social software we represent all web-based services with "an architecture of participation", that is, an architecture featuring a high interaction level among users and allowing users to generate, share, and take care of the content[1]. Mobile 2.0 is the evolution of mobile technology that allows "capturing the content at the point of inspiration", that is, in the exact moment in which the inspiration and the opportunity exists to do it.

Nowadays, Cultural Heritage Organizations (museums, archaeological sites, historical towns, even libraries, etc.) are trying to understand the evolution

[1] http://museumtwo.blogspot.com

of the web and mobile devices, and to exploit the potentialities offered by the new digital instruments. However, these organizations often neglect the social aspects, which are considered by many the true revolution related to these new technologies, and they tend to stick to their traditional role of being the sole owners of knowledge about their collections [8]. Indeed, in this research area, old and new conferences, e.g. Museum and the web[2], International Cultural Heritage Informatics Meeting[3], concentrate on the possible application of Web 2.0 concept and technology to museums, libraries and other cultural heritage institutions.

Our approach is complementary: we want to understand if a fully Web 2.0/Mobile 2.0 approach is viable for the cultural heritage field. We intend to exploit these technologies to let the crowd to be the main contents provider: people are not just passive users, but they are encouraged to create, share, and discuss cultural contents. Web 2.0, the Social Web, and Mobile Web 2.0 provide a lot of useful tools:

- *Wikis* are websites that allow users to create, edit, and link web pages easily, e.g. Wikipedia[4].
- *Blogs* are websites where entries of different types of content are usually displayed in reverse chronological order, e.g. Blogger[5] and MoBlog:UK for mobile devices[6].
- *Tagging (Folksonomy) and social bookmarking* let users use keywords to attach to a digital object to describe it, e.g. del.icio.us which launched the "social bookmarking" phenomenon[7], Mobilicio.us[8] is a "mashup" of del.icio.us or Ma.gnolia[9] online bookmarking services with Google Mobile[10].
- *Multimedia sharing* are services that let the easy storage and sharing of multimedia content, e.g., Flickr for photo[11], YouTube for video[12], Odeo for podcast[13], Twitter[14] and Jaiku[15] for mobile.
- *Virtual worlds* websites that create a virtual parallel world, e.g. Second Life[16].

According to Web 2.0 concepts of remixability and aggregation, the development and adoption of:

[2] http://www.archimuse.com/conferences/mw.html
[3] http://www.archimuse.com/index.html
[4] http://en.wikipedia.org/
[5] http://www.blogger.com/home
[6] http://moblog.co.uk/index.php
[7] http://del.icio.us/
[8] http://mobilicio.us/
[9] http://ma.gnolia.com/
[10] http://www.google.com/mobile/
[11] http://www.flickr.com/
[12] http://youtube.com/
[13] http://odeo.com
[14] http://twitter.com/
[15] http://jaiku.com/
[16] http://www.secondlife.com

– OpenApi[17];
– OpenSocial Api[18];
– DataPortability philosophy[19];

enable websites to interact with each other by using SOAP, Javascript and any other web technology. This approach allows to interconnect websites in a more fluid user-friendly manner not only for programmers but for users too. By reusing and remixing these tools, static content authorities could evolve to dynamic platforms for content generation and sharing.

In this paper, we first survey related experiments aimed at exploiting both Web 2.0 and Mobile 2.0 solutions. We then highlight their limitations and we propose an abstract and general reference model for cultural heritage systems, that lets users create, share, and use cultural contents including mobile context-aware features. Our model is the starting point of an ongoing project, and it will eventually lead to a particular implementation named m-Dvara 2.0. m-Dvara 2.0 represents an evolution of E-Dvara, a previous platform for cultural and scientific contents in digital format[20]. The "m" and "2.0" in m-Dvara 2.0 highlight the mobile and social nature of our platform.

