

The Structure of Descriptive Vocabularies for Online Findability: Comparing user experience of a folksonomy, thesaurus, and taxonomy

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Executive Summary

A thesaurus, taxonomy, and folksonomy each demonstrated unique merits as online finding tools. The thesaurus provided the most useful information for evaluating and selecting search terms, but exhibited the least flexible terminology. It was concluded that thesauri cannot enhance findability if search systems do not exploit their syndetic structure. Folksonomies displayed the best use of the relationships between terms, providing significant overlap in the results of related search terms. Whilst the structure of the taxonomy was difficult to navigate, it provided the most assurance of a complete and relevant results set.

Introduction

This report examines the performance and functionality of three descriptive vocabularies for online content – taxonomies, thesauri, and folksonomies – by examining the author’s experience of searching using systems that utilize each vocabulary. It will begin by overviewing the vocabularies and their relative merits. It will then describe the search methodology, overview each search system, and report the results of the respective searches.

Please find definitions for bold-face terms in the glossary.

Old ways, new ways

In 2005, Clay Shirky argued that **folksonomies** are better suited systems for classification of online content than traditional **taxonomy**-based information **hierarchies**. In response, Peter Merholtz (2005) stated that Shirky failed to consider the virtues of **controlled vocabularies** other than taxonomies, which may provide a more appropriate comparison with folksonomies, such as **thesauri** or Library of Congress Subject Headings.

Folksonomies are uncontrolled vocabularies that emerge from the network of **tags** generated by the users of **social tagging sites** (Hammond et al. 2005; Lu, Park & Hu 2010). Folksonomies place no constraints on the tags users apply (Rethlefsen 2009). They can be applied cheaply and at mass-scale (Lu, Park & Hu 2010).

To tightly constrain terminology to a set of **preferred terms**, controlled vocabularies are developed and maintained by authoritative sources, making them costly and time-consuming to apply (Morville 2005). Thus, compared to folksonomies, controlled vocabularies are impractical for web-wide classification.

Systems using controlled vocabularies differ in their inherent functionality depending on their **syndetic structure**. Taxonomic systems, akin to file structures, organize information hierarchically (Morville 2005). On the web, taxonomies such as Yahoo! Directory consist of URLs organized into a hierarchy of controlled classification terms (Morrison 2008).

Shirky’s (2005) key objection to taxonomies is the fact that they place online content in a single classificatory location. However, Thesauri can provide

multiple access points to items by assigning multiple terms (Merholtz 2005). The syndetic structure of Thesauri allows them to specify **equivalence**, **homographic**, **associative**, and **hierarchical relationships** amongst terms (Cumming 2005). Ideally, this structure enhances findability by directing searches of broader terms (BT) to narrower terms, and non-preferred terms (“Use For” terms or UF) to preferred terms.

Features of controlled and uncontrolled vocabularies

Folksonomies have a flat structure and foster a ‘bottom-up’ system whereby classifications emerge from content (Hammond et al. 2005). Controlled vocabularies are top-down systems that impose a meaning-system on content (Hammond et al. 2005). Shirky (2005) sees hierarchies as flawed systems that classify the natural world imperfectly, and fail dismally in digital world.

Unlike controlled vocabularies, folksonomies are in constant flux (Morrison 2008). Their bottom-up structure gives them the capacity to adapt quickly to changes in user’s needs and vocabulary (Rethlefsen 2009). Furthermore, because tags are applied from a multitude of individual perspectives, specific technical meanings and social nuance are not lost by merging many terms into a preferred term (Lu, Park & Hu 2010).

Tagging offers significant advantages for findability. Shirky (2005) describes the technical vernacular of controlled vocabularies as a barrier for the user. In folksonomies items are classified with the same kind of terms used by searchers. Evidence suggests that this enhances what Lu, Park and Hu (2010) refer to as *indexer-searcher consistency* (see Appendix A.1). Similarly, controlled vocabularies aim to reduce subject-access to a single term, whereas folksonomies are able to cover a wide domain of search terms, providing many access points (Lu, Park & Hu 2010).

