



Conference Paper

An Evidence Based Methodology to Facilitate Public Library Non-fiction Collection Development

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Abstract

Objective – This research was designed as a pilot study to test a methodology for subject based collection analysis for public libraries.

Methods – WorldCat collection data from eight Australian public libraries was extracted using the Collection Evaluation application. The data was aggregated and filtered to assess how the sample's titles could be compared against the OCLC Conspectus subject categories. A hierarchy of emphasis emerged and this was divided into tiers ranging from <0.1% of the sample to >1% of the sample. These tiers were further analysed to quantify their representativeness against both the sample's titles and the subject categories taken as a whole. The interpretive aspect of the study sought to understand the types of knowledge embedded in the tiers and was underpinned by hermeneutic phenomenology.

Results – The study revealed that there was a marked tendency for a small percentage of subject categories to constitute a large proportion of the potential topicality that might have been represented in these types of collections. The study also found that distribution of the aggregated collection conformed to a Power Law distribution (80/20) so that approximately 80% of the collection was represented by 20% of the subject categories. The study also found that there were significant commonalities in the types of subject categories that were found in the designated tiers and that it may be possible to develop ontologies that correspond to the collection tiers.

Conclusions – The evidence-based methodology developed in this pilot study has the potential for further development to help to improve the practice of collection development. The introduction of the concept of the epistemic role played by collection tiers is a promising aid to inform our understanding of knowledge organization for public libraries. The research shows a way forward to help to link subjective decision making with a scientifically based approach to managing knowledge resources.

Introduction

There remains in the broader information management specialization known as Collection Development, a tension between advocates of the traditional view of collection development as an art, and those who are interested in how scientific methods can be adapted to get the right information to users. Put simply, the question would be, “Can any bibliometric method provide the basis by which we sublimate the axiological values that underpin topical choice and subject representation?” Is there a method of collection analysis that allows us to understand what the general selection choices in public libraries look like, why they look the way they do and what should they look like? This study was formulated to help to answer these questions at the level of the non-fiction collection in the public library setting where the need for a wide range of potential topicality is, arguably, at its broadest (public libraries having to meet the knowledge needs of all sectors of civil society).

Literature Review

Identifying what material deserves a place in a public library's collection has been debated for many decades, as has the process that allows for evaluation of a collection in order for it to both maximize its usefulness to a cohort of users, and also, to determine how it stands as a set of documents that best represent the viable knowledge on a topic (Agee, 2005; Wilson, 1968). The difficulty in framing a method that is sufficiently objective to receive general endorsement, given the inherently subjective nature of collection evaluation (Evans, 2000) can

be linked to attempts to understand the relationships between various branches of knowledge. The search for a well-reasoned approach to objectivity that explicates its source in intersubjectivity (Alexander, 2012), rather than in an ideal state, can aid in this goal which also has found significant expression in the field known as the sociology of knowledge (Berger & Luckman, 1971; Bernstein, 1983; Hekman, 1986; Mannheim, 1972; Scheler, 1980; Stark, 1967).

We are seeking a system that can: 1) “guide the systematic selection of the world's recorded knowledge...according to a rationale founded upon priorities that have been identified to serve the community most effectively” (Osburn, 1979, p. 10) and, 2) incorporate the “dynamism inherent in the interactions and potential interactions of the community and the information universe via collection management” (Osburn, 2005, p. 10). Questions relating to how consideration is given to those domains that find either minimal or no representation in collections have primarily been approached from a standpoint involving checking collections against bibliographies which were thought to reveal what libraries should own. Such an approach could not reveal, however, items within a collection that should not have been included.

Elzy and Lancaster (1990) identified an innovative means by which the reciprocal or interdependent relationship between bibliographies and collections might be checked to determine measures of complementarity and quality. Evaluating materials within collections, based on ranking data, and hence audience levels (in this context “audience levels” means

that high ranking across compared libraries largely indicates a popular work in the sense of it not having scholarly content — the inference being that scholarly content largely belongs in scholarly libraries), emerged from White's *Brief Tests of Collection Strength* (1995). White's approach compared short lists of items to library holdings (the so-called "brief tests") and included Research Libraries Group Conspectus levels as part of how assessment was conducted. White's approach enabled collection level descriptions to be established quickly without the need for either extensive checks of bibliographies or the assumption of subject knowledge (Lesniaski, 2004). The "brief test" method was followed by an elaboration of the original method, the "coverage power test" remedy — which aimed to shore up a number of perceived shortcomings. This method involved testing a collection against an absolute scale of holdings counts (all of WorldCat's holdings) rather than the earlier iteration (a bibliography composed by an expert) (White, 2008). White's methods were tested and determined to be efficacious by Twiss (2001), Lesniaski (2004), Bernstein (2006), Beals and Gilmour (2007), and McMinn (2010). Other scholars have attempted to use WorldCat's Collection Analysis application to look to better understand collections with various levels of efficacy (Genoni & Wright, 2010; Lavoie, Connaway & O'Neill, 2007; Monroe-Gulick & Currie, 2011; O'Neil, Connaway & Dickey, 2008; Jensen, 2012; Perrault, 2004).