2 Mobile Social Software for Cultural Heritage: Related Work

2.1 Current solutions

Most museums, cultural sites, libraries, and other educational and cultural websites are not involved in Web 2.0 (r)evolution: they are the sole provider of contents, whereas users are only consumers. However, some cultural heritage organization and some educational institutions have introduced Web 2.0 services in their sites:

– Tagging (Folksonomy)
  – Steve[21] is a collaborative research project exploring the potential for user-generated descriptions of the subjects of works of art to improve access to museum collections and encourage engagement with cultural content. A group of US art museums are taking a similar folksonomic approach to their online collections.
  – Trant [14] has explored the potential of social tagging by comparing terms assigned by trained cataloguers and untrained cataloguers to existing museum documentation at The Metropolitan Museum of Art in New York[22].

[17] http://en.wikipedia.org/wiki/Open_API
[18] http://code.google.com/apis/opensocial/
[19] http://dataportability.org/
[20] http://edvara.uniud.it/india
[21] http://www.steve.museum/
[22] http://metmuseum.org

Preliminary results show the potential of social tagging and folksonomy to open museum collections to new and more personal meanings. Untrained cataloguers identified content elements not described in formal museum documentation. Tags assigned by users might help to bridge the semantic gap between the professional discourse of the curator and the popular language of the museum visitor.

- Virtual Worlds
  - Louvre Museum[23], one of the first museums on the web, offers no real Web 2.0 services [6], although it is present on Second Life.
  - Public Library of Charlotte and Mecklenburg County[24] has a teen outreach program that includes a presence in Teen Second Life[25].
- Community Multimedia Sharing
  - Tate museum offers the website youngtate section[26] to young people to create new learning communities, opportunities for input and activity based on personal choice, and innovative forms of interaction with art and artists [3].
  - Brooklyn Museum[27] site has a Community section with blogs, podcasts, forums and a Flickr-based photos sharing service [6].
  - Brooklyn College Library uses MySpace to allow participants to post personal profiles containing their favourite books, movies, photos, and videos[28].

Many projects have been developed to study how to integrate mobile devices in museum visits. Besides common mobile guides, projects for museum co-visits with mobile device [9] involve individual and then collaborative user activities enabling communication, sharing, and collaboration among visitors in their museum experience.

Recent work on cultural institution trying to meet Web 2.0 challenges (e.g., [10]) helps us in a classification based on topics and types of services offered to the virtual and real-world visitor. A list of topics of interest for cultural institution projects are:

- Art cataloguing and description: social services using folksonomies as more efficient way of cataloguing and description of an artwork;
- Collection access: collaborative social services in order to offer access to large collections of cultural content;
- Education: social services for collaborative creation of multimedia content for students, even educational-games, communities;
- Exhibition: resources to enrich user experience of exhibitions;
- History: social services as archival multi-medial or textual resources;
- Promotion and marketing: social services and syndication techniques to promote cultural activities, events or new available contents;

[23] http://www.louvre.fr
[24] http://plcmc.org/
[25] http://plcmc.org/Teens/secondLife.asp
[26] http://www.tate.org.uk/youngtate/
[27] http://www.brooklynmuseum.org/community/
[28] http://www.myspace.com/brooklyncollegelibrary

– Recommendation: social services and monitoring systems to provide recommendation based on user behaviour in order to suggest contents, activities, paths or tours;
– Reference service: social service to improve professionals communities;
– Youth outreach: dedicated social services to gain the close interest of young visitors.

2.2 Limits of current solutions

From these examples it is clear that Web 2.0 technologies are transforming the methods of production and perusal of cultural and educational contents, and also that the heritage sector is evolving towards user generated content. However, all these "Museum 2.0" examples also share the common approach of merely giving to the users the tools to record their personal experience, while a few expert members still are the main content providers. This is different from a full 2.0 approach, in which the users are given the real opportunity of creating contents in a way that makes themselves essential. Another issue is the fragmentation of services offered by current social software projects for cultural heritage: various approaches have been implemented, but none has been able to identify and offer an organic set of mobile and social services to support and stimulate the virtual and real-world visitor experience through collaboration and participation.

3 A Reference Model for Cultural Heritage System

In the previous analysis, we evaluated services provided by different cultural heritage systems. In this section we describe our approach, whose ultimate aim is to let users to be not only visitors of an exposition but the main content creators through a framework of collaboration and participation based on Web 2.0 and Mobile 2.0 technologies. We propose a reference model according to the work presented in [7], for mobile social software for learning. In particular the approach to the model described has been transposed to the cultural heritage field.

