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Folksonomies: Meaning, Discourse, and Information Retrieval

Abstract:
This paper explores the potential usefulness of user-generated folksonomy tagging in an academic electronic resource collection. A hermeneutic conception of meaning is applied to information retrieval (IR) technology, which emphasizes the understanding of IR systems as mechanisms for communication. The results of a survey exploring undergraduate tagging behavior are discussed.
Résumé:

Introduction

The growing popularity of social bookmarking and resource sharing websites such as Delicious and Flikr has introduced web users to the utility of folksonomy tagging for the organization of information. Systems supporting folksonomy tags allow users to create descriptive tags in order to describe, index, and share resources among a community of users. The potential application of folksonomy tagging in electronic resource collections has implications for the conceptualization of information retrieval (IR) technology in academic libraries. The development of IR methods in libraries has grown out of various assumptions of meaning and knowledge. The assumption that the meaning of a text or information package is basically fixed and objectively determinable has important implications for the development of new IR methods, as well as implications for abstracting, indexing, and classification methods.

This paper will examine theoretical assumptions that underlie IR and the subject indexing of documents, including the assumption of the existence of an objective and knowable reality. These assumptions are part of a larger conceptual framework influenced by positivism that has informed the design of IR systems. A hermeneutic conceptualization of interpretation challenges these foundational assumptions by re-imagining the relationship between the user and retrieval. This hermeneutic perspective facilitates the analysis of the potential application of folksonomy tagging in an academic electronic resource collection.

Information Retrieval and Meaning

Cornelius (1996) argues that within the social sciences, and in library and information science in particular, "the lure of science remains strong" (p. 9). The belief that using scientific methods can eradicate falsehoods and reveal objective Truth holds great appeal for information scientists. The lure of science can be linked conceptually to the lure of positivism within information science. Positivism contends that all meaningful statements are either statements of logic or mathematics, or are statements of fact (Cornelius, 1996). The latter form, statements of fact, must be empirically confirmed. According to positivists, statements that are found to be false, or cannot be confirmed, are

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essentially meaningless. This approach holds particular appeal for IR development, which has been largely influenced by computer science. The tendency to associate IR with the methods of empirical science is reflected in Korfhage's (1997) textbook *Information Storage and Retrieval*, which states, "There is a *reality* independent of the individual human observer, that is, a reality that is basically the same for everyone" (p. 2). Korfhage goes on to argue that there are essentially two portions of reality: one portion that "corresponds to the physical world," and a second portion that "is more abstract, consisting of the concepts that underlie mathematics, music, art, and other areas of knowledge and study" (p. 2). The reduction of all reality to physical phenomena, or statements of fact that can be empirically confirmed or disconfirmed, on the one hand, and the *concepts* (or underlying logic) of scholarship on the other, illustrates the positivist foundation of Korfhage's view of IR. This view assumes that every user basically operates under the same paradigm, and that the vast majority of reality is communicable.

Another illustration of the manifestation of positivism in IR is found in what Barry Smith (cited in Fonseca and Martin, 2005) refers to as the "Tower of Babel" problem. The Tower of Babel problem describes the dilemma of constructing a database that is accessible to users operating under distinct conceptual paradigms. Parsons and Wand (2000) describe this problem as the *view integration problem*, where database engineers attempt to reconcile the different conceptual schemas of a large user population. Designers may attempt to follow a utilitarian scheme by constructing a database that confers the greatest access to the greatest number of conceptual paradigms, but designers will ultimately be forced to conform to a single ontology of what types of things are held within the database, and how they are to be classed (Parsons and Wand, 2000). Any solution that attempts to preemptively imagine the perspectives of discrete paradigms will be at best incomplete, and is ultimately incompatible with the technological imperative to conform to a single ontology. Fonseca and Martin describe the positivist objection to this problem: even if this problem existed, the positivist argues, it can be solved by ruling out ontological differences altogether; all users *ought* to be of one mind anyway. Fonseca and Martin term this solution the "Newspeak Solution", referring to the Orwellian prospect of forcing users to conform to a particular paradigm in order to interact within a particular database or databases generally. The forced reduction of the plurality of conceptual paradigms to a single paradigm would require a vast project of standardizing the language of description that may require an unacceptable degree of hierarchical authority (Fonseca and Martin, 2005).

