UIUCLIS--2006/3+IMLS

Oksana Zavalina. User Searches in IMLS DCC Collection Registry: Transaction Log Analysis. Technical Report UIUCLIS--2006/3+IMLS, Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign, Champaign, IL, 2006.

Introduction

Subject access to collections has been in the focus of attention of LIS field for decades. A number of catalog use studies have been conducted in attempts to better understand its role and the problems user faces while searching for the information on a particular topic, with transaction log analysis being one of the methods widely employed by these studies. However, issues of subject access in federated collections, where the "unit of analysis" is a collection rather than an item search, have not yet been investigated. This paper reports an attempt of such an analysis performed on the IMLS Digital Collection Registry transaction log dataset.

IMLS Digital Collections and Content project is being implemented at the University of Illinois at Urbana-Champaign since January 2003. Within the project framework, a registry of all National Leadership Grant collections with digital content has been created. The IMLS Collection Registry includes collection level descriptions[1] and links to homepages of over 170 digital collections, created by libraries, museums, historical societies, botanical gardens and other cultural heritage institutions with support of the National Leadership Grant administered by the Institute of Museum and Library Services since 1998. The IMLS Digital Collections Registry is indexed with the GEM (Gateway to Educational Materials) subject headings, which provide broad categories for browsing considered suitable for the educational and cultural heritage communities.

GEM project, started in September 1996, is an initiative of the National Library of Education to expand educators' access to Internet-based lesson plans, curriculum units and other educational materials (Sutton, 1999). GEM Element Set is an extension of the Dublin Core Element Set, with eight elements added to the initial 15-element DC package. In 1997, GEM subject scheme was created as the Subject Element GEM Controlled Vocabulary to describe digital objects in Gateway for Educational Materials repository. In part due to high national and international

[1] See for example http://imlsdcc.grainger.uiuc.edu/collections/FullDisplay.asp?cid=2404

reputation that GEM project in general has gained since its inception, today GEM subject scheme's application goes beyond its original domain: the Gateway to Educational Materials database. GEM subject scheme is now one of the many[2] controlled vocabularies and subject hierarchies being used to provide subject access to online resources and digital libraries such as Everglade, Internet Scout Portal, Federal Resources for Educational Excellence (FREE), RefWorks, National Science Digital Library etc. Being a domain-specific controlled vocabulary aimed at educators, GEM subject headings are considered suitable for browsing databases in both educational and more general humanities domains.

GEM subject scheme (see Attachment 1) consists of 12 "level 1" broad subject headings: Arts, Educational Psychology, Foreign Languages, Health, Language Arts, Mathematics, Philosophy, Physical Education, Religion, Science, Social Studies, Vocational Education, each of which has from 12 to 29 narrower "level 2" headings under it. The second level subject headings for Philosophy and Religion replicate ERIC Thesaurus "Narrower Terms" for these two broad subjects. Several of the level 2 GEM subject headings – Careers, History, Informal education, Instructional issues, Process skills, and Technology – are facets applicable to each of the twelve broad subject headings.

According to Stuart Sutton (2004), the major deficiency of the digital library architecture, including GEM, is the absence of the standardization in name authority; neither name nor place subject are represented in GEM subject scheme.

Collection administrators participating in the IMLS Collection Repository project are required to provide top-level GEM subjects in collection descriptions for the registry. Use of other subject headings is not required but supported by the metadata schema. As recently collected survey and interview data show, collection administrators are not completely satisfied with GEM subject scheme use for collection level description. Most of them point at the significant drawback of GEM subject scheme – lack of breadth and depth in topic coverage, especially at the top level of the subject hierarchy.

Research Question

The major research question in this study was: How suitable is the GEM (Gateway for Educational Materials) subject scheme adopted by IMLS Collection registry for describing diverse collections in the Registry? If it does not provide appropriate subject representation,

[2] GEM subject scheme is one of the 129 thesauri listed by the Library of Congress list of codes for subjects http://www.loc.gov/marc/sourcecode/subject

would another controlled vocabulary do a better job for this particular registry?

Based on the literature for evaluating subject schemes (Cochrane 1986, Larson 1991A etc.) and my own observations I have formulated eight general criteria for measuring GEM subject scheme suitability to collection level description in IMLS registry:

1. diversity of topics covered by GEM subject headings (breadth and depth of subject coverage),
2. syndetic structure of the GEM subject scheme,
3. heading structure of GEM subject headings,
4. currency of GEM subject headings,
5. availability of links between GEM subject headings and subject terms from other controlled vocabularies
6. degree of overlap between GEM subject terms and other subject terms used in the collection level description,
7. degree of overlap between the collection level description GEM subject terms and subject headings used in item level description.
8. semantic match between the GEM subject terms and keywords used by searchers of the registry.

A preliminary analysis of a sample of 23 digital collections based on the first seven criteria demonstrated overall inability of GEM subject scheme to adequately represent breadth and depth of subjects of the diverse collections in IMLS Collection registry. For this project, I chose to focus on the last and very important criterion – the semantic match between keywords applied by users in their searches and the GEM subject headings used in collection description records. Because no research has been done yet with the focus on specifics of search types and approaches in federated collections at collection level, another area of my interest in this project is general description of the searches made by users in IMLS Digital collection registry: the weight of subject versus known-item searches, typical query profile in terms of the number of words, frequency of each query use etc. I am also interested in correlation – if any – between the type of search and the semantic match of search terms with controlled vocabulary terms.

Given all the above, the more specific research question for this project is: how similar are the IMLS Collection Registry user keywords (extracted from transaction log) and the controlled vocabulary terms from three different controlled vocabularies – GEM thesaurus and its

alternatives? Which of the three controlled vocabularies matches higher percentage of the search terms from the user queries made in the Registry?

Data Collection and Data Analysis

Based on the recent decade's research on matching user terms with controlled vocabulary terms (Collantes 1995, Dubin 1998, Greenberg 2001, Gault, Shultz & Davies 2002, Gross & Taylor 2005, Nowick & Mering 2003, Qin 2000), the following conclusions can be made regarding the typical data source, data processing and data analysis techniques applied:

*Typical source of data***:** transaction logs, user terms submitted for mediated search

*Typical data processing techniques***:**

- Parsing user queries into separate terms (excluding stop words) and phrases
- Extracting stems from the words in user queries

*Typical analysis steps***:**

- Match user queries with controlled vocabulary terms: most often exact, near exact matches (with variations in spelling, endings and plurals/singulars), and synonyms (SYN), sometimes – also broader terms (BT), related terms (RT), narrower terms (NT) (the latter works only in structured thesaurus, which GEM is not).
- Run user queries (with user terms either mapped or un-mapped to particular thesaurus, including SYN, BT, NT, RT) in the same or other comparable system they originate from (e.g. OPAC, article database)

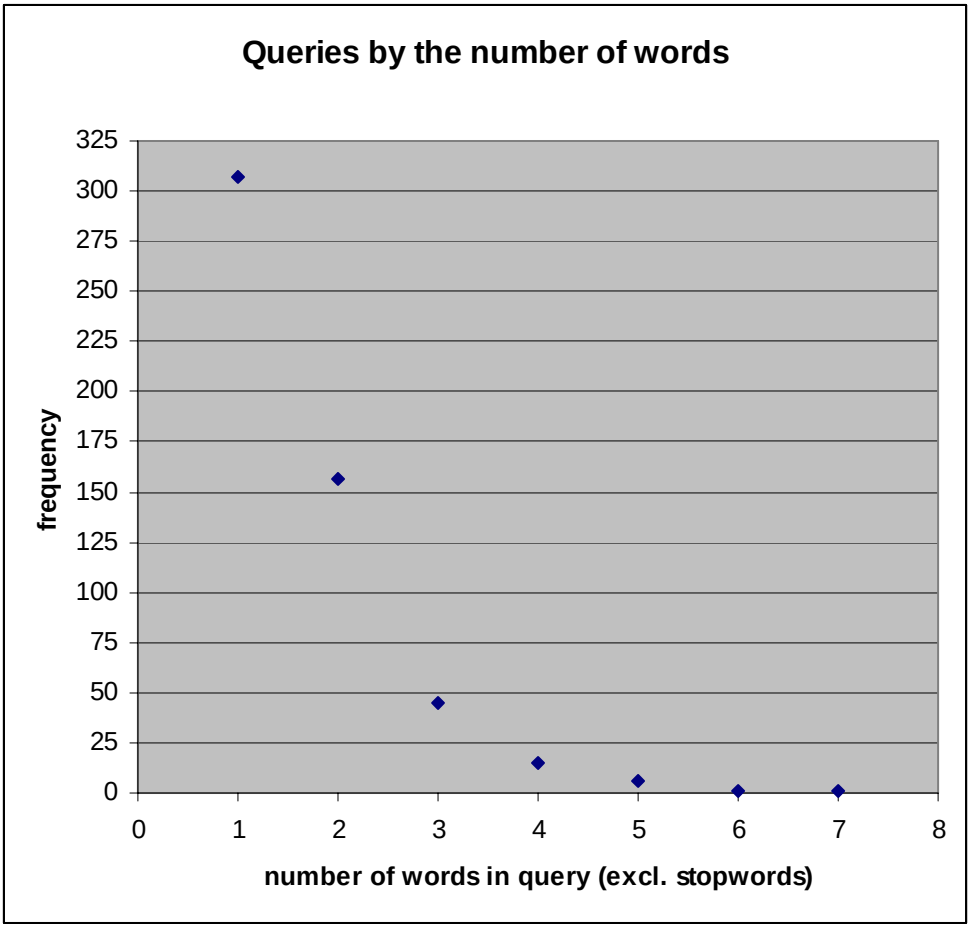
Typical data analysis techniques: Qualitative analysis and descriptive statistics.