Our research questions are: can the crowd become an effective and reliable contents producer? Can the crowd actively participate at the cultural heritage preservation and dissemination process? How users can be motivated to participate? Can we achieve these goals by means of appropriate Web 2.0 and Mobile 2.0 tools already existing?

3.1 Requirements

The reference model we propose describes how existing tools can be used in order to create a Web and Mobile 2.0 system for cultural heritage. In few words, our idea is to combine data from more than one existing source into a single integrated tool. Thus, we suggest a mashup model for cultural heritage system that implies:

– reuse of Web 2.0 technologies;
– reuse of Mobile 2.0 technologies;
– mix of web and mobile services;
– minimum implementation, through mashup of Web 2.0 and Mobile 2.0 services available online.

Also, our model conforms to the main tenets of the Web 2.0 philosophy: it is user centered, it is based on social software, it aims at anywhere and anytime access by means of mobile devices, and it allows and fosters knowledge sharing. We want to ask the user the minimum effort possible so that she can interact with our service platform in an easy and comfortable way. As it has been done partially by Brooklyn Museum and TateYoung, we want to integrate all possible Web 2.0 systems that the user usually uses for her online community activities (MySpace, Flickr, Blogger, etc). By doing so, we will provide an all-in-one familiar set of services for users. Our reference model is an empty box, with many mashup services, where contents have to be inserted by both expert and non-expert users. There is not a central authority that publishes and controls all contents, but the crowd is the real controller of contents. From the development point of view, although the integration of existing services reduces implementation efforts, we cannot ignore its complexity, due to the functional heterogeneity of the same services. This heterogeneity affects also information visualization and user interaction aspects, but this matter is out of the aim of this first work, and it will be dealt with in future steps of our project.

3.2 Functionalities

System functionalities can be classified according to users location and technology being used:

– technology (a user can use a mobile device, desktop, notebook, etc.),
– location (a user can be on-site or off-site).

These user features are used to provide the appropriate services, e.g., a tourist visiting an exhibition will not need a video guide, or will not watch detailed photos on a mobile device, but probably she would like to listen to a location-aware audio guide. In particular, our model describes the way in which both on-site tourists visiting artworks and off-site users interact with the system (figure 1). In both cases, users can add content (posts, comments, etc.), upload new photos, videos, audios. We propose to mashup all these collected information in order to give to user a view of her work (*user view*). Moreover, we can obtain a more complete view about an artwork joining all users views. To accomplish this aim we can aggregate, filter, evaluate, and rate all available contents about an artwork. In this way our system can create an *artwork view*. Conceiving a social tool for cultural heritage in which we could use all available information about registered users, we can capitalize also on the power of the long tail, i.e., on those users that know (or use) only few system functionalities. We can keep track of all events generated by users, (i.e., visited objects, that can be real or