Controlled vocabularies possess an inbuilt structure, but Shirky (2005) argues that in Folksonomies associative relationships emerge as tags accumulate, allowing sites to suggest related tags and group related objects into ‘fuzzy’ categories (Hearst 2009). Shirky (2005) also argues that as tags accumulate, valid descriptors get reinforced through consensus, diminishing the impact of aberrant terms.

Nevertheless, research shows that large proportions of tags are not valid descriptors of the content of documents (see Appendix A.2), and are inconsistent with metadata derived from more authoritative sources (eg. Trant (2009); see Appendix A.3-4). Whilst such findings may indicate folksonomies provide useful access terms not provided by other systems, they may simply reflect the poor quality of many tags (see Appendix A.5). Folksonomies are liable to become populated with synonyms, homonyms, variations in spelling and punctuation, and terms related to idiosyncratic user needs.

Whilst the search facility of social tagging sites may be adequate for user’s personal collections, search-performance is not an explicit objective for which such sites were designed (Morrison 2008). Critics insist that the lack of vocabulary control and syndetic structure cripples the search functionality of folksonomies (Morville 2005). Research by Morrison (2008) supports this view:

although folksonomies return many more results compared to directories, their result sets contain a smaller proportion of relevant results and capture less of the relevant content that is available for finding (see Appendix A.5).

Examining vocabulary functionality

The author conducted a set of searches on Yahoo! Directory (<http://au.dir.yahoo.com/>), a directory utilizing a taxonomy, delicious (<http://www.delicious.com/>), a social tagging site based on a folksonomy, and ProQuest's Library and Information Science Abstracts (LISA), a subscription-based bibliographic database that uses a thesaurus for its subject terms.

The author selected a target search term and two alternate terms – a BT and a UF term – for querying each system (see Table 1). To simulate the process of a genuine user search, terms were selected prior to conducting any searches for them on any of the information sources. Searches were conducted by navigating through the directory hierarchy, searching for tags in delicious, and searching for exact matches in LISA's subject-heading field.

Table 1 Target term and alternate terms

Target Term	"Folksonomies"
BT	"Metadata"
UF	"Tagging"

In delicious, result sets include a list of 'related tags'. These lists were used in the current report as an indicator of vocabulary functionality (see Appendix B).

LISA's result sets are accompanied by a set of "Suggested Subjects". Result sets can be narrowed according to the attributes of items within the set ("faceted searching"). For this report, faceted subject-terms were noted as a potential source of information for the user about related subject terms, and as a means of calculating the overlap between result sets (see Appendix B).

Appendix B contains further details about the search processes and each system's search interface.

Yahoo! Directory

Figure 1 displays the search progression through the hierarchy. It was not obvious, based on category headings, which branches to follow to locate the target term. Two false branches were followed before the correct category was found:

1. The search was commenced incorrectly in the *Social Sciences* category. A cross-reference directed the search to the branch upon which the target term resided

2. A cross-reference to an alternate branch (*Business and Economy*) was followed (to *Knowledge Management*)

At least one other category (*Computers and Internet*) would appear to have been an appropriate starting point.

The target category was on the fifth layer of the hierarchy. It contained fourteen items.

Locating the target term was facilitated by the fact that the BT term, “Metadata”, actually appeared as a broader term for the target term.

Both the target term and UF term were included in the category heading (*Folksonomies and Tagging*), thus facilitating recognition for somebody who may be unfamiliar with one term.