The major dataset used in the analysis is the IMLS Collection Registry transaction log dataset – an Access file that consists of over 19,000 records and covers a period of approximately 7 months, between February 2005, when collection registry was first made publicly accessible, and September 2005. Initially transaction log file consisted of over 100,000 records, but after exclusion of the noise – searches and browsing made in the Collection Registry by web crawlers and Registry testers – the size was reduced to approximately 19,000 records. Each record/row contains information on IP address the query originated from, date and time of access, webpage visited within the Collection Registry, raw query string etc.

The transaction log was manually processed to extract all the keyword search query strings – a total of 945, which were then alphabetized (see Attachment 2). Given the time constraints of this project, a subset of 533 user queries was selected for analysis. Since the sample constitutes a large portion – over 56% – of the total dataset, it should be representative of a dataset as a whole.

Sampling procedure was conveniently applied as follows: queries that start with letters “A” to “L” were selected for analysis. The limitations of such sampling include uneven distribution of potential search terms throughout the alphabet: some letters have much more words starting with them than the others. Also, the search terms that started with numbers were not included. The rest of the dataset will be included in further analysis.

The user keyword queries vary in complexity and length. For example, the number of words in each query ranges from 1 to 7, with the vast majority consisting of one or two words, as can be seen from the chart below.



Preserving the context of a search is an important factor for analysis, especially when trying to decide on search type and finding a match with the terms in a controlled vocabulary. Therefore, the decision was made not to parse queries into separate words or even further – into stems. The minimal processing of the queries was done with noun words in queries: plurals were truncated and grouped together in the same query with the singulars of the same words (e.g. “Indians” and “Indian” became “Indian*”, “clipper ships” and “clipper ship” became “clipper ship*”). Both correct and misspelled versions of the same words were considered the instances of the same query (e.g. “Antarctica” and “antartica”, “immigration” and “imigration”).

At the **first stage of analysis**, general descriptive statistics procedures were used: search frequencies and the number of words excluding stop words in queries were calculated for each query, averaged for the whole sample and for each category separately. The stop words for these purposes included prepositions, conjunctions and articles.

The major part of the first stage of analysis was categorizing the user queries into seven broad search types or categories, derived from the Functional Requirements for Bibliographic Records (FRBR, 1998) classification of the entities in bibliographic universe. Seven out of ten FRBR entities that can be subjects of the work were used in this study's framework: *work*, *person*, *corporate body*, *concept*, *object*, *event* and *place*. The definitions of each entity and examples given by FRBR – detailed for *work*, *person*, and *corporate body*, but scarce for *object*, *concept*, *event* and *place* – were followed as guidelines for distinguishing between the categories. In essence, seven categories are characterized by FRBR as:

1. *work*: a distinct intellectual or artistic creation (FRBR, p. 16)
2. "*person*: an individual; encompasses individuals that are deceased as well as those that are living" (p. 23)
3. "*corporate body*: an organization or group of individuals and/or organizations acting as a unit; encompasses organizations and groups of individuals and/or organizations that are identified by a particular name, including occasional groups and groups that are constituted as meetings, conferences, congresses, expeditions, exhibitions, festivals, fairs, etc. The entity also encompasses organizations that act as territorial authorities, exercising or claiming to exercise government functions over a certain territory, such as a federation, a state, a region, a local municipality, etc. The entity encompasses organizations and groups that are defunct as well as those that continue to operate" (p. 24)
4. "*concept*: an abstract notion or idea; encompasses a comprehensive range of abstractions that may be the subject of a *work*: fields of knowledge, disciplines, schools of thought (philosophies, religions, political ideologies, etc.), theories, processes, techniques, practices, etc. A *concept* may be broad in nature or narrowly defined and precise" (p. 25)
5. "*object*: a material thing; encompasses a comprehensive range of material things that may be the subject of a *work*: animate and inanimate objects occurring in nature; fixed, movable, and moving objects that are the product of human creation; objects that no longer exist" (p. 26)

6. "*event*: an action or occurrence; encompasses a comprehensive range of actions and occurrences that may be the subject of a work: historical events, epochs, periods of time, etc."(p. 27)
7. "*place*: a location; encompasses a comprehensive range of locations: terrestrial and extra-terrestrial; historical and contemporary; geographic features and geo-political jurisdictions"(p. 27).

FRBR's *expression, manifestation* and *item* entities were not adopted as categories for this analysis, since it is virtually impossible to detect from transaction log what exactly the user was searching for: an abstract work, its particular expression, manifestation or item. Therefore, in my classification of Collection Registry queries, *work* is broader than FRBR's *work* and covers any artistic creation that has a title, including the digital collections that are members of IMLS Collection Registry.

Although the FRBR *person* entity does not currently cover families, there is a provision to update FRBR model with adding *family* entity to the same group of entities that contains *person* and *corporate body*. Therefore, I tentatively expanded the *person* category in my analysis to include families (e.g. "Cushmans"), as well as ethnic groups/nationalities (e.g. "Irish Americans") and classes of persons (e.g. "children that are abused") that I believe belong to the same group of entities and are tightly connected with *person* entity.

The rare occasions of fictitious characters were treated on the basis of "what they would be if they really existed" (e.g., TV series' character Alf is a creature, thus an FRBR's *object*, as would also be a dog or a squid).

For consistency in distinguishing between types of searches in less straight-forward cases, some simple rules were developed: unspecified social and business institutions (e.g. "library", "archive", "can company", "amusement park") were classified as *concepts*, institutions for which physical structure is more important (e.g., "ballrooms", "highways") as *objects*, and more specifically named ones (e.g., "Icy Hot Bottle Co.", "library+Moorhead") as *corporate bodies*. Some queries presented a real challenge for classification: "books" was one of them, which I tentatively categorized as a *concept*, although it could as well be an *object*. As any categorization, such an approach is inevitably judgmental, which is one of the limitations of the study. Another limitation of applying FRBR framework – as probably any other – for

categorization of subject searches lies in ambiguity of actual searches, further discussed in Findings and Discussion section.

The queries that presented no clue as to what type they belong to (e.g., “aF”, “beyond”, “LU+65”) were grouped together in an eighth category – *unknown*.

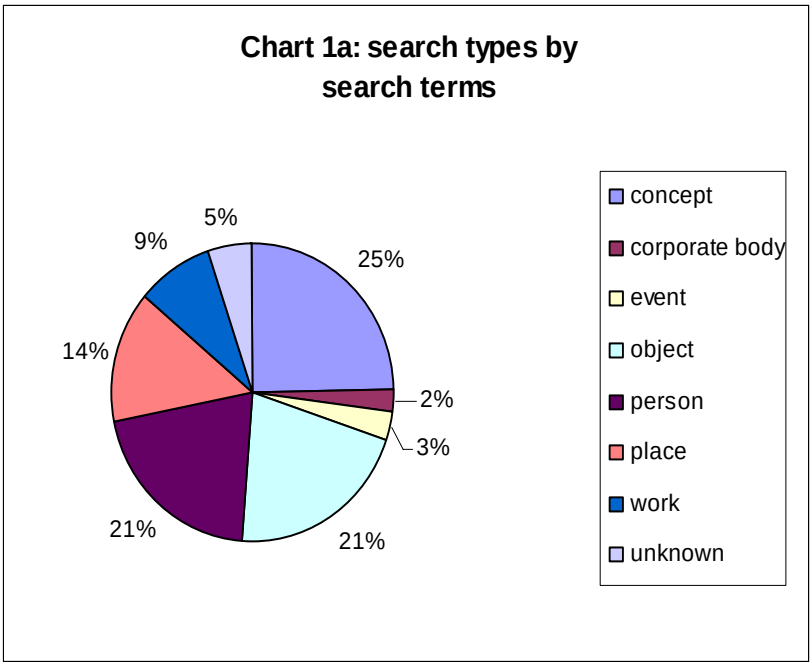
The **second stage** of analysis included searching in three controlled vocabularies – GEM, LCSH, and Art and Architecture Thesaurus – for the semantic matches of actual user queries from the IMLS Collection Registry transaction log. Library of Congress Subject Headings was selected for analysis as a controlled vocabulary that almost a half of digital collections participating in Collection Registry are using for item-level description and that is being considered by some of surveyed collections as an alternative to GEM for collection-level description. OCLC Connexion database features – LCSH authority file and Web Dewey search for editorially mapped LCSH headings – were used for matching user queries with LCSH. Art and Architecture Thesaurus (AAT) was selected as another plausible alternative for describing cultural heritage materials – and possibly collections. A number of collections participating in the registry are using AAT for their item-level description. Moreover, AAT is a controlled vocabulary of a smaller scope than LCSH, but significantly more detailed than GEM.