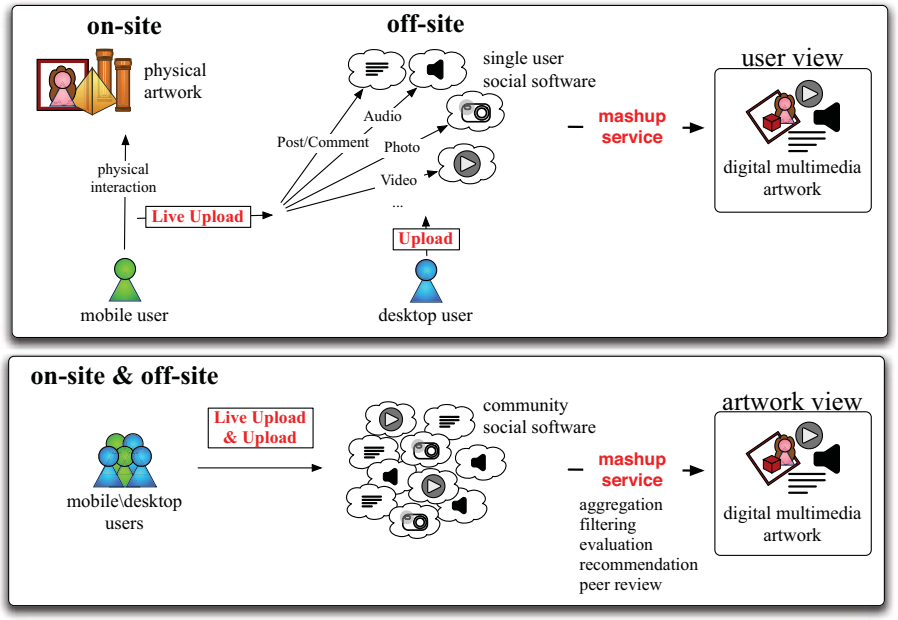

Fig. 1. On-site and off-site user interaction model: mashup creation of user view and artwork view

digital, time spent near each artwork, etc.) and we can create for each of them a *user events cloud* (a kind of user cultural history), that can help us to enjoy new features or improve already existing services (e.g., rank of content to be shown in a social tour or by social guides); see, for example, what we call *custom tour* in Section 3.2.

We can distinguish main system functionality according to Shneiderman's approach to relating human activities and relationships: Activities and Relationships Table (ART) [13]. Table columns represent four activities: collect (information), relate (communicate), create (innovate), and donate (disseminate). The four rows represent relationships, each one describing an increasingly large group (self, family and friends, colleagues and neighbors, citizens and markets) that we generalize to: self, neighbors (including family, friends, and colleagues), and the whole Web (table 1).

We now describe the main system features by means of three possible scenarios.

Scenario 1. On-site user with a mobile device In this scenario we imagine a tourist visiting a museum, an artwork exhibition, an archaeological excavation, etc.

Live Upload The tourist can capture content at the point of inspiration and upload it in real-time on system. Content can be of different kinds: photos,

	Collect	Relate	Create	Donate
Self	Bookmark M-Bookmark Feed Reader		Note Live Upload Upload	
Neighbors	M-Teach Teach	Comment 3D interactive environment	Blog MoBlog Wiki Live Upload Upload M-Meach	
Whole Web	Social Tour	3D interactive environment	Blog MoBlog Wiki Live Upload Upload Live Tagging Social Guides	Recommendation Rating User Events Cloud

Table 1. ART: Activities and Relationships Table of a user in a cultural heritage system

videos, audios, text about an artwork (comments or posts), drawings, etc. She can update her personal page or public page. Twitter, Jaiku technology, and/or YouTube Mobile[29] can be used to upload video. Live Upload differs from simple Upload: the first one take place in real-time, for example while the user is visiting a museum, in contrast with the second one that is related to non real-time experiences.

Live tagging The tourist can tag, using her own mobile device, the artwork she is looking at.

Evaluation and rating Collaboration and participation features involve evaluation mechanisms and for this reason we propose the adoption of social evaluation. Following [11], all contents can be judged by users (e.g., according to accuracy, comprehensibility, etc.). The score assigned to a content item will depend on the combination of the score given by a user and the user's actual score. In addition, every content provider has a dynamic reliability score that depends on the scores of contents she produced. In this way, the crowd is the reviewer of its own contents. Moreover, a tourist can rate every artwork. This rating, combined with the user profile, contributes to improve the artwork profile. In this way the system can suggest to tourists the artworks closer to their preferences.

Social tour The system can help tourists by suggesting a tour. The tourist can request to the system an ideal tour according to her preferences, and/or

[29] `http://youtube.com/mobile`

tourist can select on her mobile device a tour criterion. There are three main kinds of tours: custom, dynamic and contextual tour. For custom tour we mean that system can detect user information keeping track of her actions (e.g. visited places or artworks, commented posts) or it can evaluate user's profile to set her preferences, then system process these information in order to create the user's ideal tour. A dynamic tour does not relate to user's personal information, but it depends on all users actions, thus user can decide to visit the most viewed, most commented, or most voted artworks. In other words, she can visit all the artworks that the crowd (community) advises to see. Finally, in a contextual tour, user can decide to visit only artworks about a specific topic or artworks belonging to the same artist, and so on. In addition, a tourist can change the tour criterion or she can add or remove artworks to visit from the suggested list at any time. To detect user location we intend to integrate Google Mobile with MoBe location features [5, 4].