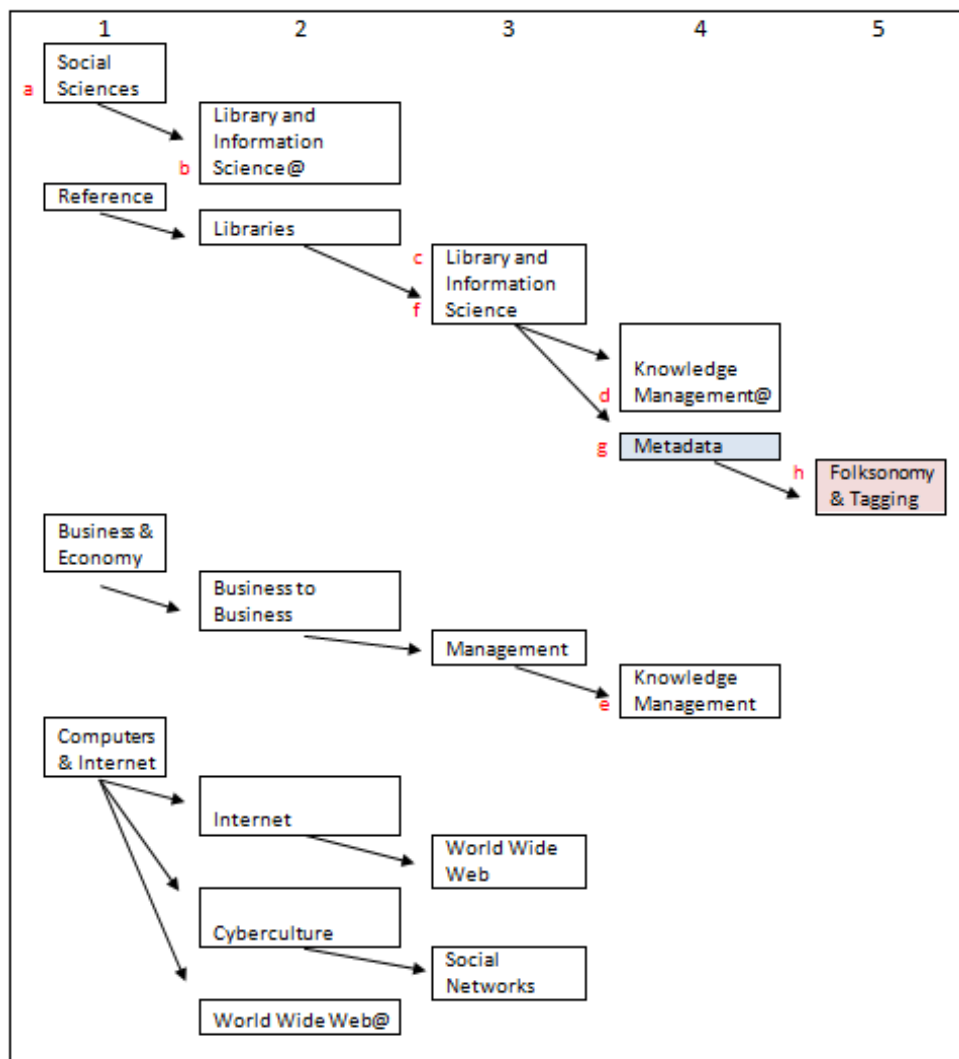


Figure 1 Search process in Yahoo! Directory. Letters indicate search stages. '@' indicates that a node is located on an alternate branch.

delicious

A search for the target term produced 4326 results. All the alternate terms were present in the “Related Tags” list. However, the target term was not present in the “Related Tags” for any of the alternate terms.

Results sets for the UF and BT contained 62% and 23% of the same items returned for the target term, respectively.

Library and Information Science Abstracts

Both alternate terms were found in the LISA thesaurus, but the target term was not. Despite this, the target result set included twelve items. The alternate terms appeared amongst the faceted subject-terms, but no alternate terms appeared as “Suggested Searches”.

Neither alternate term contained the target term amongst its “Suggested Searches”. The target term appeared amongst the faceted subject-terms of only the UF term, which returned two items in common with the target term’s result set (an overlap of 17%)¹.

To properly evaluate the functionality of the thesaurus three additional searches were performed using a target term from the thesaurus (“Classification of Knowledge”) with specified BT and UF terms (“Knowledge” and “Knowledge Classification” respectively).

Classification of knowledge returned 92 results. The BT appeared in the target’s “Suggested Searches” list.