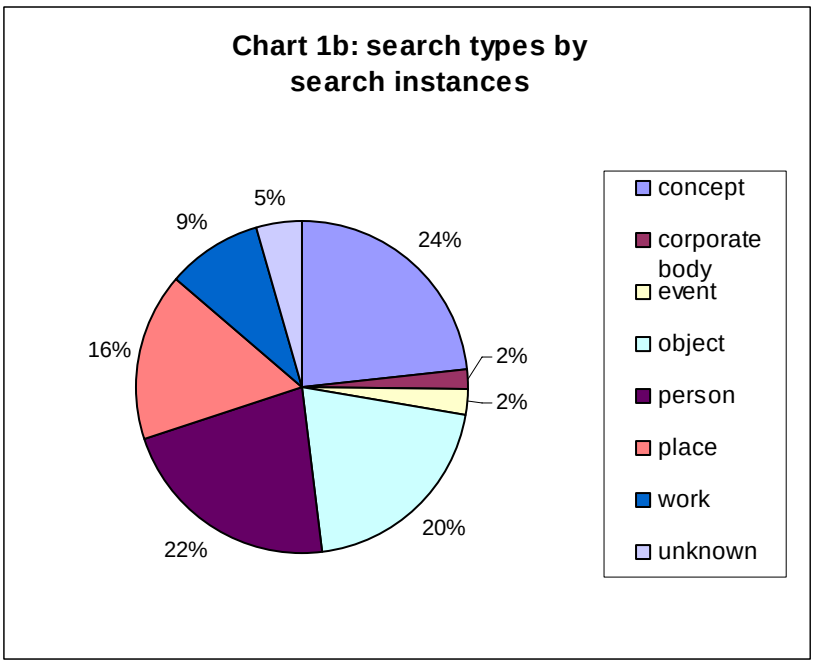
Only exact/abbreviated and synonymous matches (e.g., “inoculation” and “vaccination”) were treated as semantic matches for the purposes of this analysis. Abbreviated queries were matched with the full terms in controlled vocabularies, e.g. “ilgwu” with “International Ladies’ Garment Workers’ Union”. The order of the terms in the query, as well as presence or absence of prepositions and conjunctions was ignored for analysis. (e.g., “French art” was matched with “Art, French”; “epistemology” with “knowledge, theory of”, “children that are abused” with “abused children”). Endings of the words were also disregarded, as long as they did not affect the meaning (e.g., “automated speech recognition” was matched with “automatic speech recognition”). Both preferred terms and variant terms in controlled vocabulary were considered legitimate matches. For example, both 150 MARC field (USE) and 450 field (USE FOR) in LCSH authority records were analyzed to find a semantic match to a user query. Simple user queries were in some cases matched with compound LCSH subject headings, for instance “housing for shipyard workers” was matched with “Shipbuilding industry—Employees—Housing”.

The number of matches was totaled and averaged for the whole sample and for search types. Complete categorized listing of user query terms, along with descriptive statistics and calculations is available at https://netfiles.uiuc.edu/zavalina/MDRTpapers/AtoLwithAAT.xls.

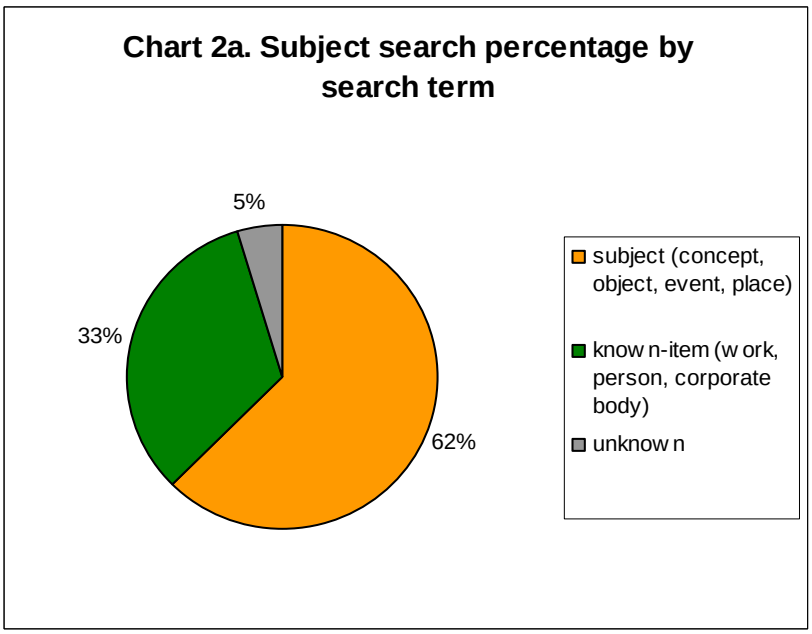
Findings and Discussions

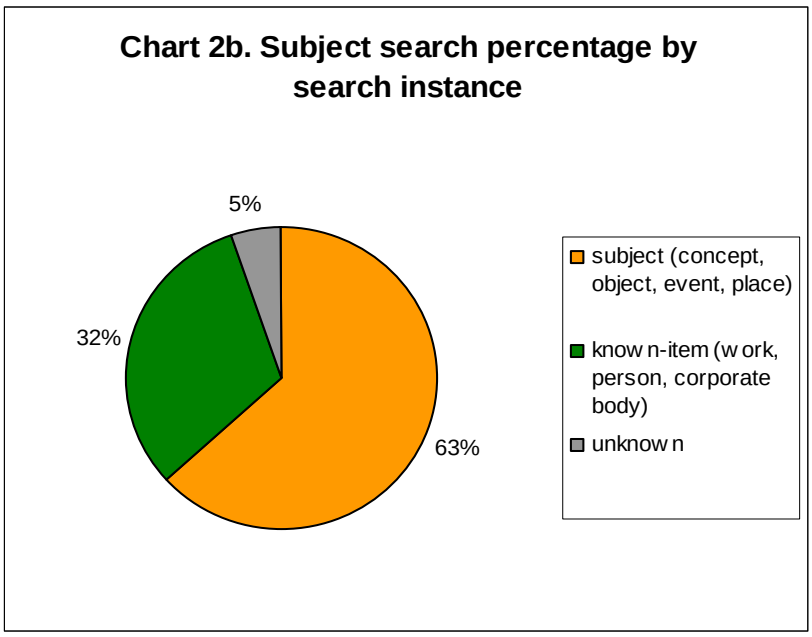
As the first stage of analysis demonstrated, two thirds of all searches made in IMLS Digital Collection Registry are spread between three broad FRBR categories: *concept*, *object*, and *person*, with *concept* search leading among both search terms and search instances. *Place* also takes significant percentage of searches, while *corporate body*, *event*, *work*, and *unknown* search types combined total below 20% of the searches. The low level of *event* searching is surprising, since most of the historical searches would be searches for *events*.