Social guides A cultural heritage system could be a guide. A tourist can record an artwork description as a guide and listen an audio description from her mobile device about the item she is examining. She can also access a wiki in order to read or use a screen reader to know what she needs. All different descriptions about a certain object are rated according to the crowd opinion (social evaluation). We can use, again, Twitter or Jaiku.

Travel diary The system can keep track of artworks, monuments and places the user has seen, in order to maintain a personal travel diary.

Questions and answers A tourist can post a question, or answer to question posted by other users in the community.

M-Note The tourist can note down on her mobile device whatever she needs to retain about the object she is observing. To this aim we can exploit Google Notebook.

M-Bookmark To bookmark from mobile devices. For this we can integrate Mobilicio.us.

M-Teach Students can use their own mobile devices for educational lab activities.

Scenario 2. Off-site user with a desktop or notebook device User accessing to cultural heritage system from his own desktop or notebook device.

Wiki per topic User can create, add, modify, delete contents about a topic or an object to the open wiki in a collaborative way like, e.g., in Wikipedia.

Wiki per author Each article can be written by a single author and other users can edit it only with permission from the author, like, e.g., in Knol. There are also multiple articles for the same topic, each written by a different author. Readers may rate or comment on the articles. Wiki per author lets users know who wrote what, so they can make better use of Web content.

3D collaborative environment User can visit a 3D museum or a 3D exhibition, interact with other users or a guide in the museum, as in the real word. Moreover we can merge the 3D museum (e.g. Second Life) with wiki, chat, photo, and comments of users. In this way user can visit 3D environment

and talk with other visitors, but she can also update a wiki, write comments, upload photos, videos, etc.

Blog User can write a post about an artwork on her own blog, or on a blog dedicated to a specific topic. Also, she can comment in other blogs.

Bookmark User can bookmark other users Web-pages or artwork dedicated Web-pages.

Personal profile and social network User can manage his social network, defining white and black lists. He can select his "friends" in order to create a personal sub-community. He can also suggest other user he is interested in, in order to be notified of their new posts. Similarly a user can suggest posts or themes he is interested in to be notified of their evolution.

Scenario 3. Off-site user with a mobile device User accessing to cultural heritage system from his own mobile device.

MoBlog User can upload photo, video, text, audio on the blog section. We can exploit MoBlog.

Live Upload Like tourist on-site, also user online with mobile device can live upload content on system.

4 Conclusions and Future Work

In this paper we have presented how various museum evolution projects aim at providing Web 2.0 services for improving user's experience. However, these projects lack of users participation as the central content creators, since the main content creators remain a few institutional experts. We have then described the starting point of an ongoing project, namely a reference model for a more integrated approach. The goal of our project is to produce a service that allows the crowd of users to control (manage) the knowledge flow through collaboration and participation. The service will be developed as an aggregator of Web 2.0 and Mobile 2.0 services for institutions of humanistic field. Users participation and motivation are essential and this leads to the question: "why the user should use our system?". Our system could be an important added value service to the user, but we are going to verify our believes only at the final stage of the project, with appropriate user testings. At this point, we trust in the popularity of the Web 2.0 services we rely on. The project is rather ambitious, and we will be facing many problems. For example, the reuse and remixing of other services involve the direct dependence on their existence (what would happen if some service stops its functioning?). Redundancy and robustness will be key factors. Also, copyright issues are a complex field, dependent on single nation legislation, and should be taken into account when working with cultural heritage contents.

Focusing on the evaluation system, there are several aspects that need future investigations. In particular there should be just one general user's score, or it is better to have a score for each field of contribution? Several scores help to give a more detailed evaluation of a user, that could be an architecture expert

but have no experience in science. On the other side, giving a score for a specific field requires the use of a kind of classification, like, for example, a folksonomy.

A user's score can also change because of an interaction between the community and the user's contributions. Possible parameters are: "how many times a content is read", "how many times a content is updated by the community", "how much time passes between a creation of a content and an update", etc. For example, if a content is frequently read, but never changed, it could be a good content; on the contrary if a content is never read, it is probably not good. Having no control on users' contributions, we hypothesize that this evaluation system could be a way to automatically manage the contents quality.