There was no notification that a UF term was being searched when a preferred term was available. Furthermore, the target term did not appear in the “Suggested Searches” or faceted subject-term list of either alternate term.

Neither the UF nor the BT demonstrated any overlap with the target result list.

Conclusions

Systems differed markedly in the information available for users to evaluate or select search terms. A browsable thesaurus lets the user determine the most appropriate search term from the outset. Folksonomy tags cannot be browsed easily, but a search for a tag immediately indicates whether the term exists as a tag. A taxonomy conceals its structure and terminology until the user goes into it, providing no way to know in advance what terms are used for classifications, whether the search term exists as a category or, if it doesn’t, which alternative term should be sought.

Consistent with Shirky’s (2005) comments, the thesaurus was most limited in its terminology. The target term did not appear in the thesaurus despite existing as

¹ Interestingly, numerous terms that were not in the thesaurus appeared in the various faceted subject-term lists, some of the most anomalous of which included *and*, *corc*, *for*, *openurl*, *loseva*, *a*, *f*, *of*, and *use for*.

a subject term. The taxonomy's category labels appeared less granular and contemporary than the folksonomy tags, but superior to the thesaurus terms².

Findability within the taxonomy involved very different processes compared to the other systems, with the greatest challenge being the process of searching by navigating through the hierarchy. This would often involve some vertical and horizontal browsing before the target category is found, especially if it is deep within the hierarchy. Categories expressing related concepts may be on entirely different branches of the hierarchy.

As long as the user has sufficient knowledge of the terminology used for category headings the taxonomy circumvents problems relating to the appropriateness of the user's chosen search term – they begin browsing concepts rather than specific terms.

Once the search arrived at the most appropriate category, the directory was probably the system that provided the best assurance of the relevance and completeness of the result set.

For folksonomies and thesauri, questions of findability revolved around the degree to which the system uses the vocabulary to direct users towards ideal search terms, or directs the search process to target result sets.

delicious exploits the relationship between tags to suggest related tags³. In the current searches, related terms returned significantly overlapping result sets. By contrast, the thesaurus appeared to deal with terms as unique entities – the result sets of the target and alternate terms were effectively quarantined from each other – suggesting effective vocabulary control but poor use of syndetic structure.

delicious' "related tags" list provides the user with an indication of other possible search terms. However, this list was not comprehensive: for the current report it provided no cue enabling the user to transit from alternate terms to the target term.

LISA did not alert the user when a non-preferred term was being used in place of a preferred term. Two probabilistic means of redirecting users from a non-preferred term or a broader term to a target term were offered – "Suggested Searches" and faceted subject-terms. However, like the folksonomy, neither proved reliable at doing so, even when terms were drawn explicitly from the thesaurus.

It appears that in LISA the thesaurus serves as a list of suggested terms for use by classifiers and users, but is not exploited by the search system to improve search

² Ironically, the folksonomy appeared to have trouble finding terms that were too technical. No bookmarks labeled "Knowledgeclassification" or "Knowledge_classification" were found, probably reflecting a bias in the kinds of materials bookmarked on these kinds of sites: namely contemporary web-content, with a focus on technology and popular culture.

³ delicious also appears to use semantic relationships between terms to cluster terms together in searches: although not included in the current study, when *folksonomies* was entered into the search box as a general search term (as opposed to a tag specific search), delicious returned this message: "We have included results for *folksonomy* - Show only *folksonomies*". It is noted that this may be related to simple algorithms detecting grammatical variations, rather than use of emergent relationships between tags *per se*

performance or redirect the user's selection of search terms – a finding that was most inconsistent with the author's expectations.

This report suggests that there are advantages and disadvantages to the use of each form of vocabulary, which should be considered in combination with the user's search needs when conducting an online information query.