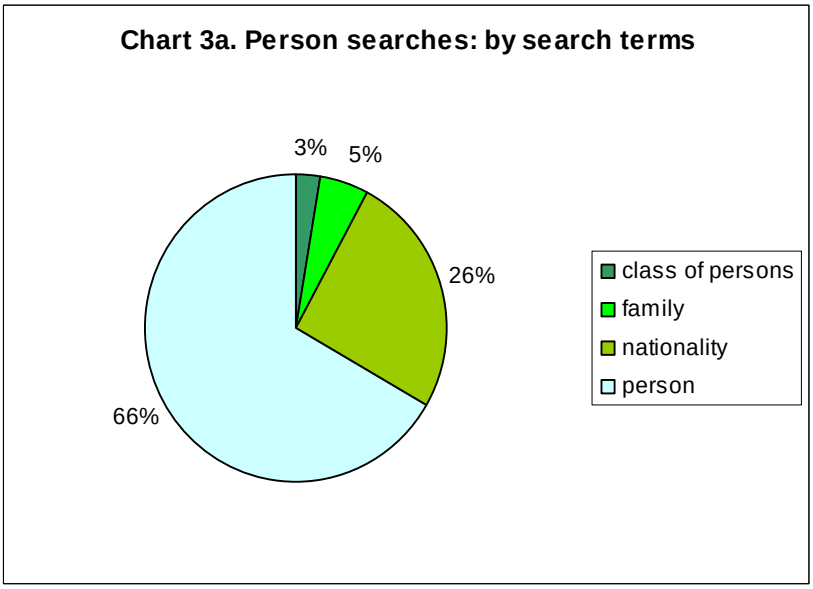


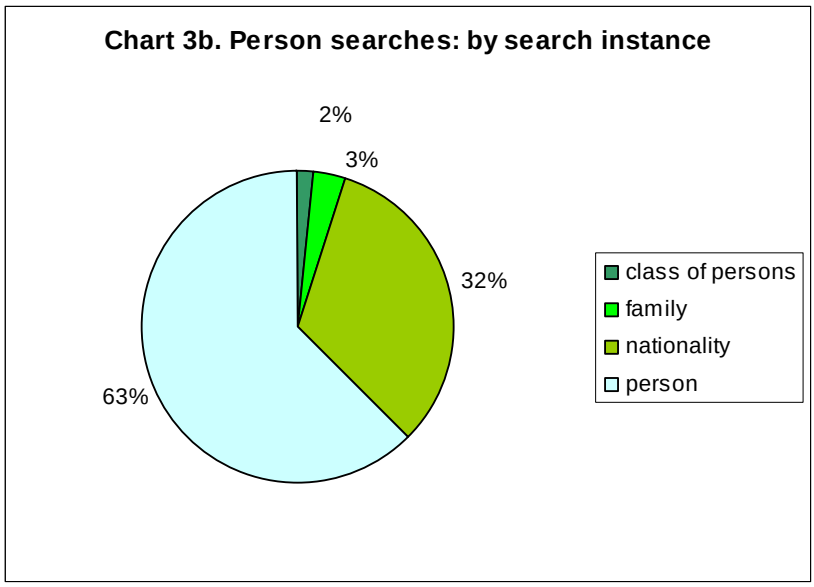
Because of the very nature of *concept*, *object*, *place*, and *event*, these cannot possibly belong to the widely-used in LIS general type of known-item searches (i.e. searchers where the user knows either author or title of the work sought), and therefore search categories can be safely considered subject searches in the IMLS Collection Registry. As can be easily seen from the chart below, then subject search constitutes at least 62% of all search terms and all search instances.



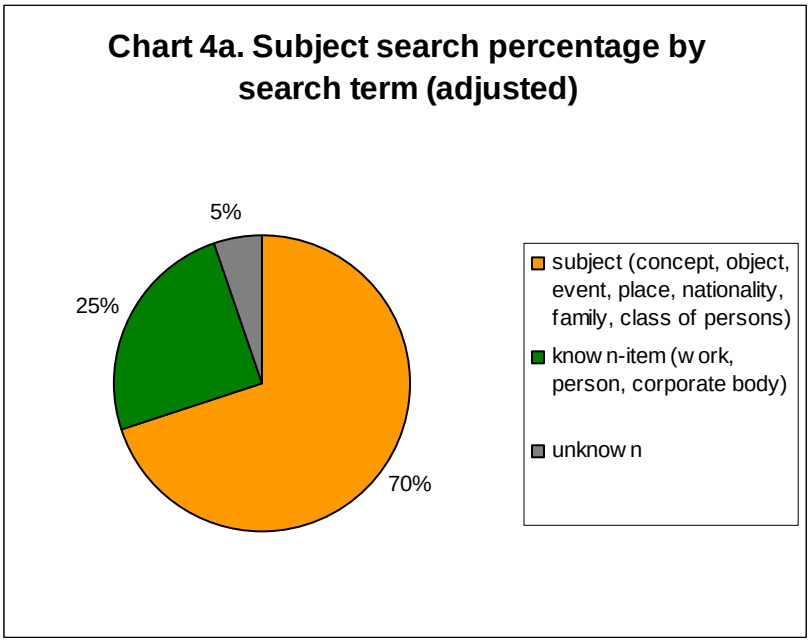


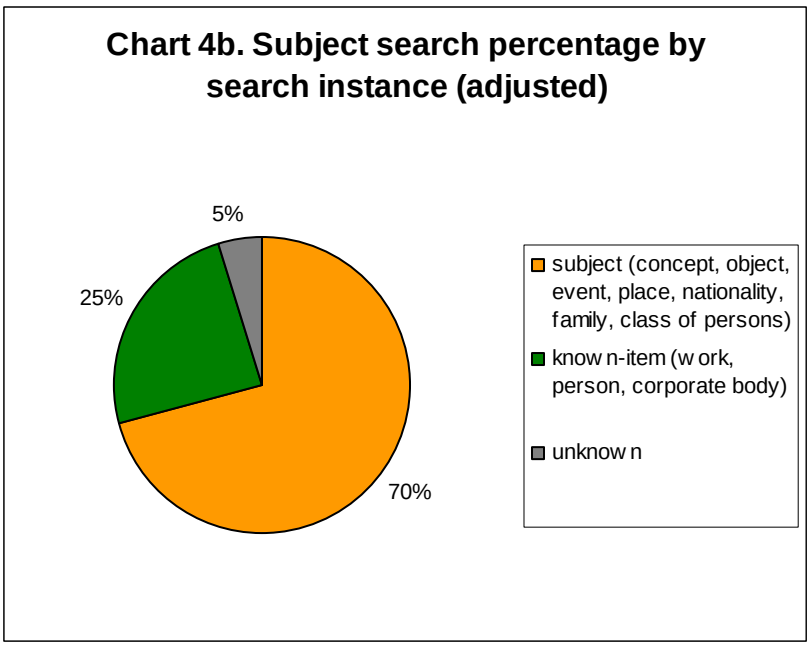
However, of course not all *person* searches will be known-item searches, since the broad *person* category includes also families, ethnic groups/nationalities and classes of persons. In the sample studied, over one third – 34% to 37% – of all searches initially assigned to the *person* search type represents these types of searches:





Thus, by adding these family, ethnic group/nationality and class of persons searches to the pool of subject searches, the percentage of subject searches made in the IMLS Collection Registry increases to 70% by both search term and search instance:





Although the number of federated digital collections has been rapidly growing recently, as did the creation and use of collection registries, no attempt has been documented in LIS literature so far to conceptualize known-item and subject searches at the collection level. In my operational definition, since in IMLS Digital Collection Registry the searches are conducted at the collection level, the known-title search in such situation will be the search, where the user knows the title of the digital collection; everything else will be a subject search, which, broadly defined, includes both controlled- and uncontrolled-vocabulary searches with an intent to find information on particular subject/topic/discipline/area.

The majority – sixty-three percent of search terms and seventy-two percent of search instances – of the *work* searches in the Registry were the searches for specific digital collection title, thus a known-item search. Although the rest of *work* searches were for the specific item-level titles, and therefore at the collection-level search can be treated as subject searches, the number of them was not significant enough to affect the distribution of two major search types – subject and known-item – as shown above.

The prevalence of subject search is obvious from the charts and remains in agreement with results of the 1982 large-scale Council for Library Research (CLR) study of online catalog use, which radically changed the conception of catalog use by finding subject search to be unexpectedly widely used by patrons – 59% of all searches. Compared to the earlier transaction log studies of online catalog use (e.g., Larson 1991B), including CLR study itself, the relative value of subject search as shown by the current study is much higher, which can be explained by at least two reasons:

- a general shift towards subject searches in a world where abundance of publication makes it less and less possible to know the title or author of the specific item
- a conceptual difference between collection-level and item-level searches, which implies a trend towards increased levels of subject search in federated collection registries.

Further research into how the search type distribution in IMLS Item-level Repository and IMLS Digital Collection Registry correlate with each other will help to answer these questions.

It should be noted here that actual searches conducted by users in the Registry rarely could be categorized "strictly" as any one of the search categories/FRBR entities, and sometimes presented a real challenge in determining which entity was the major component of a query. Below is a discussion of some of the examples found in this transaction log:

1. ***"Amusement park".*** As an abstract idea of amusement parks this query might be categorized as a *concept*. On the other hand, amusement parks are physical structures created by people, which makes it an *object* in FRBR definition. There is no correct answer to this question, even asking a user what (s)he meant when making this search would not clarify the ambiguity in most cases, because a concept of amusement parks is tightly connected to the object of amusement park. If you ask a user, you might learn that the search was for a specific institution, thus a FRBR *corporate body* Similar examples of queries from the sample studied include ***"Archives", "Ballrooms", "Highways", "detroit+historical+museums"*** (the latter is also inseparable from a specific location – FRBR *place*, as is ***"library Moorhead"***).

2. ***"Industrial models"***. The very word "models" implies it being a *concept*, as modeling requires conceptualizing. On the other hand, industrial models are physical structures created by people to assist in specific industrial processes, therefore it can also be categorized as an *object*. ***"lesson+plans"*** appears to be a very similar example, only from another realm – education rather than industry.

3. ***"Landscape"*** is something that exists in the nature, or can be created by people, thus it seems to be a FRBR *object.* However, the possibility exists for it to be classed as a *concept* too, if a user is searching for literature on landscapes and landscaping as a discipline.