The problem with positivism, argues Cornelius (1996), is the assumption that facts can be verified from within a theoretically neutral space. Korfhage's (1997) statement that "there is a reality independent of the human observer" (p. 2) leads to the prospect that if this independent reality can be *known*, then its Truth may be incontrovertible if discovered using the true and correct method. In this view, the only right method that can be used must begin from a theoretically neutral place, a place firmly grounded in the objectivity of science. Korfhage (1997) summarizes this position with his definition of knowledge: "Knowledge builds upon information, integrating any new information with that previously known to form a large, coherent view of a portion of reality" (p. 9). As Kuhn (1962) has argued, this view is problematically ahistorical, ignoring the effect that time and intellectual change has had on our understandings of meaning. The assumption that knowledge builds upon itself in a linear sense arises from the privilege of hindsight. This privileged position allows us to imagine a linear history of inquiry that has provided the foundation for the intellectual progress that continues today. As Rorty (1979) states,

> This need to say that talk about something we don't recognize is 'really'
> talk about something we do recognize used to be gratified by simply
> assuming (in 'Whiggish' fashion) that our misguided ancestors had
> 'really' been talking about whatever our best-approved contemporary
> inquirers claimed that they were talking about. (p. 268)

For example, was Aristotle *really* talking about gravity when he spoke of natural downward motion? According to Rorty and Kuhn, this is the wrong question, and it reveals a tendency of positivism to assume that the history of inquiry has tapped into the same objective reality that only science can reveal. The assumption overlooks Aristotle's vastly different cultural and intellectual paradigm, and it discounts the possibility that the questions and conclusions Aristotle came to might *mean* very different things when examined contextually.

Critically examining the assumptions underlying Korfhage's explanation of IR poses important questions for the development of new IR technologies. As the Tower of Babel problem illustrates, conceiving of IR development as a field of study in which facts and meaning can be verified through empirical testing does not encourage the kind of large-scale interaction that facilitates the communication between and among different paradigmatic frameworks (Fonseca and Martin, 2005). Korfhage's positivist assumptions do provide useful guidelines for query-matching and Boolean logic-based IR technologies. However, new technologies are emerging within the free web that represent a more inclusive and social view of indexing, organizing, and retrieval. These new technologies include folksonomy tagging and tag clouds.

Toward A Hermeneutic Understanding of Information Retrieval

Rather than addressing the Tower of Babel problem with problematic "Newspeak" solutions, Fonseca and Martin (2005) argue for abandoning the questions aimed at integrating ontologies and begin looking for solutions that bring diverse users together to resolve systematic problems with retrieval. Fonseca and Martin advocate recognizing that "databases are mechanisms for communication involving judgments and interpretations by intelligent and knowledgeable users" (p. 46). The conception of databases as *mechanisms for communication* implies that using a database is a two-sided, interactive enterprise. This conception of database interaction differs significantly from Korfhage's view, which centers upon users extracting documents from a database to satisfy a preconceived information need. Korfhage's view is one-sided: the user enters a query, and documents that have already been indexed by designated authorities are returned, perhaps weighted by a mathematical interpretation of relevance based on term weight. In Fonseca and Martin's view, databases serve user needs best when they mirror a conversation rather than linear document delivery. Fonseca and Martin's position, in contrast to Korfhage's positivism, is a hermeneutic view.

A significant challenge to a positivist construction of IR is what Wittgenstein describes as the Paradox of Ostensive Definition. An ostensive definition can be defined as explaining "the use – the meaning – of a word when the overall role of the word in language is clear" (Stern, 2004, p. 94). The Paradox of Ostensive Definition, which is related to the Tower of Babel problem, states, "an ostensive definition can be variously interpreted in every case" (Stern, p. 92). This paradox reveals a problem with the positivist assumption that only those things that can be empirically verified have meaning. For query matching

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systems, the Paradox of Ostensive Definition reveals the incompleteness of the technology to interpret the user's intentional meaning. Such systems may inadequately respond to problems such as polysemy, where a single word may have multiple meanings.

Wittgenstein argues that an underlying impediment in solving the Paradox of Ostensive Definition is that in order to understand the meaning of terms, we must know the place of the term within the whole of the language to which it belongs. Wittgenstein's chess example illustrates this problem: if one points out a piece on a chess board and states 'this is the king,' such a demonstration only has meaning if I understand the role of the king piece in the game (Stern, p. 94). The phrase 'this is the king' presupposes knowledge of the rules of the game; knowing that a particular piece is the king has much less meaning if I am ignorant of what the king is *in relation to the other pieces*. The conclusion of the chess example can be extrapolated to meaning within language: to understand the ostensive definition of 'orange cat', we must first know a) that orange is a color, b) that in this phrase, color is used as an adjective to describe the noun that follows, and c) that 'cat' is a type of animal species and *not* a color or other category in this case. The problem underlying ostensive definitions is that they presume a great deal of knowledge of the whole of language, as well as how different types of words function within the whole.