Appendix A – Review of Empirical Literature

1. Evidence for indexer-searcher consistency in folksonomies:
 - Heyman and Lothian (2007, cited in Lu, Park & Hu 2010) found a significant overlap between a list of search queries indexed by AOL, and tags used in delicious
 - Bischoff, Firan, Nejdil and Paiiu (2008, cited in Lu, Park & Hu 2010) found that in 30.6% of delicious queries every search terms matched a tag, and in 65% of queries at least one term matched a tag.
2. Studies examining the relevance of tags in social tagging sites:
 - Kipp and Campbell (2006, cited in Lu, Park & Hu 2010) found that 16% of delicious tags were not related to the subject of the URL.
 - Bischoff, Firan, Nejdil and Paiiu (2008, cited in Lu, Park & Hu 2010) found that less than half of the delicious tags they examined could be found in the body text of URLs.
 - Heyman and Lothian (2007, cited in Lu, Park & Hu 2010) reported that 84% of the delicious URLs they examined were not tagged with a term from the title. Half of the delicious URLs they examined were not tagged with a term from the body text.
3. Lu, Park, and Hu (2010) conducted a study comparing tags of books in Library Thing (www.librarything.com) to the thesaurus-like Library of Congress Subject Headings for the same books.
 - Overlap between tags and LCSH terms at the within-book level:

At least one match between a tag and an LCSH term in 85% of the bibliographic records they examined. Eighty-percent of the tags and LCSH terms did not match in half of the records they examined.

- Overlap between tags and LCSH terms at the collection level:

Tags, with their sheer number, cover LCSH content far more effectively than LCSH covers the content of tags: 97.8% of the Library-Thing tags could not be found within the LCSHs, whereas 50% of LCSH terms were found amongst the tags.

- Overlap between tags and terms in the title:

Taggers are far more likely than experts to simply borrow terms from the title – For 60% of books in the sample, at least one tag was derived from a title term, compared to 18% of books containing an LCSH term in the title. However, due to their vast numbers, there are many more tags relating to non-title content than those relating to the title – only 2.3% of Library Thing tags were found in the title, whereas 10.6% of LCSH terms could be found in the title

- Overlap between tags and LCSH subdivisions:

Tags failed to cover content related to the LCSH chronological subdivisions: only 18% of books that contained chronological subdivisions had a matching tag

4. Studies investigating the relationship between tags and alternate, authoritative sources of metadata:
 - Suchanek, Vojnovic and Gunawardena (2008, cited in Lu, Park & Hu 2010) searched two online dictionaries for a sample of delicious tags, and found that (a) over half of the tags were not in the dictionaries, and (b) most of those that were found contained multiple meanings.
 - Bischoff, Firan, Nejdil and Paiiu (2008, cited in Lu, Park & Hu 2010) found that a third of last.fm tags could not be found in expert music reviews of the same track, and 54% of tags could not be found in reviews of the same track on allmusic.com.
 - By contrast, Trant (2009) reported that 86% of user-tags of museum collection items could not be found in museum documentation of the same item, and there was very little overlap with terms from two museum-related controlled vocabularies.
5. Lu, Park, and Hu (2010) compared tags applied to books in Library Thing to LCSHs applied to the same books, and found the most frequently used LCSH terms applied by experts were different terms from the most frequently used tags. Amongst the top-30 most frequent Library Thing tags were tags such as 'read', 'own', 'tbr', 'to read', 'owned', 'read in 2009', 'read in 2008', and 'signed'.
6. Morrison (2008) examined the URLs returned by eight search systems, namely taxonomy-based directories (including Yahoo! Directory), search engines, and social tagging sites (including delicious). They reported the precision (proportion of relevant URLs retrieved), and relative recall (relevant URLs retrieved as a proportion of the total number of relevant URLs returned by all systems) for the first twenty results and the first five results of each system.

Folksonomies tended to return larger result sets than directories. For the first twenty documents retrieved, directories were more precise than folksonomies, but recall was similar. For the first five items, directories demonstrated better precision and recall than folksonomies.

Generally, search systems try to sort results according to relevance, but delicious was the only system that did not demonstrate improved precision as the number of results evaluated increased from one to twenty. The authors suggested that this reflects an inferior page-relevance-ranking system.