4. ***"letters+from+19th+century"*** is a pretty straightforward example of *object* search. However, it is qualified by a specific time period, which, in FRBR definition, is an *event*.

5. ***"asian+American"*** appears to be a *person* search, although often refers to a broader category nonexistent in FRBR model yet – an ethnic group. However, it is inseparable from two *places* – Asian and American continents. In my understanding, a person or ethnic group in general is in most cases defined through place. Similarly, ***"children+that+are+abuse"*** is also a group (or a class) of *persons* inseparable from another FRBR entity, but defined by *event* of abuse rather than by *place*.

6. ***"henry+fordmuseum+and+greenfiel+village"*** is a specific corporate body (the Library of Congress corporate body authority file exists for it in WorldCat). However, it is

obvious, that a *person* of Henry Ford and a *place* of Greenfield Village are integral parts of this query.

7. ***"don+quijote"*** is both a fictitious character created by Cervantes and a phrase widely known as a title of his book -- although in fact it is just a part of the book's title. Categorization of this search entirely depends on the user intention, which cannot be known from the query itself. If the search was for a book, it was a *work* search, but if it was for a character it was either a *concept* (something abstract that does not exist and never physically existed), or a *person* if we follow the logic of "what it would be if it existed".

8. ***"Civil rights movement"*** might be classified as an *event*, which is a tricky entity because it is, according to Functional Requirements to Subject Authority Records (Zeng and Salaba, 2005), a combination of *place* and time. But where is time and place in this query? It may equally refer to various times and place, e.g. 1950s United States, or 1960s France, or 1970s Soviet Union, or 2000s China. Does the absence of explicit or implicit qualifiers make it a *concept?* ***"Census"*** seems to belong to the same cluster of examples.

Studies of transaction logs typically look at the frequencies of search term use and the average number of words in the search query. For the sample of queries analyzed in this study, the average frequency of term use was rather low – 1.4. The highest search term use frequency was recorded for *place* category – 1.58 – and the lowest was recorded for *event* category – 1.08. In terms of the typical number of words in query excluding stop words, the average for the whole sample constituted 1.69 words per query. The highest average number of words per query was recorded for *corporate body* category of search – 2.78 – and the lowest was recorded for *place* – 1.35 words per query.

At the second stage of analysis, the number of matches for user search queries in three controlled vocabularies – GEM subject scheme, Library of Congress Subject Headings, and Art and Architecture Thesaurus – was compared for each search term (combination of terms in the user query), for each category of searches, and for the whole sample. A total of 10 matches – 2.6% out of 380 unique search terms – were found in GEM subject scheme. A total of 271 matches – 71.3% – were found in LCSH. Art and Architecture Thesaurus matched only 86 – 22.63% of user keywords. The only category of user searches GEM had matches to was *concept*, while LCSH had matches to all the categories, including a couple of *unknown* searches, which as the category were the worst represented in LCSH. Art and Architecture Thesaurus terms matched mostly *concepts* and *objects*, with no matches at all in *corporate body*, *place* and *work* search categories. The table below illustrates absolute and relative values of these semantic matches:

Table 1.

FRBR subject type	**Unique search terms**	**search instances**	**GEM match**	**GEM match, %**	**LCSH match**	**LCSH match,%**	**AAT match**	**AAT match, %**
concept	94	125	10	10.54	87	92.55	53	56.38
corporate body	9	10	0	0	5	55.56	0	0
event	12	13	0	0	6	50.00	2	16.66
object	79	108	0	0	51	64.56	29	36.71
person	78	117	0	0	63	80.77	1	1.28
place	55	87	0	0	51	92.73	0	0
Work	34	49	0	0	4	11.76	0	0
Unknown	19	24	0	0	4	21.05	1	5.26
TOTAL	***380***	***533***	***10***	***2.63***	***271***	***71.32***	***86***	***22.63***

The low level of matching between the user search terms and the GEM subject terms is explained by the extreme broadness of this subject scheme. There is no widely shared notion of the digital collection even among collection creators and managers (Lee 2000, Hill et al. 1999); much more confusion exists among the users of federated collection repositories. Such an ambiguity can cause sometimes unjustified preciseness and narrowness of collection-level search terms selected by Registry users, who are not making distinction between searching for items in collection and searching for collections in collection registry. Whatever is the reason, the mismatch between the GEM subject scheme and actual searches is obvious.

Surprisingly, LCSH, although matching most of the user terms, still leaves almost 30% unmatched. LCSH is the most effective in matching *places* and *concepts*, while *works* remain the least matched; only about a half of *corporate bodies* and *events* from this study's sample are covered by LCSH terms. The reason may lay in general inflexibility of LCSH – a large scheme that is extremely hard to keep up-to-date. A vivid illustration from this study is the absence of such term as "learning standards" in LCSH authority file.

However, as can be seen from the Table 2 below, compared to the other two controlled vocabularies, LCSH on its own (without overlap with AAT or GEM) covers the lion share – almost 50% of user search terms. Only 6 terms matched by AAT were not also matched in LCSH, and all the terms matched in GEM were also matched in LCSH.

Table 2.

FRBR subject type	unique search terms	matched by GEM alone	matched by GEM and LCSH	matched by GEM and AAT	matched by LCSH alone	matched by LCSH and AAT	matched by AAT alone	matched by ALL	matched by NONE
concept	94	0	3	0	32	45	1	7	6
corporate body	9	0	0	0	5	0	0	0	4
event	12	0	0	0	4	2	0	0	6
object	79	0	0	0	26	25	4	0	24
person	78	0	0	0	62	0	1	0	15
place	55	0	0	0	51	0	0	0	4
work	34	0	0	0	4	0	0	0	30
unknown	19	0	0	0	3	1	0	0	15
TOTAL	*380*	*0*	*3*	*0*	*187*	*73*	*6*	*7*	*104*

The most unexpected finding of the second stage of analysis was that well-developed, up-to-date, flexible and faceted Art and Architecture Thesaurus, which seems to be especially suitable for describing cultural heritage materials and possibly collections, matched such a small proportion of user search terms. The explanation can lay in the fact that AAT, just as GEM, does not include name and place authority files. However, the broader Getty Thesaurus framework, along with AAT, also includes such authority files.

Conclusions

This study results demonstrate an unusually high for catalog use / transaction log analysis studies level of subject searching made by patrons at the collection level. Further investigation is needed into the reasons of such increase in subject search proportion, including collection of data through collection registry users' interviews and observations.

Further research is also needed into which controlled vocabulary would best represent digital collections in the IMLS collection registry. Although LCSH has shown relatively good results, none of the three controlled vocabularies in this study fully represents the subjects of diverse collections in the IMLS Digital Collection Registry, or at least a user's expectations towards these subjects. For the future study, another – more flexible than LCSH – controlled vocabulary of the moderate scale, which, unlike GEM or AAT, represents a wider variety of search types – not just *concepts* and/or *objects* – should be selected for the same analysis and for comparison with GEM, LCSH, and AAT. To compensate for deficiencies of the transaction log analysis as a method that does not provide any insight into user motivations and intentions and deals only with user actions, think-aloud protocol observation of the users searching IMLS Digital Collection registry should be incorporated into further analysis.

Bibliography

Cochrane, P. (1986). *Improving LCSH for Use in Online Catalogs*. Colorado Springs, CO: Libraries Unlimited.

Cochrane, P. (2000). Improving LCSH for use in online catalogs revisited: what progress has been made, what issues still remain. *Cataloging and Classification Quarterly, 29 (1/2*), 73-89.

Collantes, L. Y. (1995). Degree of Agreement in Naming Objects and Concepts for Information Retrieval. *Journal of the American Society for Information Science, 46(2),* 116-132. http://www3.interscience.wiley.com.proxy2.library.uiuc.edu/cgi-bin/fulltext/10050153/PDFSTART

Dubin, D. S. (1998) Addressing the heterogeneity of subject indexing in the ADS databases. In U. Grothkopf, H. Andernach, S. Stevens-Rayburn, and M. Gomez, editors, *Library and Information Services in Astronomy III, volume 153 of A.S.P. Conference Series*, 77-83, San Francisco. Astronomical Society of the Pacific.http://www.eso.org/gen-fac/libraries/lisa3/dubind.html

Functional Requirements for Bibliographic Records: Final report (1998). IFLA. *UBCIM Publications, New Series,* 19. http://www.ifla.org/VII/s13/frbr/frbr.pdf

Gault, L. V., Shultz, M., & Davies, K. J. (2002). Variations in medical subject headings (MeSH) mapping: From the natural language of patron terms to the controlled vocabulary of mapped lists. *Journal of the Medical Library Association (JMLA), 90(2),* 173-180. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=100762

Greenberg, J. (2001). Automatic Query Expansion via Lexical-Semantic Relationships. *Journal of the American Society for Information Science, 52(5),* 402-415. http://www3.interscience.wiley.com.proxy2.library.uiuc.edu/cgi-bin/fulltext/77002637/PDFSTART

Gross, T., & Taylor, R. (2005). What Have We Got to Lose? The Effect of Controlled Vocabulary on Keyword Searching Results. *College and Research Libraries, 66 (3),* 212-230. http://vnweb.hwwilsonweb.com/hww/jumpstart.jhtml?recid=0bc05f7a67b1790e183771395b86e5aa985cedb4235ee102d23781fb323b5ec2a6cec93038a63198&fmt=P

Hill, L., Janée, G., Dolin, R., Frew, J., & Larsgaard, M. (1999). Collection metadata solutions for digital library applications. *Journal of the American Society for Information Science, 50 (13),* 1169-1181.