Authority controlled vocabularies, such as Library of Congress Subject Headings (LCSH), provide a successful model for the contextualization of descriptors by employing carefully constructed subdivisions. However, while controlled subject headings serve a crucial role in IR, these headings are often difficult to search by novice users constructing natural language queries. Wittgenstein's Rule Following Paradox (Stern, 2004) illustrates that knowing all of the rules of a language does not guarantee understanding because all rules are subject to interpretation. As the Rule Following Paradox asserts, "A rule can be variously interpreted in *every* case" (Stern, p. 119). Returning to the chess example, knowing the rules of the game does not allow us to function in abnormal situations such as an unfamiliar board configuration. The potentially endless possibilities of how the player can move the king, given the extensive variety of ways the game can progress, cannot be encompassed by a single rule. Even if the rule governs the conditions under which the king can be moved, and where it can be moved in relation to other pieces, the context under which we obey the rule vary so widely that we may interpret the meaning of the rule under varying conditions as having multiple meanings. As Stern points out, "there can be no guarantee that the next case will not be abnormal" (Stern, 2004, p. 147). The Rule Following Paradox illustrates that conditions may vary so extensively that a rule may not be applied in the way it was intended by the formulator. Could the solution be to provide a more complete, and more stringent, definition of what the game is? Wittgenstein argues that no explanation can ever be sufficient:

> How should we explain to someone what a game is? I imagine that we should describe games to him, and we might add: 'This and *similar things* are called 'games''. And do we know any more about it ourselves? It is only other people whom we cannot tell exactly what a game is? But this is not ignorance. We do not know the boundaries because none have been drawn. (Stern, p. 116)

The statement that "we do not know the boundaries because none have been drawn" forms the crux of the connection between Wittgenstein's discussion of language and its application to IR. The positivist asserts that meaning is fixed; that knowledge doesn't change but rather, in Korfhage's words, "builds upon information...to form a large, coherent view of a portion of reality" (p. 9). This assumes a positive trajectory of progress whereby the foundational information never changes, but where new information merely builds upon old information. Wittgenstein's position, which is a hermeneutic position, argues that the foundations cannot be trusted, and that the foundations we build upon are always subject to radical change. This corresponds to a Kuhnian view that the history of science has not been continually progressing toward inevitable conclusions, but rather that the paradigms under which the scientific mind operates shift to whichever understanding works better *at our present moment*. The attachment to the idea of progress, as Rorty argues, encourages the assimilation of old ideas into our present paradigm. This assimilation maintains the impression that the history of inquiry has *always* been investigating the same phenomena, and that we are getting closer to the scientific Truth that governs that phenomena. Wittgenstein argues that the rules we construct to explain how our world functions are always open to interpretation; thus even carefully controlled, contextualized subject headings are vulnerable to both misinterpretation and gaps in description. Our interpretation is therefore unreliable, as the boundaries that govern meaning have not been brightly drawn.

The potential application of hermeneutics to IR is revealed in Wittgenstein's assertion that the boundaries of the language game have not been drawn, and that we cannot assume that the meaning of documents or information packages is fixed. This assumption, however, has been argued as the primary business of librarians. As Peterson argues, "the cataloger aspires to be the unbiased professional, making cataloging decisions and without the interference of personal interpretations" (Peterson, 2008, p. 1). As Peterson maintains, "perhaps the most important philosophical underpinning of traditional classification is the phrase, "A is not B" (Peterson, 2006, p. 2). Peterson (2006) also minimizes any obligation for controlled indexing to explore the relatedness of concepts: "Book A might be related to Book B, but a choice has to be made between them when classifying them. Classical cataloging is restrictive rather than expansive" (p. 2). While this type of indexing is crucial to ensuring explicitly related records can be retrieved consistently, the paradoxes of Rule Following and Ostensive Definition indicate a need for some expansive descriptive indexing. This type of expansive indexing would encourage subjective description (while explicitly acknowledging its subjectivity) and provide a space for developing shared interpretations through communication and the exchange of ideas.

As with Wittgenstein's chess example, the meaning of an information package is *beyond itself*. There is more meaning within a text than the topics it considers or its plot; this is why records are used for *document* retrieval rather than *information* retrieval (Taylor, 2004). Extracting keywords from a document is an important part of indexing, but it may not provide the whole picture of the 'aboutness' of a document. As Taylor (2004) points out, ambiguities of meaning are not to be attributed "to a failure of controlled vocabulary. It is a failure of individuals to determine the same 'aboutness'" (p. 246). The problem of ambiguity of meaning occurs at the level of interpretation rather than the level of assigning differing indexing terms. It is not that we cannot find the best terms to use to describe the meaning of the document; it is that any single meaning may not be sufficient to describe the range of subjective interpretation. As Riceour (1976) writes, "The text as a

whole and as a singular whole may be compared to an object, which may be viewed from several sides, but never from all sides at once" (p. 77).

Peterson (2006) argues that maintaining the *goal* of neutrality is a significant reason to prefer controlled classification; that is, the fact that catalogers attempt to remove their personal preferences and consider both authorial intent and the needs of information seekers makes controlled classification preferable. A pragmatic hermeneutic perspective would not be troubled by the assertion that the particular viewpoint of the cataloger is *useful*; rather, the hermeneutic perspective would argue against accepting that traditional classification is (or can be) *objective* or neutral. The weakness of positivism lies not in accepting a particular useful rule; it lies in defending those rules as immutable.