Roughly 98.5% of documents returned by folksonomies were not returned by directories (n=2578), but only 8% of those documents were rated as being relevant. By contrast 94.6% of documents returned by directories were not returned by folksonomies (n=659), 17% of which were judged to be relevant.

Appendix B – Additional Descriptive Data Relating to Searches

The following broad questions were considered during the search process for each system:

1. How does the vocabulary facilitate the process of gathering the result set?
2. How explicit is the vocabulary? Is it available to the user for use and/or evaluation? Are the terms used and the relationship between them explicated for the user prior to their search?
3. How large is the result set?
4. How well is the “Gathering together” function of the system performed, in terms of how, or whether, the system directs the user to the target results from an alternate term?
 - a. Is the target term suggested during searches for alternate terms and/or automatically incorporated into the search?
 - b. Does the target term appear as a term in the result set for alternate terms?
 - c. How much overlap in content occurs between searches for the target term and searches for an alternate term?

Yahoo! Directory

Figure 1 demonstrates Yahoo! Directory’s 16 level-one categories, with some of their child categories listed beneath them.

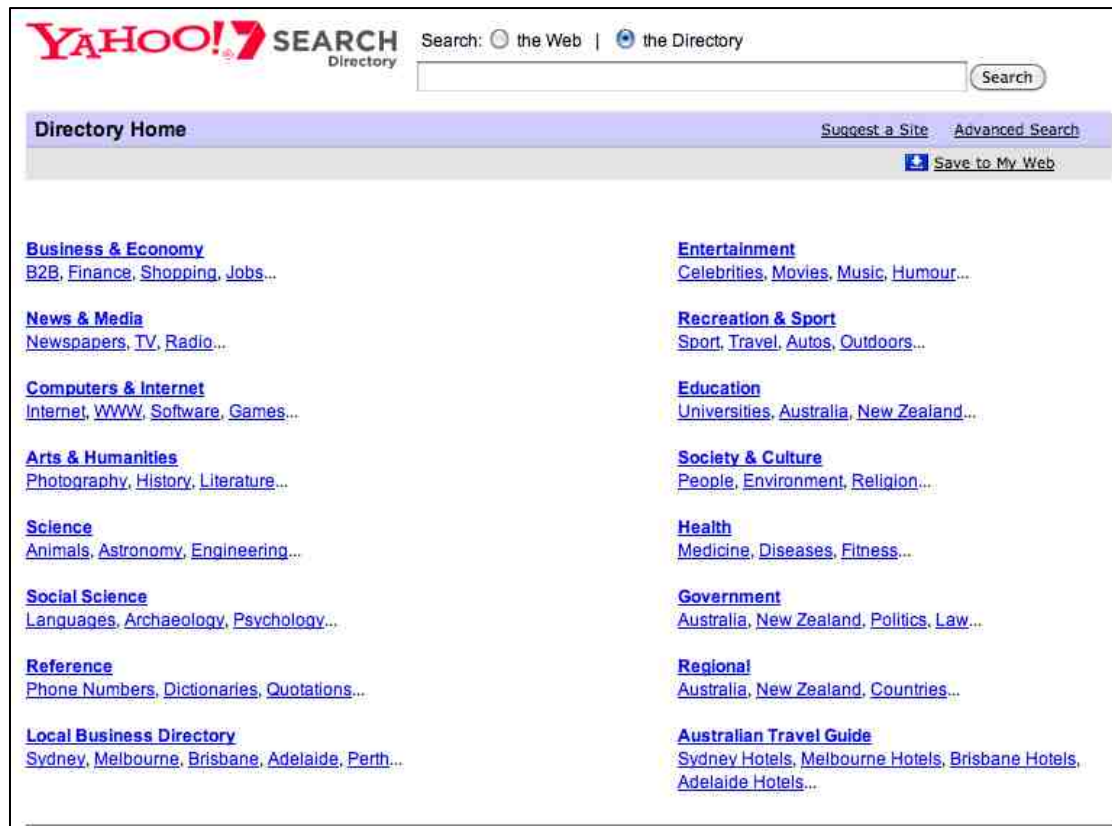


Figure 2 Yahoo! Directory main interface

A search field on the main page does not search category terms, but bypasses the hierarchy by searching the content of all URLs within the directory.