Larson, R. R. (1991A). Between Scylla and Charybdis: Subject searching in online catalogs. *Advances in Librarianship, 15,* 175-236.

Larson, R. R. (1991B). The decline of subject searching: long-term trends and patterns of index use in an online catalog. *Journal of the American Society for Information Science, 42* (3), 197-215.

Lee, H. (2000). What is a collection? Journal of the American Society for Information Science, 51(12), 1106-1113.

Matthews, J. R., Lawrence, G. S., & Ferguson, D. K. (Eds.), (1983). *Using online catalogs: A nationwide survey*: *A report of a study sponsored by the Council on Library Resources.* New York, NY: Neal-Schuman.

Nowick, E., & Mering, M. (2003). Comparisons between Internet Users' Free-Text Queries and Controlled Vocabularies: A Case Study in Water Quality. *Technical Services Quarterly, 21(2),* 15-32. http://www.haworthpress.com.proxy2.library.uiuc.edu/store/E-Text/View_EText.asp?sid=F38AWX7KVNXE8G8K3MJ2XBKG9S4U2SXE&a=3&s=J124&v=21&i=2&fn=J124v21n02%5F02

Qin, J. (2000). Semantic Similarities between a Keyword Database and a Controlled Vocabulary Database: An Investigation in Antibiotic Resistance Literature. *Journal of American Society for Information Science, 51(2),* 166-180. http://www3.interscience.wiley.com.proxy2.library.uiuc.edu/cgi-bin/fulltext/69501138/HTMLSTART

Sutton, S. A. (1999) "Conceptual design and deployment of a metadata framework for educational resources on the Internet." *Journal of the American Society for Information Science, 50,* 1182-1192.

Sutton, S. A. (2004) Building an Education Digital Library: GEM and Early Metadata Standards Adoption. In *Metadata in Practice.* Ed. by D. I. Hillmann, E. L .Westbrooks - Chicago: American Library Association, 1-15.

Zeng, M., & Salaba, A. (2005). Toward an International Sharing and use of Subject Authority Data. FRBR Workshop, OCLC, 2005. http://www.oclc.org/research/events/frbr-workshop/presentations/zeng/Zeng_Salaba.ppt

ATTACHMENT 1

Gateway to Educational Materials Subject Scheme

GEM Level 1	GEM Level 2
Arts	Architecture Art therapy Careers* Computers in art Dance Drama/dramatics Film History* Informal education* Instructional issues* Music Photography Popular culture* Process skills* Technology* Theater arts Visual arts
Educational technology	Audio-visual equipment Careers* Educational media History* Informal education* Instructional issues* Integrating technology into the classroom Language laboratories Multimedia education Process skills* Staff inservice Technology* Technology planning
Foreign languages	Alphabet Bilingualism Careers* Cultural awareness Grammar History* Informal education* Instructional issues* Linguistics

	Listening comprehension Process skills* Reading Speaking Spelling Technology* Vocabulary Writing
Health	Aging Body systems and senses Careers* Chronic conditions Consumer health Death and dying Disease Environmental health Family life History* Human sexuality Informal education* Instructional issues* Mental/emotional health Nutrition Process skills* Safety Smoking Substance abuse prevention Technology*
Language Arts	Alphabet Careers* Debate Grammar Handwriting History* Informal education* Instructional issues* Journalism Listening comprehension Literature Mechanics Phonics Process skills* Reading Reading aloud Speech

	Spelling Story telling Technology* Vocabulary Whole language Writing (composition)
Mathematics	Algebra Applied mathematics Arithmetic Calculus Careers* Discrete mathematics Functions Geometry History* Informal education* Instructional issues* Measurement Number sense Number theory Patterns Probability Process skills* Statistics Technology* Trigonometry
Philosophy Note: 2nd level = ERIC Thesaurus "Narrower Terms"	Aesthetics Careers* Educational Philosophy Epistemology Ethics Existentialism Hermeneutics History* Informal education* Instructional issues* Logic Marxism Phenomenology Platonism Process skills* Semiotics Technology*
Physical	Adventure and risk challenge activities

Education	Aquatics Careers* Games (educational) Gymnastics(educational) History* Individual sports Informal education* Instructional issues* Motor/movement skills Outdoor education Process skills* Rhythms and dance Skill-related fitness Team sports Technology*
Religion Note: 2nd level = ERIC Thesaurus "Narrower Terms"	Buddhism Careers* Christianity Confucianism History* Informal education* Instructional issues* Islam Judaism Process skills* Taoism Technology*
Science	Agriculture Astronomy Biological and life sciences Biology Botany Careers* Chemistry Earth science Ecology Embryology Engineering Entomology General science Geology Histology History* Informal education* Instructional issues*

	Metallurgy Meteorology Natural history Oceanography Paleontology Pharmacology Physical sciences Physics Process skills* Space sciences Technology*
Social studies	Anthropology Careers* Civics Comparative political systems Criminology Current events/issues Economics Geography Gerontology History* Human behavior Human relations Informal education* Instructional issues* Process skills* Psychology Social work Sociology State history Technology* Technology and civilization United States Constitution United States government United States history Urban studies World history
Vocational education	Agriculture Allied health occupations Business Careers* Cooperative education Distributive History* Informal education*

	Instructional issues* Occupational home economics Process skills* School-to-work Tech prep Technical Technology* Trade and industrial

ATTACHMENT 2

User Keyword Queries in IMLS Digital Collection Registry: Alphabetic Sequence

1. 16+MM
2. 1704
3. 1704
4. 1800-1849+fashion+
5. 1800-1849+fashion+of+clothing
6. 1800-1849+fashion+of+clothing
7. 1818+
8. 1876
9. 1895
10. 1895
11. 1976
12. 19th+century+epistles
13. a%3F
14. A.J.+Small
15. a+bird+in+a+gilded+cage
16. a+streetcar+named+desire
17. aboriginal
18. accounting
19. adams
20. adult
21. aerial
22. aeruak
23. africa
24. africa
25. africa+focus
26. africa+focus
27. african
28. african
29. african+american+studies
30. agriculture
31. aircraft
32. Ajumawi
33. Ajumawi%2Fatsugewi
34. akron
35. alex+janis
36. alf
37. alferd+packer
38. alfred+packer
39. algeria
40. alternative+energy
41. american+
42. American+Centuries
43. american+history&type=text
44. american+indian
45. american+jouneys
46. american+jouneys
47. american+journeys
48. american+journies
49. american+literature
50. american+literature
51. american+natural+science
52. american+studies
53. amusement
54. amusement+park
55. amusement+parks
56. animals
57. ansil+addams
58. Antarctica
59. Antarctica
60. antarctica
61. Antarctica
62. antartica
63. antartica
64. Antifederal+Club
65. arab
66. archaeological
67. archaeology
68. archaeology
69. architecture
70. architecture
71. Architecture
72. archives
73. Arizona
74. arkansas

75. art+deco
76. artificialintelligence
77. Asia+continent
78. asian+American
79. assessing+governmental+performance%3A+an+analytical+framework
80. astronomy&type=image
81. Atsuge
82. audio
83. autoharp
84. automated+speech+recognition%94+&type=dataset&type=text
85. automated+speech+recognition%94+AND+%28software+OR+system%29
86. automated+speech+recognition%94+AND+%28software+OR+system%29&type=dataset&type=text
87. automobile
88. automobile
89. automobile
90. Baby+Beauty+Contests+in+Pittsburgh%2C+PA+1936-1941
91. Ballrooms
92. Bangwell+Putt
93. Bangwell+Putt
94. baseball
95. baseball
96. baseball&type=image&type=moving+image&type=sound
97. basketball
98. baskin
99. basque
100. basque
101. battle+of+new+orleans
102. Bay+State+Belting+Co.
103. beadwork
104. beaver
105. Belle+Isle
106. berkely+university+dinosaur
107. berryman
108. beyond
109. biography+of+Enid+M.+Baa
110. birds
111. birth+announcements
112. black
113. black+studies
114. blimp
115. blue&type=sound
116. blue&type=sound
117. blue&type=sound
118. BNDIAN+SITE
119. body
120. bohemian+grove
121. bohemian+grove
122. bohemian+grove
123. bohemian+grove
124. bohemian+grove
125. bolles
126. Books
127. books
128. Boston+City+Directory+1885
129. Boston+City+Directory+1905
130. Boston+City+Directory+1935
131. bottom+trawling
132. Bozeman+area+Indians
133. BROMELIAD
134. bronx+neighborhoods
135. bronx+postcards
136. bronxart.lehman.cuny.edu%2Fpa%2Fneighborhood.htm
137. brooklin%2C+maine
138. brooklin+me
139. Brooklyn+Daily+Eagle+-+Dittman
140. Brooklyn+Daily+Eagle+in+1941
141. broward
142. busquets
143. california+city+directories
144. california+digital+library
145. californian+indian+art
146. cameo
147. can+company
148. Canada
149. canada
150. Canaletto