Folksonomies and Hermeneutic Classification

If library science is to resist the lure of positivism, how can a hermeneutic view be functionally put into place? One interesting manifestation of the hermeneutic stance in IR is the development of folksonomy tags and tag 'clouds'. Tags consist of either single- or multiple-term descriptives that may be created by multiple users. Jessica Dye (2006) identifies two categories of folksonomy: broad folksonomies, where third parties assign tags to the same content, and narrow folksonomies, where users tag self-created material so that it is easier to find. Broad folksonomies, according to Dye, can be referred to as *social classifications*, "since seeing what other users are thinking about is as much a part of the site as finding what you need. The richness and participation of the communities around these folksonomies are, in large part, what fuels interest in them" (p. 40). Broad folksonomy systems are evident on sites such as Delicious, through which users can tag bookmarked web material. Narrow folksonomies are implemented on sites like Flikr, a social photo-sharing website. On Flikr, users may upload their own images and tag them based on their content or their context (when/where they were taken, etc.) Tag clouds display tags using a ranked visual; popular tags are displayed as larger relative to less-popular or rarely used tags. As Sinclair and Cardew-Hall (2004) argue, "In essence, the tag cloud translates the emergent vocabulary of a folksonomy into a social navigation tool" (p. 16). Tags are typically hyperlinked, much like controlled vocabulary systems in OPACs and other electronic resource systems, so that a user can click on a tag in a tag cloud and navigate to a list or grouping of articles that are similarly tagged.

Sinclair and Cardew-Hall (2004) evaluated the effectiveness of tag clouds for IR by studying a group of first-year college engineering students as they tagged articles and navigated tag clouds for IR. The students were instructed to engage with a retrieval system in which 70 of the most popular user-supplied tags for a data set were displayed in a tag cloud, with popularity correlating to size of the displayed tag text. Sinclair and Cardew-Hall found that a majority of the students used the tag cloud to answer a set of general and specific questions. By analyzing the 'last-strike query' data, or the last links from which the users were able to retrieve answers, Sinclair and Cardew-Hall also discovered that for six out of ten questions, users preferred a search box. Users tended to prefer browsing with the clickable tags in the tag cloud to answer questions that were general, while preferring to enter queries into the search box for more specific searches. Sinclair and Cardew-Hall conclude that "tag clouds support browsing or serendipitous discovery" and note that others have found this functionality with folksonomies in general (p. 23). When the query is more specific, however, users tend to prefer search boxes.

Sinclair and Cardew-Hall (2004) argue that the user behavior illustrates a difference between "browsing" and "finding". Although in exit surveys, participants stated a preference for the search box overall, many participants also mentioned that familiarity with the search box and how to use it made it more preferable. Participants also mentioned that the tag clouds did not require as much "work" to formulate a search query when retrieving documents from the system. As one participant put it, "When you want to search something but you don't know where to start, using tags are the right way to start" (p. 26). Sinclair and Cardew-Hall note that this aspect of tag use may be helpful for students for whom language may be a barrier to document retrieval, as tags provide an immediate "jumping-off" point for conducting research.

Serendipitous discovery of the type Sinclair and Cardew-Hall (2004) discuss may also occur with the use of controlled vocabulary. However, controlled vocabularies may not be representative of the various conceptual schemes of users, who may operate with varying levels of precise or technical vocabularies. In addition to the problem of language barriers mentioned by Sinclair and Cardew-Hall, author-supplied keywords, which may be highly relevant to the article but difficult for a user to generate when forming a search query, also contribute to the limitations of controlled vocabulary. As Cornelius (1996) notes, traditional classification has always faced the difficulty of managing "the constant need to accommodate new branches of knowledge within structures of existing schemas" (p. 131). Cornelius argues that as professional information managers, librarians continue to juggle the demands of encouraging scholarly discourse while balancing the needs of a larger social community. With folksonomies, it may be possible for librarians to better answer to the needs of a larger social community, or perhaps for users to take a portion of the responsibility of organizing knowledge and engaging in productive discourse. It remains unclear, however, if placing this responsibility on the user would aid in information organization or harm retrieval precision by creating irrelevant or misleading classification schemes. While the participatory benefits of folksonomies may be apparent, the *usefulness* of folksonomies to aid retrieval remains a central question.

If library and information science is to adopt a hermeneutic, interpretive stance with regard to classification and IR, folksonomies offer a great deal of appeal. The fundamentally social nature of broad folksonomies allows users to classify information packages according to their own perspectives and experiences, but also to engage with the perspectives of others. This type of engagement is less strictly hierarchical, and contradictory tags are allowed to coexist. However, tag clouds provide slightly more structure by displaying tags according to their relative popularity. Tags assigned by more users appear larger (and thus potentially more heavily weighted for retrieval) in the tag cloud display. This type of display reflects the premise that many users may find agreement on *central* themes of a text, while peripheral meanings may be more varied – but are nonetheless important to users who have different readings and interpretations of the information package.