For the current report, to examine the functionality of the directory's taxonomy *per se* search was conducted by browsing through the hierarchy rather than using the search field.

delicious

delicious is based around three structures: users (or 'people'), tags, and URLs (or 'bookmarks'). The folksonomy is composed of all tags applied by all people to all bookmarks.

Figure 2 illustrates a sample of bookmarks returned by a search for the tag 'folksonomy'. The record of the first result ("Unitag | drupal.org") reveals that 31 people have assigned a total of seven unique tags to the URL. A set of "Related tags" can be seen on the right side of Figure 2, which delicious returns when a user searches for a tag.

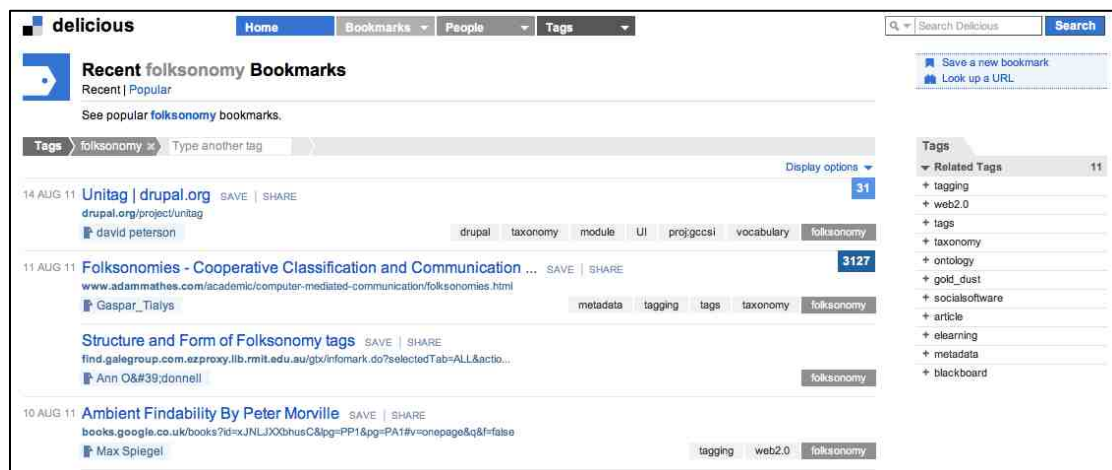


Figure 3 A result set on delicious

delicious treats each term in a search query as separate terms joined by an 'AND' operator. Users create tags with multiple words by concatenating words or replacing spaces with underscore characters.

Users are able to add "Tag Descriptions" to provide information about their use of a particular tag.

Searches for tags can be performed in one of two ways: (1) navigating to the Tags tab and selecting 'Explore', or (2) entering a tag-search phrase in the main search field (eg "tag:folksonomies"). The second method was used in this report. A search was conducted for the target term, and the result set and 'Related Terms' were noted. This process was repeated for the alternate terms.

delicious allows result sets to be narrowed by adding additional search terms, such that a subset of results containing an additional tag can be retrieved. In the current study the overlap between results returned by the target term and

alternate terms was investigated by narrowing the result set for an alternate term to those items also tagged with the target term⁴.

LISA

LISA indexes and abstracts over 440 periodicals of relevance to library and information professionals (ProQuest 2011).

A link to LISA's specialized thesaurus is available from the Advanced Search window, where it can be used to select search terms. The thesaurus is purportedly used by editors to assign subject headings to documents in each database (ProQuest 2011). The thesaurus specifies preferred terms, synonyms (UF), broader (BT) and narrower (NT) terms, related terms (RT) and scope notes describing the preferred term.

