



# A social capital perspective on meta-knowledge contribution and social computing

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## ARTICLE INFO

### Article history:

Received 22 May 2009

Received in revised form 16 December 2011

Accepted 22 December 2011

Available online 30 December 2011

### Keywords:

Meta-knowledge

Tagging

Tags

Social capital

Social computing

Flickr

## ABSTRACT

Recent years have seen a substantial growth of social computing, where large numbers of individual users share content with others in online communities. Social computing systems have thus led to a profusion of highly heterogeneous data, further exacerbating the traditional problems of knowledge sharing. This has made Meta-knowledge (knowledge about knowledge) important and more widely used, as it helps users locate knowledge easily. However, the reasons for people's meta-knowledge contribution in the social computing context and the extent to which this may differ from traditional knowledge contribution remain largely unexplored. This gap is addressed in the present study. Building on social capital theory, and using a combination of survey and independent system data, we explore what affects individual meta-knowledge contribution on Flickr, a popular photo-sharing service.

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## 1. Introduction

Recent years have seen a substantial growth in social computing systems [22,36] that serve as intermediaries for social relations [46], and are characterized by online community formation and user content creation [12,36]. Some of the best known social computing systems are content sites such as Wikipedia, Flickr, YouTube, social networking sites such as MySpace and FaceBook, and social bookmarking services such as del.icio.us [28,36,37]. Overall, these social computing systems are characterized by a high heterogeneity of information sources and make large amounts of information available to their users [45,54]: Wikipedia, for example, has more than 2 million entries in English alone [34], and Flickr has more than six billion uploaded photos.

This accumulation of large amounts of heterogeneous information calls for the use of meta-knowledge – i.e. “the description of additional information about pieces of data stored in a database or knowledge base” [45] – in order to facilitate the organization and retrieval of this knowledge in the repository [30,45]. Thus, the rise of social computing in recent years has been supported by increasing use of user-contributed annotation in the form of tags [9,14,28,42], which convey knowledge about the content. Tags are keywords (e.g. “lighthouse”, “Christmas”, “California”) used to annotate various types of content, including images, bookmarks, blogs, and videos [42,49], and are a form of meta-knowledge that can

significantly improve the discovery, retrieval, and understanding of relevant knowledge from the repository [45]. As tags provide knowledge about available content [14,29], organizers of content repositories often let users categorize content and share knowledge about it by tagging [9,29]. The popularity of tagging is attributed, at least in part, to the benefits users gain from effectively organizing and sharing very large amounts of information [9].

One prominent example of a tagging-intensive social computing system is Flickr, a photo sharing with over 51 million users [57]. Tagging in systems like Flickr is an important change in the way photos are organized and shared [49], as photos by themselves, despite their high information content, do not contain inherent information about what the photos represent, whereas the tags make the photos searchable by the uploading user, as well as by others [3].

While contribution of first-order knowledge has been studied, it is not clear how the results would apply to meta-knowledge contribution: when a person makes a first-order knowledge contribution by responding to a question posted on a bulletin board, or uploading a picture to a online photo-sharing community, the contribution is immediately visible and directly beneficial to other members; and the contributor has some level of certainty that her contribution will bring the reward she desired. Meta-knowledge, such as tagging, does not inherently bring any direct benefits to its audience. Although the trends and patterns emerging from a large collection of meta-knowledge in a community could be valuable information to certain parties, the immediate benefits expected by the contributor of individual pieces are achieved only when used in combination with first-order contribution. In addition, the effects of meta-knowledge contribution, while long-lasting, may not be as immediate as first-

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order contribution. While the benefits of first-order knowledge are clear to most members, how meta-knowledge contribution would benefit the contributors and others may not be clearly understandable to all members, especially novice members. For example, the content of a photo sharing web site such as Flickr benefits considerably from users adding meta-knowledge via tags especially as the first-order knowledge in this example is not easily amenable to searching.

Therefore, from both theoretical and practical perspectives, it is important to investigate the antecedents to meta-knowledge contribution. In the present study, we aim to extend the use of Social Capital theory to explain contribution of *Meta-knowledge*, rather than first order knowledge. We draw on, and extend, recent work on the criticality of the structural, relational, and cognitive dimensions of social capital, as well as individual motivations as the starting point to investigate meta-knowledge contribution in online communities. Extending the qualitative work of [3], the present study contributes to the information systems literature on social capital by developing a framework in which the latter helps to understand a fast growing IS-facilitated phenomenon – social computing. Specifically, the findings make it possible to compare the relative strength of meta-knowledge contribution' antecedents, and suggest that meta-knowledge contributors are primarily socially driven.