Research Question

The hermeneutic support for folksonomy tagging and tag clouds requires an examination of how users derive tags from documents and what those tags contribute to the shared discourse tags are intended to promote. Full-text search capabilities found in many electronic resource collections reduces the importance of keyword identification. In other

words, identifying key terms already present within the text does not significantly provide additional support to existing retrieval technology. However, tagging may have the potential to improve retrieval by contributing to term weighting, which can be organized visually into tag clouds. Tagging may also provide unique words and phrases that supply additional access points for searchers if tag clouds were searchable. Although Sinclair and Cardew-Hall's (2004) research indicates a strong preference on the part of searchers for search boxes, it remains unclear whether searchable folksonomy tag clouds would alter retrieval significantly enough to warrant inclusion in electronic resource collections. In order to address these potentialities, the research question in this study seeks to discover 1) what proportion of user-generated tags are repeated by more than one user, thus enabling term weighting, and 2) what proportion of user-generated tags are original words or phrases that do not appear in the original article text, thus providing additional access points to the resource?

Methods

An author-developed survey was distributed to undergraduate students enrolled in an Information Use class at the University of Missouri. The students represented a variety of major concentrations and degree progress. The survey asked students to read a short news article describing the discovery of a vitamin D receptor gene that had recently been linked to reduced melanoma risk (ABC/Reuters, 2008). After reading the article, students were asked to write as many tags as necessary to describe the article. The students were told that such tags should be considered to enhance the "findability" of the article. 197 surveys were collected listing a total of 1,199 tags, with each user supplying 6 tags on average to describe the article. The tags were then queried in the original full text of the article to simulate a query-matching database search. The queries were run to match all words in the tag.

A hermeneutic approach was undertaken to gather descriptive data relating to the types of tags users assign to an individual article. This approach emphasizes Guba and Lincoln's (1989) assertion that "Truth is a matter of consensus among informed and sophisticated constructors, not of correspondence with an objective reality" (p. 44). In other words, the validity of description is dependent upon discourse within a community of constructors. With this conceptualization of truth in mind, folksonomy tags are analyzed in relation to the words and phrases in the text and in relation to other folksonomy tags. As such, the tags will be primarily evaluated for how often the tag appears in the original article (if at all) as well as how often other users assign the tag. The proportion of novel tags (tags that do not appear in the original article) to derived tags (tags that appear in the original article) is of special interest.

Data Analysis

Out of 1,199 tags, 769, or 64% consisted of words or phrases derived directly from the original article. These 769 tags yielded 86 distinct derived tags. Of the 86 distinct tags, 53 or 62% yielded a relative term weight greater than 1.00. Relative term weight was calculated by the number of users who supplied the tag divided by the number of times the word or phrase actually appears in the article. Table 1 shows the top ten tags based on relative term weight. Column B shows the number of times the tag was assigned by

students, and Column C shows the number of times the term appeared in the original article.

A	B	C	D
Tag	*User Assigned*	*Original Article*	*Relative Weight*
Skin cancer	65	1	65
Vitamin receptors	36	1	36
Sun exposure	22	1	22
American cancer society	15	1	15
Genetics	15	1	15
Melanoma risk	29	2	14.5
Boosting vitamin D	13	1	13
Vitamin D	105	11	9.54545455
Receptor gene	27	3	9
Vitamin D and melanoma	9	1	9

Table 1 – Top ten tags appearing in original article organized by relative term weight

The top 25 tags based on absolute tag frequency (the absolute number of times a tag word or phrase was assigned by users) appear in Table 2. In Column D, tags with no applicable relative weight consist of words or phrases not found in the original article.

A	B	C	D
Tag	*User Assigned*	*Original Article*	*Relative weight*
Melanoma	111	14	7.928571429
Vitamin D	105	11	9.545454545
Skin cancer	65	1	65
Vitamin receptors	36	1	36
Cancer	36	5	7.2
Melanoma risk	29	2	14.5
Receptor gene	27	3	9
BsmI	24	4	6
Sun exposure	22	1	22
Gene	19	11	1.727272727
American Cancer society	15	1	15
Genetics	15	1	15
Boosting vitamin D	13	1	13
Vitamin D receptors	11	0	N/A
Dr. Donato Nitti	10	0	N/A
Dr. Simone Mocellin	10	0	N/A
Genes	10	0	N/A
Receptor genes	10	0	N/A
UV rays	10	0	N/A
Vitamin D and melanoma	9	1	9
Vitamins	9	1	9
BsmI variant	9	2	4.5
TaqI	8	1	8
FokI	8	2	4
Receptor	8	7	1.142857143

Table 2 – Top 25 tags derived from original article organized by number of times assigned by user