151.canalleto
152.canion
153.cannibals
154.cape+cod
155.cape+may
156.car
157.car
158.car
159.car
160.car
161.car
162.car
163.car
164.car
165.car
166.carbon
167.Cars
168.cars
169.cars
170.cat
171.catherine+beecher
172.catherine+beecher
173.catherine+beecher
174.census
175.cervantes&type=text
176.chemistry&type=unknown
177.Cheques
178.chess
179.chicago
180.chicago
181.child+abuse
182.child+abuse+
183.childabuse+case+
184.childabuse+case+in+maryland
185.children+that+are+abuse
186.Chile
187.Chinese
188.chinese
189.Chinese
190.chinese&type=text
191.chinese+American
192.chinese+language
193.city+directories
194.civil+rights+movement
195.civil+war+records++illinois
196.clark
197.cleveland
198.clipper+ship
199.clipper+ship+cards
200.clipper+ships
201.close+quarters+in+detroit
202.coal
203.coal
204.Colorad
205.Colorado
206.Colorado
207.Colorado
208.colorado
209.Colorado
210.Colorado+Granger
211.Colorado+Granger
212.columbia
213.communist
214.community
215.computer
216.comradeship
217.concrete+music
218.confucianism
219.Congressional+Record
220.Connecticut
221.connecticut
222.connecticut+history
223.connecticut+history+online
224.connecticut+teaching
225.conservation
226.Cook
227.Cook+San+Francisco+Scrapbook
228.Cook+Scrapbook
229.cookbook
230.cookbooks
231.coommunity
232.correspondence+19th+century
233.costume
234.county

235. Crosley
236. cruikshank
237. Cruikshank
238. cruikshank
239. cruikshank
240. cuba+
241. cuba+
242. cuba+indipendence
243. cuban+immigrants
244. cuban+immigrants
245. cubans
246. cultural+competency
247. currency
248. cushman
249. Cutrell
250. Daugherty
251. daumier
252. Daumier
253. deaf
254. deaf+child
255. Deerfield
256. Deerfield
257. deerfield
258. deerfil%5Celd
259. demography
260. dentist
261. dentist
262. design
263. Detoit
264. Detroit
265. Detroit
266. Detroit+Boat+Club
267. detroit+historical+museums
268. detroit+river
269. diaries+from+the+1930s+under+the+New+Deal+agencies
270. digital+dress
271. digital+dress
272. digital+dress
273. dinosaur
274. dinosaurs
275. dissertations
276. documenting+american+south
277. documenting+the+american+south
278. dogs
279. dogs
280. dolphins
281. dolphins%5C
282. don+quijote
283. don+quixote
284. dorothea
285. dorothea+lange
286. dorothea+lange
287. dorothea+lange
288. Dorothea+Lange
289. dorothea+lange
290. dorothea+lange
291. dorothea+lange&submit=Search
292. dortha+lange
293. dottie+long
294. dottie+lucille+long
295. drabik
296. dresses+from+the+1900+to+1980
297. durer
298. earth+field+trip
299. easter
300. eastern+Europe
301. Eastman
302. economics
303. economics
304. economics
305. edge+of+the+cedars+museum+collection
306. education+by+design
307. edward+curtis
308. edward+curtis+wax+cylinder
309. Edward+Mattis
310. edwards
311. Egypt
312. eico+369
313. Elsevier
314. empire+state+building
315. empire+state+building
316. epistemology
317. erik+satie

318. eubie+blake
319. eubie+blake
320. eubie+blake+scores+free
321. eugenics
322. exploratorium
323. fairport+ny
324. family
325. family+tree
326. farming+
327. fashion
328. fashion
329. fashion
330. fashion+for+the+1800-1849
331. fashion+for+the+1800-1849%5C
332. feeding
333. feeding
334. feeding+America
335. feeding+america
336. feeding+america
337. ferrotype+Lincoln
338. FILM
339. find+it
340. fire
341. florida
342. florida
343. Florida&type=dataset&type=interactive+resource
344. Florida&type=dataset&type=soun
345. florida+folklife
346. flying+cloud
347. folkstreams
348. Fox+%2Cet+al+First+steps+to+accreditation+%2C+1992+gazette
349. fragrance
350. Frances+Lee+Pratt
351. freemasonry
352. french+art&type=image
353. french+art&type=image
354. freshwater+mussels
355. gabriel+Moulin
356. gambling
357. gandhi
358. gardener
359. GATT
360. gauguin
361. GEM
362. Genealogical
363. genealogy
364. genealogy
365. genealogy&type=image&type=text
366. george+washington
367. gerd
368. Giant+Squid
369. glen+genz
370. global+warming
371. glopad
372. google
373. grainger
374. grand+central+station
375. graves
376. graybar+building
377. great+lakes
378. Gros+Ventres
379. Guinea
380. Hamonic
381. Hamonic+Fire
382. harry+collins
383. hartford+Connecticut
384. haven%2C+maine
385. haven+colony
386. Hawaii
387. hawaii%2C
388. hearth
389. heliotrope
390. Heliotropium
391. Heliotropium+tenellum
392. henry+fordmuseum+and+greenfiel+village
393. henry+fordmuseum+and+greenfiel+village
394. Hibi
395. higher+education
396. Highland+Park
397. Highways
398. hippopotamus
399. hippopotamus&type=image

400. hisako
401. historic+atlas
402. historic+atlase
403. historic+atlases
404. History
405. history
406. history+of+highways
407. history+of+physical+education
408. Hokusai
409. Hollywood
410. Hollywood
411. holocaust
412. holocuast
413. homefront
414. honore
415. honre
416. horse
417. House
418. housing
419. Housing+for+Shipyard+Workers
420. hungary
421. Icy+Hot+Bottle+Co.
422. ieee+collections
423. ieee+publications
424. ilgwu
425. illinois
426. illinois
427. Image
428. imigration+diaries
429. imigration+photographs
430. immigration+
431. immigration+diaries
432. impeachment
433. indian
434. indian
435. indian
436. indian
437. Indian
438. indian
439. indian
440. indian
441. Indian+House+Door
442. INDIAN+MOUND
443. Indians
444. indians
445. Indonesian
446. industrial+models
447. infomine
448. INFOMINE&type=unknown
449. information+
450. injection
451. inoculation
452. inquisition+
453. insurance
454. insurance
455. insustrial+models
456. international+pewter
457. Internet
458. interstate+compacts
459. Interstate+Water+Compacts
460. Interstates
461. Iquique
462. Iranian
463. irish
464. irish+american
465. irish+country+people
466. Irish+folk+tales
467. iron
468. iron+forge
469. israel
470. Israel
471. israel
472. italy
473. j.+b.+priestley
474. jabotinsky
475. jackson
476. jackson+davis
477. jackson+davis
478. jacques+louis+david
479. jameskojack
480. japan
481. Japan&type=moving+image
482. Japanese+art&type=image&type=physical+object

483. Japanese+art&type=moving+image%2C+physical+object
484. Japanese+art&type=moving+image&type=physical+object
485. Japanese+art&type=physical+object
486. jerusalem
487. jew
488. jewish
489. jews
490. Jews
491. john+brow
492. john+brown+invoice
493. john+cage
494. K-12
495. Kansas
496. Karachi
497. kendall+thomas
498. kendall+Thomas
499. kennywood
500. kentucky
501. keystone&type=image
502. king+county+snapshots
503. king+philip
504. king+Philip
505. King+Philipe+Augustus
506. King+Philipe+II
507. King+Phillip+II
508. klan
509. klimt
510. kmoddl
511. knowledge+wins
512. labor
513. labor
514. laboratory&type=image
515. ladies+garmet+workers+of+1900
516. lake+st+clair
517. Lakota
518. land+development
519. Landscape
520. landscape&type=image
521. landscape&type=image
522. Landscape+prints
523. learning+standards
524. lesson+plans
525. letters+from+19th+century
526. lewis
527. librarian
528. librarians
529. librarianship
530. librarianship
531. librarianship
532. libraries
533. library
534. library
535. library%2Bmoorhead
536. Lincoln
537. lincoln+blood
538. linking+florida
539. list+of+cherokee+names+
540. list+of+cherokee+registery+names+
541. list+of+cherokee+registry+names
542. liver
543. liver+disease
544. logging
545. los+angeles
546. losier
547. love+letters+
548. Lowry
549. lozier
550. LU.+65
551. lyman
552. madison+county
553. maine+memory
554. making+results-based+state+government+work
555. mambi
556. man&type=image
557. manuel+fernandez+del+casillo
558. manuel+fernandez+del+Castillo
559. maps
560. maps&type=dataset
561. maps&type=image
562. maps&type=interactive+resource
563. maps&type=moving+image