## 2. Literature review

### 2.1. Meta-knowledge

A number of scholars have discussed the differences between knowledge, information and data (e.g., see [1,2,53]). Meta-knowledge, as the prefix *meta* implies, is knowledge about knowledge. Although it is generally conceptualized as some form of second-order knowledge that exists at the level above first-order domain knowledge, the manifestation of meta-knowledge varies from different perspectives. From the philosophical perspective, meta-knowledge refers to “knowledge that deals with the very nature of knowledge and knowing” [35](pp 7). A more strict view of meta-knowledge considers it as knowledge of (the existence of) knowledge, or “knowledge (awareness) about the knowledge you possess” [8] (p. 222); in other words – *knowing that I have specific knowledge*. This conceptualization of meta-knowledge, analogous to what Socrates considered as wisdom, dates back to Plato; and it has been shown to be critical to knowledge retrieval for individual human beings (e.g., [58]). Some researchers take the learning perspective, and consider meta-knowledge as knowledge of the ways to produce knowledge [35], in other words – *knowing how to gain specific knowledge*.

Another view of meta-knowledge, popular among computer scientists (e.g., [30,45]), considers it as knowing the relevant contextual information of first-order knowledge; in other words – *knowing what specific knowledge is about*. For example, while a picture of the Home Insurance Building at the turn of the 20th century is first-order knowledge, knowing this piece of knowledge is about “history”, “Chicago”, “architecture”, “first skyscraper”, “steel frame”, and “William LeBaron Jenney” would be meta-knowledge. At the implementation level, this form of meta-knowledge can be codified, stored, and queried as metadata (e.g., [48]). For our purpose, we adopt this view of meta-knowledge, and as we will discuss in the next section, content annotations has been identified as a powerful representation of this form of meta-knowledge.

### 2.2. Meta-knowledge in knowledge repositories

The advance in computer technologies has enabled large scale electronic knowledge repositories in the past few decades. Such knowledge repositories are often characterized by a high heterogeneity of information sources and large volume of knowledge pieces

deposited [45]. In addition, as we have discussed in the introduction, the rising of the Internet and social computing services has enabled many Web based knowledge repositories with millions of users serving as individual contributors. For such electronic knowledge repositories, meta-knowledge, or “the description of additional information about pieces of data stored in a database or knowledge base” [45], could play a valuable role in facilitating the organization and retrieval of knowledge in the repository [30,45].

As the importance of meta-knowledge is being understood, meta-knowledge management has become a critical aspect in designing electronic knowledge repositories. While some developers rely on computer algorithms to scan and annotate contents, especially, non-textual contents such as videos, audios, and images (e.g., [4,17,31]), many have recognized user-contributed annotations (tags) as a form of meta-knowledge that can significantly improve the discovery, retrieval, and understanding of relevant knowledge from the repository [45]. In fact, using annotations as a tool for communicating ideas and sharing knowledge was popular among scholars during the medieval times, and has seen renewed significance in computer supported collaborations [56]. Using the example from the previous section, a user who is studying the Chicago School of architecture would be much more likely to find the picture as a relevant knowledge piece from the repository when it was properly annotated with “Chicago” and “architecture”; and the additional annotations such as “first skyscraper”, “steel frame”, and “William LeBaron Jenney” would help her to better understand the relevance and significance of this knowledge piece.

### 2.3. Outcome expectations, social capital, and knowledge contribution

Given the value of user generated meta-knowledge to an electronic knowledge repository, user motivation to contribute meta-knowledge is a vital yet underexplored issue. Sustained participation and contribution from individual members is critical for the viability of a social collectivity, especially, a computer mediated virtual community [10]. Research has identified individual beliefs that motivate contribution of first-order knowledge contributions in electronic networks of practice [10,27,55]. Consistent with the expectancy-value tradition of predicting human behavior, contributions generally follow individuals' expectations of favorable outcomes from their contributions, such as reputation enhancement in the professional community, or being helpful to others [55]. Chiu and colleagues [10] also suggest that individuals are motivated to contribute knowledge to a virtual community by their expectations for beneficial outcomes for themselves and the community. These expectations alone, however, do not fully capture the influence of the social network on user contribution in a virtual community. As [10] have pointed out: “why do individuals spend their valuable time and effort on sharing knowledge with members in virtual communities, should be addressed from the perspectives of both personal cognition and social network” (p. 1875).

As knowledge contribution is an action performed in social contexts, the construct of social capital has emerged as key to understanding individual knowledge sharing in recent literature [6,18]. Social capital refers to the collective resources emerging from and embedded inside a social network, as a result of the interconnected relationships of its members [32,40]. It represents the contacts and social ties members form over time, and the gratitude, respect, trust, and friendship they have toward each other. It is considered a resource critical to a social community's functioning and survival [32]. At the individual level, the connections and reputation a specific person built within a social collectivity also lead to the social capital he or she acquired by being a member. Such individual level social capital represents the resources a specific member can tap into and benefit from as a member. Therefore, [32] defined social capital as “the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit” (p. 243).

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