Figure 1 is a tag cloud display of the top 25 tags based on absolute tag frequency. More frequently assigned tags appear larger than less frequently assigned tags.
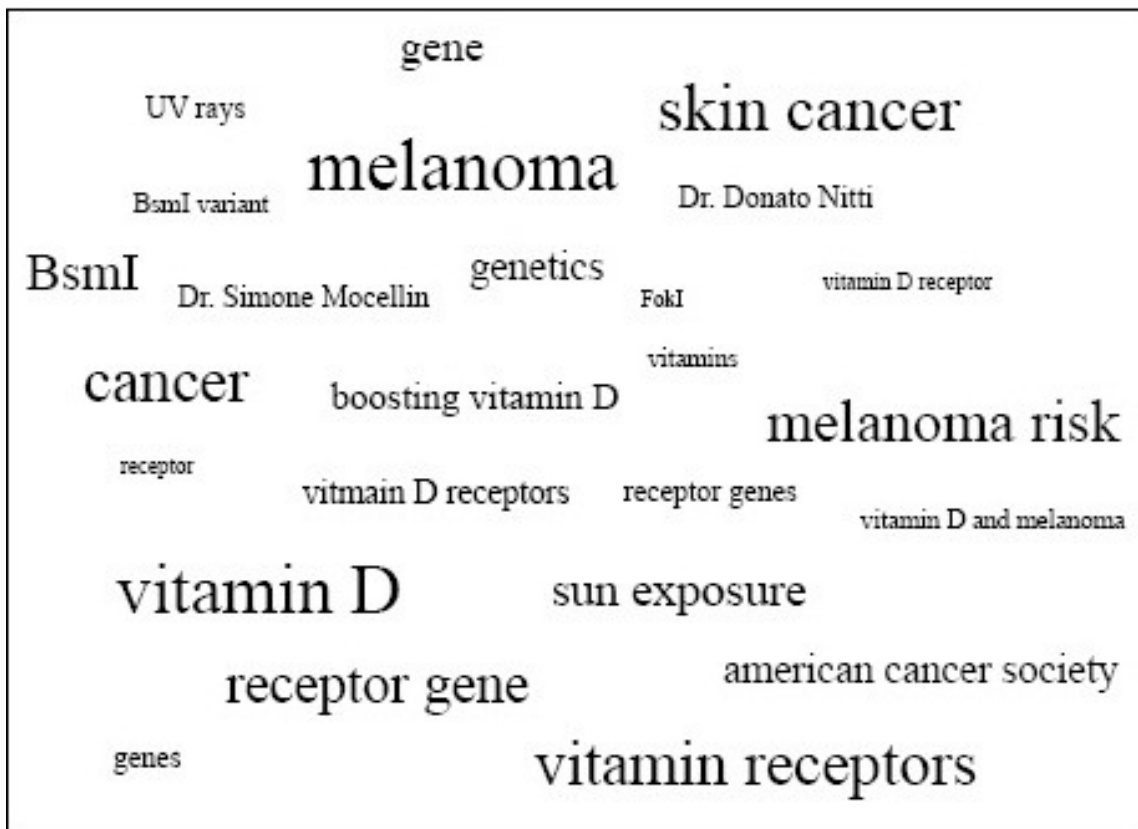
Figure 1 – Top 25 tags by number of times assigned by users in displayed in tag cloud

Novel tags (which are tags consisting of words or phrases not found in the original article) comprised 36% of all tags assigned by students. Of the 430 novel tags assigned, 39 distinct tags were assigned by more than one student. Table 3 shows the top ten novel tags by number of times assigned by students. Dr. Donato Nitti and Dr. Simone Mocellin are researchers mentioned in the original article using the prefix "Dr" with no punctuation.

A	B
Novel Tag	*Assigned by Users*
Vitamin D receptors	11
Dr. Donato Nitti	10
Dr. Simone Mocellin	10
Genes	10
Receptor genes	10
UV rays	10
Sun exposed skin	5
UV light	5
Causes of skin cancer	4
Gene variants	4

Table 3 – Top 10 novel tags organized by number of times tag assigned by users

The set of novel tags includes 26 misspelled words, one hyperlink leading to a related source, and one Boolean logic phrase.

Discussion

The data indicate that while the majority of students assign tags based upon the original text of the article, the majority of those tag terms are weighted much more heavily than the term weights in the original text of the article. Allowing users to search tag fields would therefore provide an opportunity for users to retrieve different sets of results or differently ranked results based on relevancy. Novel tags, which are tags users constructed outside of the text of the original article, provide a different benefit: a significant increase in the access points of a given article. Within the set of novel tags, 190 tags were distinct, or 16% of all tags assigned in the survey. Those tags could potentially provide 190 new query matches to access the original article, or provide new hyperlinked pathways to related material. Even misspelled tags, which may be removed in some tagging systems, could aid in retrieval for documents featuring frequently misspelled words.

Two examples in the data stand out as particularly illustrative of the potential utility of tagging and tag clouds. The first is the tag for "skin cancer," which is only mentioned once in the article but was tagged to describe the article by 65 students, or 32% of the sample population. Performing a full-text search in a database using the query "skin cancer" might result in a much different ranking of the original article in a relevance-ranked results list than would a search of tag fields. Although more students assigned the term "melanoma" than the term "skin cancer," "melanoma" actually had a lower relative term weight than "skin cancer" due to the higher term density of "melanoma" in the original article. The strong identification of the term "skin cancer," despite its low rate of occurrence in the original text, indicates that many students are interpreting and relating the meaning of the text to their personal experiences and vocabularies when assigning tags. This is consistent with the hermeneutic argument that "meaning is negotiated mutually in the act of interpretation; it is not simply discovered" (Schwandt, 2003).