To most accurately assess the functionality of the thesaurus, all searches were entered in the command line, searching for the exact term in the subject field, ie. SU.EXACT("Folksonomies").

The size of the result set, terms in the subject facet, and terms in the "Suggested Searches" were noted for the initial search for the target term. This process was replicated for the alternate terms.

Depending on the items in the result set, 'subject facets' may provide a link from the results of an alternate term to the target term. Thus, the subject facets of the alternate terms were inspected for the target term. If the target term was present amongst the faceted subject terms, the number of documents listed as containing both subject terms was used to calculate the overlap of documents between the target-term and alternate-term result sets (using a formula similar to that reported for delicious in the footnote on this page).

It was decided that if the target term did not appear in the thesaurus, further searches would be conducted using a term that does appear in the thesaurus with a UF and BT term, thus providing a more accurate evaluation of the role of the thesaurus.

⁴ The formula for determining overlap in delicious can be expressed as:

$overlap\% = 100 * (number\ of\ results(target_term + alternate_term) / number\ of\ results(target_term))$

Glossary

Definitions are sourced from the Online Dictionary for Library and Information Science (<http://www.abc-clio.com/ODLIS/searchODLIS.aspx>) unless otherwise stated.

Associative relationship	“A semantic relation in which two words or phrases are conceptually connected, sometimes within a specific context, but are not related hierarchically”. In a thesaurus, such terms refer to each other as related terms (RT)
Controlled vocabularies	“Lists of terms that have been enumerated explicitly” wherein terms have an “unambiguous, non-redundant definition” (Pidcock 2002). In their most basic form, controlled vocabularies specify the terms permitted for use: if the term has homonyms, a single meaning for the term is specified, and if it has synonyms, one of these is selected as the preferred term. This vocabulary control permits more inclusive but also more targeted retrieval, by capturing synonyms of the search terms and excluding homonyms from the search.
Equivalence relationship	A semantic relationship between two terms in which the terms are closely related conceptually (synonyms) but not hierarchically. In a thesaurus, one such term will be the designated preferred term, whilst the other (the “Use For”, or UF) term is the non-preferred term
Folksonomy	The network of tags that results from users collaboratively tagging content in social tagging sites, and the emergent relationships between those tags (Lu, Park & Hu 2010)
Hierarchical relationship	A semantic relationship between two terms characterized by parent-child relationship, such that one term is a broader term (BT) and the other a narrower term (NT) where a parent term is broader than a child term
Hierarchy, information	A system “in which the classes are subdivided on the principle of logical subordination, from the most general subjects to the most specific”
Homographic relationship	A semantic relationship between two terms indicating that although they are spelt the same they differ in meaning (homonyms)

Polyhierachy	An information hierarchy in which a term may have more than one parent, thus providing multiple means of accessing a term (Morville 2005)
Preferred term	A term selected as an authorized descriptor or subject heading. The preferred term is cross-referenced from synonyms and related terms, ensuring that similar items are accessible from the same term
Social tagging sites	Web-sites that allow users to find, store, organize, and share content such as images (eg. Flickr), video clips (YouTube), bibliographic references (CiteYouLike, Library Thing) and URLs (<i>social bookmarking</i> sites such as delicious and Diigo) by tagging content
Syndetic structure	The network of “interconnected and reciprocal cross-references” indicating the semantic relationships between terms. Such relationships may be explicated as hierarchical relationships, equivalence relationships, homographic relationships, or associative relationships
Tag	A personal classification terms assigned to online content by a users of a social tagging site (Lu, Park & Hu 2010)
Taxonomy	Taxonomies are controlled vocabularies with a syndetic structure defining hierarchical relationships (Pidcock 2002)
Thesaurus	A “networked collection of controlled vocabulary terms” that incorporates associative as well as hierarchical relationships(Pidcock 2002). Thesauri possess syndetic structure including hierarchical, associative, and equivalence relationships , explicitly defining broader terms (BT), narrower terms (NT), ‘Use for’ terms (UF), and/or related terms (RT) for preferred terms (Cumming 2005).

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