Acknowledgements

The authors acknowledge the financial support of the Italian Ministry of Education, University and Research (MIUR) within the FIRB project number RBIN04M8S8.

References

1. A. Alain and M. Foggett, (2007). Towards Community Contribution: Empowering community voices on-line. In J. Trant and D. Bearman (eds). Museums and the Web 2007: Proceedings. Toronto: Archives & Museum Informatics, `http://www.archimuse.com/mw2007/papers/alain/alain.html`
2. P. Anderson, (2007). What is Web 2.0? Ideas, technologies and implications for education, JISC Technology and Standards Watch, `http://www.jisc.ac.uk/media/documents/techwatch/tsw0701b.pdf`
3. R. Cardiff, (2007). Designing a Web Site for Young People: The Challenges of Appealing to a Diverse and Fickle Audience. In J. Trant and D. Bearman (eds). Museums and the Web 2007: Proceedings. Toronto: Archives & Museum Informatics, `http://www.archimuse.com/mw2007/papers/cardiff/cardiff.html`
4. P. Coppola, V. Della Mea, L. Di Gaspero, S. Mizzaro, I. Scagnetto, A. Selva, L. Vassena, and P. Zandegiacomo Riziò, (2005) Information Filtering and Retrieving of Context-Aware Applications Within the MoBe Framework. In Proceedings of CIR 2005 - International Workshop on Context-Based Information Retrieval, CONTEXT 2005, Paris, France.
5. P. Coppola, V. Della Mea, L. Di Gaspero, S. Mizzaro, I. Scagnetto, A. Selva, L. Vassena, and P. Zandegiacomo Riziò, (2005) MoBe: A Framework for Context-Aware Mobile Applications. In Proceedings of CAPS 2005 - Workshop on Context Awareness for Proactive Systems, Helsinki, Finland.
6. G. Crenn and G. Vidal, (2007). Les Musées Français et leurs publics a lâge du Web 2.0. Nouveaux usages du multimédia et transformations des rapports entre institutions et usagers? , in International Cultural Heritage Informatics Meeting (ICHIM07): Proceedings, J. Trant and D. Bearman (eds). Toronto: Archives & Museum Informatics, `http://www.archimuse.com/ichim07/papers/crenn/crenn.html`

7. T. De Jong, M. Specht and R. Koper, (2007). A reference model for mobile social software for learning. International Journal of Continuing Engineering Education and Life-Long Learning, 18(1), 118-138, http://hdl.handle.net/1820/996
8. B. Groen, (2007). Culture 2.0, Cultuur 2.0 Online PDF Publication, http://www.virtueelplatform.nl/download.php?id=5721
9. Y. Laurillau, and F. Paternò, (2004). Supporting museum co-visits using mobile devices. Proceedings of Mobile HCI 2004, Glasgow, Scotland, http://giove.cnuce.cnr.it/pdawebsite/publications/MobileHCI04.pdf
10. M. Middleton and J. Lee, (2007). Cultural institutions and Web 2.0. In Proceedings Fourth Seminar on Research Applications in Information and Library Studies (RAILS 4), RMIT University, Melbourne, http://eprints.qut.edu.au/archive/00010808/01/Cultural_Institutions_and_Web_2_0.pdf
11. S. Mizzaro, (2003). Quality Control in Scholarly Publishing: A New Proposal, Journal of the American Society for Information Science and Technology, 54(11):989-1005.
12. T. O'Reilly, (2005) What Is Web 2.0, Design Patterns and Business Models for the Next Generation of Software, http://www.oreilly.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html
13. B. Shneiderman (2002). Leonardo's Laptop: Human Needs and the New Computing Technologies. MA: The MIT Press. Cambridge, http://mitpress.mit.edu/main/feature/leonardoslaptop/pdf/chapter5.pdf.
14. J. Trant, (2006). Exploring the potential for social tagging and folksonomy in art museums: proof of concept. New Review of Hypermedia & Multimedia, 12(1), 83-105, http://www.archimuse.com/papers/steve-nrhm-0605preprint.pdf