The second example is found more obscurely in the data, but is illustrative of the same principle associated with the "skin cancer" tag. The tags "tanning" and "tanning positives" each appear once within the novel tag set. The original article does not directly discuss recreational tanning for aesthetic purposes, but these tags further illustrate how students are interpreting the article in a way that might improve findability for themselves as students and searchers. In this instance, the application of the tags related to tanning demonstrates the potentiality for folksonomy tags to provide better retrieval of works that have peripheral meanings relevant to student research. Relating the article's discussion of skin cancer to tanning also demonstrates how the age, cultural experiences, and possible gender and geographic location of the user may influence the lens through which the article is interpreted. The relationship between user characteristics and tagging behavior may be an important area for future research.

The ability of folksonomies to include these peripheral meanings as access points may improve retrieval of relevant materials linked by peripheral meanings. Moreover, the weighting of tags based on tagging frequency provides a limitation on the potential expansion of irrelevant or misleading tags. Figure 2 illustrates that less frequently appended tags (which appear smaller in the display) are largely spelling or phrase variations of more popular tags. Highly specific terms such as "BsmI" and "TaqI," which are specific vitamin D receptor gene variants discussed in the original article, also rank lower. By organizing relevance of searchable tag fields by the number of times users have assigned the tag, the potential for poor retrieval precision is reduced. Tags that may

be vague, confusing, or misleading may be tagged with less frequency than terms that a larger percentage of readers agree on. Indeed, misleading descriptors were found among the least popular tags (in this case, tags supplied by only one student) including the tags "vitamin D cures cancer" and "sun is good for you". However, the unpopularity of these tags, and subsequent low keyword weight, contributes to their low potential to harm retrieval precision. From the perspective of the novice searcher, however, a natural language search using a query similar to the tags above may provide an access point to this article that was not present before. It is conceivable that though a query matching the tag phrase "vitamin D cures cancer" is potentially rare, the article does report on the relationship between vitamin D and cancer and a user may find this result relevant to such a query. As Ricoeur (1976) notes, "if it is true that there is always more than one way of construing a text, it is not true that all interpretations are equal" (79). Tag clouds and tag frequency weighting illustrates that all folksonomy tags do not need to be weighted equally for retrieval, but that consensus among users can aid in implementing tags as a viable and useful retrieval aid.

Ricoeur (1976) concludes, "the sense of a text is not behind the text, but in front of it" (p. 87). Traditional cataloging has sought to get *behind* the text, to extract its fundamental hidden meaning so that when users seek that meaning, it can be found easily. But there are many meanings within a single text, and those multiple meanings are important with respect to how that document may be retrieved and used. Folksonomies provide a method to transform cataloging into a *dialogue* that incorporates an ongoing conversation into the way meaning is used in document retrieval. A hermeneutic perspective recognizes that a document is more than the topics it discusses, but it is also much more than the sum of its words. By inviting a variety of perspectives to examine a work, folksonomy tagging avoids the restrictive nature of the cataloger's summary while engaging the "muteness" of the text into a dialogue (Ricoeur, 1976).

As Taylor (2004) points out, "in the cataloging of books and serials in libraries, the cataloger generally has attempted to find the one overall subject concept that encompasses the whole item. Depth indexing…has usually been done by commercial indexing enterprises" (p. 250). Taylor further explains the distinction between document retrieval and information retrieval, and demonstrates that summarization rarely extends beyond document retrieval. Summarizing terms often direct users to resources based on major themes, whereas depth indexing leads to the retrieval of smaller, more specific units of information. With electronic resources, depth indexing becomes easier to achieve, due to full-text searching that can locate individual words or phrases quickly and thoroughly. As Taylor argues, "Depth indexing is likely to increase precision because more specific terminology is used. Summarization is likely to increase recall because the search terms are broader and more sweeping in their application of terminology" (p. 251). As academic institutions continue to expand electronic resource collections, libraries "will have to think carefully about summarization versus depth indexing" (Taylor, p. 251). Folksonomies may provide an intermediary link between summarization and depth indexing by providing a forum in which varying levels of analysis, perspectives, and paradigms can be used to index a work.

Within a system of folksonomy tags, the user has the opportunity to contribute to the system of information from which documents are retrieved. Information is not isolated in packages but part of a larger conversation in which the user can take part. The 'one-sidedness' of reading, with the participatory potential of the folksonomy tag, is diminished; a dialogue among information seekers is encouraged, and retrieval may be

improved for novice users employing natural language searching. As Fonseca and Martin (2004) have argued, the ability to view databases as mechanisms of communication or as a multi-sided enterprise can improve retrieval by providing a virtual space in which multiple paradigms and perspectives congregate to seek information.