564.maps&type=physical+object
565.maps&type=sound
566.maps&type=text
567.maps&type=unknown
568.maria+thomas
569.marianas
570.marin
571.marin+county
572.mark+twain
573.mars+hill
574.masonic+%2Bmanuscripts
575.massachusetts
576.massachusetts+arms+invoice
577.matsusaburo+Hibi
578.mccaskey
579.mchale
580.meadow+brook+hall
581.medieval+quest
582.mesta+machine+co
583.method+of+dating
584.metis
585.michael+Collins
586.middle+east
587.Migrant+workers
588.milgrim
589.milgrims
590.mind+mode%3Bs
591.mind+models
592.mines
593.mining
594.mining
595.mining+stocks
596.minnesota
597.mint
598.MISANTHROPE
599.mizltplec
600.moac
601.monsen
602.moon&type=image
603.moorhead
604.motor+city
605.motorcycle
606.motorcycle
607.MP3
608.msp01047
609.msp01047
610.msp01047
611.Mulholland+highway
612.museum
613.museum+Illinois
614.music
615.music+boxes%22&type=image%2C+physical+object%2C+sound%2C+text
616.music+boxes&type=image%2C+physical+object%2C+sound%2C+text
617.music+boxes&type=image&type=physical+object&type=sound&type=text
618.music+therapy
619.musique+concrete
620.mussels
621.Mystic
622.naismith
623.naismith
624.Nakajima
625.narraguagus+river
626.Native+American
627.Native+American
628.Native+American
629.native+american+photos
630.native+american+settlement
631.native+american+settlement
632.naturalization
633.naturalization
634.naturalization+lesson+plans
635.ND-10043
636.Nevada
637.New+Deal+agencies
638.new+jersey
639.new+york
640.new+york+city+skyline
641.new+york+picture
642.new+york+public+library
643.newberry
644.newspaper

645. newspapers
646. nietszche
647. noank
648. Norman+Rockwell
649. Norman+Rockwell
650. Noronic
651. north+Carolina
652. north+Carolina
653. north+carolina+experience
654. north+caroline+experience
655. Oac
656. oakland+california
657. octopus
658. oklahoma
659. olfaction
660. olga+constantine
661. oliver
662. online+archive+of+California
663. oteiza
664. otto+perry
665. Ottoman
666. park+forest
667. park+forest%2C+il
668. pdf
669. pee+wee
670. Peep+into+the+Antifederal+Club
671. pennsylvania
672. penrose+correspondece
673. penrose+correspondece
674. penrose+correspondece
675. perfum*
676. perfum*
677. perfum*&type=image&type=text
678. perfume
679. perfumer
680. perfumes
681. perfumes
682. personal+correspondence
683. philadelphia
684. philadelphia&type=dataset
685. philadelphia&type=interactive+resource
686. philippines
687. photographs
688. Photographs
689. photographs+of+river
690. photographys
691. photos+of+Matilda+Wilson+Dodge
692. pictures+of+Enid+Baa
693. pictures+of+Enid+M.+Baa
694. pioneer
695. Pit+River
696. Pitt+River
697. Pittsburgh
698. Pittsburgh+And+Lake++Erie+Rairoad
699. pittsburgh+and+lake+erie+r.r.
700. Pittsburgh+And+Lake+Erie+Railroad
701. Pittsburgh+And+Lake+Erie+Railroad
702. plain+Indians
703. plains
704. plains
705. plant%2Blabel
706. plant+images
707. plate+no+28
708. plate+no+29
709. plate+no+29
710. plate+no+39
711. plate+no+39
712. policy
713. Polio
714. population
715. portfolios
716. portraits
717. poster
718. Pratt%2C+Frances
719. pre-Columbian
720. prisoners
re-entry%5C
721. prisons
722. prohibition
723. propaganda+
724. propaganda+techniques
725. public+art
726. public+art+bronx
727. puck

728. quilt
729. quilts
730. R. Pullman

---

731. raffles
732. raid+on+deerfield
733. raid+on+deerfield
734. raid+on+deerfield
735. raid+on+Deerfield
736. raid+on+deerfield
737. raid+on+deerfield
738. raid+on+Deerfield
739. railroad
740. real+estate+appraisal
741. red+sox
742. re-entry
743. registry+repair
744. renewable+energy+
745. renewable+energy+sources
746. rhinoceros
747. richard+olderman
748. Richmond++Housing+for+Shipyard+Workers
749. rights
750. riker-jaynes
751. riot
752. rivers+of+Guinea
753. rivers+of+Guinea
754. Roads
755. rochester
756. rubus
757. russia
758. rwanda
759. sailing+ships
760. Saint-denis
761. Saint-denis+tombs
762. Saint-denis+tombs
763. sales+reciept
764. satellite
765. savage+indian
766. savage+indian
767. sayres
768. scalping
769. scarves
770. Scavenger
771. Scavengers
772. scent
773. scent
774. scorsasie&type=moving+image
775. sculpture
776. Sheldon
777. Sheldon+House+Door
778. ship+images
779. ships
780. Shoshone
781. singapore
782. Sioux
783. sioux+indian
784. sitting+bull
785. skyscraper
786. smell
787. smell
788. Smithsonian
789. social+customs+
790. social+security
791. social+work
792. sonora
793. south
794. southeast+asia
795. soviet+union
796. spain
797. spanish+american
798. spanish+american
799. spectra&type=unknown
800. Springer+link
801. Springfield
802. springfield+ymca
803. standard+operating+procedure+for+laboratories
804. stanford+green+library
805. star+maps&type=image
806. stark+county (**cd**=2484)
807. stars&type=image
808. starvation
809. steel+works

810.stephen+king&type=text
811.street
812.streets
813.stutler
814.stutler+brown
815.stutler+brown
816.summer+drawings
817.summer+drawings
818.summer+landscape&type=image
819.summer+landscape&type=image
820.summons
821.summons+to+comradship
822.summons+to+comradship
823.Sweets+Ballroom
824.tain+bo+%22
825.teacher+and+student+resources
826.teaching+with+digital
827.team+work
828.teamwork
829.teepee
830.TELEVISION
831.tepee
832.test
833.texas
834.The+Great+Plains
835.the+nazi+march+in+Skokie
836.The+Tigers+claw
837.the+uffizi+an+anthology
838.the+wave
839.Theresa+Cha
840.thesis
841.three+rivers
842.tibbetts
843.tobacco
844.tobacco+currency
845.tobacco+currency
846.tom+sawyer
847.tom+sawyer&type=moving+image
848.tools
849.top+religion+in+1930s
850.Topaz
851.topiary
852.TRAIN&type=image
853.training
854.trains
855.Transportation
856.transportation
857.Transportation
858.transportation
859.tranvias
860.Turkish
861.type=moving+image
862.U.S.+History
863.ukraine
864.university
865.university+collections
866.university+of+California
867.university+Wisconsin
868.utah+newspaper
869.vaccination
870.van+gogh&type=text
871.Van+Horn
872.vanhorn
873.varese
874.victor+elford
875.Vocational+Education
876.voice+of+colorado
877.volleyball
878.von+tilzer
879.voyager+spacecraft
880.W.P.A.+PHOTO
881.w.p.a.+puppets
882.Wales
883.walking+stick
884.walking+stick
885.Walter+Hawkins&type=text
886.war
887.war
888.war
889.war
890.Washington&type=image
891.washington+stae
892.washington+state
893.washington+state

894. Washington+township
895. Watkins
896. wayne+state%22
897. Welsh+language
898. western+1818
899. western+high+schoo
900. western+high+school
901. western+waters
902. westervelt
903. wgbh
904. whaling
905. whaling
906. white+train
907. Whitman
908. William+Letts+Oliver
909. windorpski
910. wisconsin
911. wisconsin
912. wisconsin
913. wisconsin
914. Women
915. women
916. women
917. women
918. women , 2530)
919. world+war
920. world+war+i
921. world+war+i
922. World+War+I
923. World+War+I
924. wpa+program
925. wrighting
926. wrighting
927. WW1+Posters
928. wwii
929. Wyandoch+Kansas
930. yearbook
931. ymca
932. YMCA
933. YMCA
934. YMCA
935. YMCA
936. YMCA
937. ymca
938. ymca
939. YMCA
940. yoko+ono
941. z39.50
942. zeppelin
943. Zionism
944. Zohaib+khan
945. zoo