Conclusion

I have argued that folksonomies may provide one kind of solution to the problems of meaning and interpretation that positivism encounters within library and information science. The Tower of Babel problem and Wittgenstein's Paradox of Ostensive Definition reveal the difficulty traditional classification and IR systems have with responding to user queries and information needs. The positivist answer to this problem might focus on improving or updating controlled vocabulary ontologies or otherwise focusing on information management solutions, while the hermeneutic solution seeks to expand the population of interpreters by utilizing folksonomies. In addition to facilitating browsing and serendipitous discovery, folksonomies also serve as forums in which users may participate in information management and contribute new perspectives and interpretations. Wittgenstein's assertion that the boundaries of meaning have not yet been drawn applies directly to the problem of controlled classification: such classification schemes assume strict boundaries of meaning; when those boundaries do not, and perhaps should not, exist.

Further research may examine the characteristics of user communities and differences in tagging behavior between students, faculty, librarians, and other members of academic communities. Future studies might also explore the usefulness of organizing tags based upon the group affiliation of the tagger. By categorizing the identities of taggers, searchers may be able to search tags only assigned by faculty members or by students in a particular degree program. Institutional repositories, which organize research produced by members of particular university communities, may provide powerful sites for the implementation of folksonomy systems and for further testing of their impact on retrieval. As locally managed systems, institutional repositories can create folksonomy systems that best respond to the particular information needs of the user communities they serve.

Folksonomies have the potential to illuminate connections between and among the scholarly record by bringing together a social community of users operating under diverse paradigms. Folksonomy systems respond to Taylor's concern that information managers may be forced to choose between summary and depth indexing by revealing layers of navigable meaning, varying subtly or radically in terms of specificity and interdisciplinary participation. By involving a community of users, folksonomies moderate the hierarchical power structure of information management that may result in stale classificatory taxonomies outside the vernacular of users (Rosenfeld, 2006). Most importantly, folksonomies facilitate discourse that raises the potential for users with different perspectives to reinvigorate how the scholarly record is used and interpreted.

References

ABC/Reuters. 2008. Receptor gene linked to melanoma risk. *ABC Science*.

> http://www.abc.net.au/science/articles/2008/09/23/2372001.htm. Last accessed 4-
> 9-09.

Cornelius, Ian V. 1996. *Meaning and Method in Information Studies.* Norwood, N.J:

> Ablex Publishing.

Dye, Jessica. 2006. A game of high-tech (and high-stakes) tag. *EContent* 29(3).

Fonseca, Frederico T., and Martin, James E. 2005. Toward an Alternative Notion of

> Information Systems Ontologies: Information Engineering as a Hermeneutic
> Enterprise. *Journal of the American Society for Information Science and*
> *Technology, 56*(1): 46-57.

Guba, E.G., and Lincoln, Y.S. 1989. *Fourth Generation Evaluation*. Newbury

> Park, CA: Sage.

Guy, Marieke and Tonkin, Emma. 2006. Folksonomies: Tidying up Tags? *D-Lib*

> *Magazine* 12(1).

Korfhage, Robert R. 1997. *Information Storage and Retrieval.* New York: John Wiley

> & Sons.

Kuhn, Thomas S. 1962. *The Structures of Scientific Revolutions.* Chicago: University

> of Chicago Press.

Parsons, Jeffrey, and Wand, Yair. 2000. Emancipating Instances from the Tyranny of

> Classes in Information Modeling. *ACM Transactions on Database Systems* 25(2),
> 228-268.

Peterson, Elaine. April 2008. Parallel Systems: The Coexistance of Subject Cataloging

> and Folksonomy. *Library Philosophy and Practice*.

Peterson, Elaine. November 2006. Beneath the Metadata: Some Philosophical Problems

> with Folksonomy. *D-Lib Magazine* 12(11).

Ricoeur, Paul. 1976. *Interpretation Theory: Discourse and the Surplus of Meaning*. Fort Worth: Texas Christian University Press.

Rorty, Richard. 1979. *Philosophy and the Mirror of Nature.* Princeton, N.J.: Princeton University Press.

Rosenfeld, Louis. Folksonomies? How About Metadata Ecologies? http://louisrosenfeld.com/home/bloug_archive/000330.html. Quoted in Guy, Marieke and Tonkin, Emma. 2006. Folksonomies: Tidying up Tags? *D-Lib Magazine* 12(1).

Schwandt, Thomas A. 2003. Three Epistemological Stances for Qualitative Inquiry: Interpretivism, Hermeneutics, and Social Constructionism. In Lincoln, Yvonna S., and Denzin, Norman K. 2003. *The Landscape of Qualitative Research: Theories and Issues*. Thousand Oaks, CA: Sage.

Sinclair, James and Cardew-Hall, Michael. 2004. The folksonomy tag cloud: when is it useful? *Journal of Information Science* 34(1), 15-29.

Stern, David G. 2004. *Wittgenstein's Philosophical Investigations.* Cambridge: Cambridge University Press.

Taylor, Arlene G. 2004. *The Organization of Information*, Second Edition. Westport C.T.: Libraries Unlimited.