The Standing Committee of the International Federation of Library Associations and Institutions' (IFLA) Acquisition and Collection Development Section (2001) noted how the process of outlining a collection policy relating to subject breadth and depth contributes to reducing personal bias and reducing gaps in a collection (pp. 2-6). They advocated an approach using the OCLC conspectus to aid evaluation that can contribute to libraries holding a more extensive range of subjects or a deeper coverage of those subjects. By approaching subject range and depth as not only capable of being assessed

qualitatively, but also as a desirable precursor to answering questions relating to how subjective and objective approaches to knowledge domains and subject representation are contextualized within civil society settings, we begin to develop a more resilient (social) epistemological basis for the model of knowledge that we choose to promote in public libraries (Budd, 2001; Egan & Shera, 1952; Fallis, 2006). Matthews and Stephens (2010) describe this in a general sense as "the optimization of systems of knowledge acquisition through an appreciation of social strategies and motivations" (p. 541). Such an approach is also present in Capurro's (1992) information hermeneutics that looks to move beyond the simple question of what is the best way to promote collection development and ask more fundamental questions such as what is collection development for, and moreover, how might it serve the interests of civil society in the context of public libraries?

Aims

This research was designed as a pilot study to test the methodology for subject-based collection analysis that will help:

1. To determine how subjects in adult non-fiction monograph collections in Australian public libraries are distributed;
2. To describe the commonalities in distribution that reveal subject priorities or subject gaps;
3. To assess how subjects in adult non-fiction monograph collections in public libraries are distributed in terms of a weighting that indicates range and depth of coverage;
4. To identify subjects that have measurable priority or omission, and to assess if this is associated with the range of materials available for acquisition or if the epistemic values of selectors drive an imbalance in collections.

By grounding the broader research in these specific factors, a further qualitatively-based aspect of the research will, it is expected, be better placed at a later date to determine the criteria that selectors bring to bear on their selection and evaluation decisions for non-fiction monograph collections in public libraries. This later aim is to examine what selectors consider to be “core knowledge” as well as what knowledge represented in subject domains is considered to be crucial to meeting the educational, informational and recreational needs of public library users.

Methods

From the cohort of 31 municipal public library services in Australia that agreed to take part in the ongoing research project, 8 libraries were selected to take part, based on the similarity of the level of their reported collection holdings in WorldCat. A survey was conducted in 2014 that totaled the eight libraries’ combined holdings in WorldCat at over 2.2 million items. The WorldCat holdings data was extracted using OCLC’s proprietary Collection Evaluation application; this application was accessed online.

The Collection Evaluation application requires comparisons to be made against the holdings of an “Anchor Library” (in a practitioner setting this is the practitioner’s own library). In this case, the data from the “Anchor Library” — the first library which agreed to participate — was extracted first. This data was not included in the study and is referenced here to illustrate part of the process of working with Collection Evaluation as a research tool. Following this a “One-to-Many” analysis was conducted with 8 other libraries’ collections and then further refined by using the “Benchmarking” filter on the Collection Evaluation website which was set to show that the titles to be delivered in the FTP transfer were “Not Held” by the “Anchor Library.”

The data was also pre-filtered in the Collection Evaluation website for print and e-books. The spreadsheet file was downloaded through the OCLC FTP server and the print/e-book filter was applied, resulting in 1,557,380 items held in WorldCat in June 2015. Of these, 1,023,453 were unique titles; these formed the basis of this study. The ratio of unique to shared titles was 70:30 for the initial pre-active-filtered data set downloaded from WorldCat with 306,663 items/titles shared by 1 or more libraries and 254 items/titles shared by all. Further spreadsheet filtering took place to ensure that only adult, non-fiction print or e-books were represented. This process included deleting 187,934 juvenile titles, 139,112 non-English language titles, 140,616 audiovisual titles, 34,981 non-book titles, 241,062 fiction titles, 205,607 items described as unknown classification, and 9,025 titles whose subject categories crossed over between foreign language and literature. Where foreign language was specifically dealt with in the subject category, the item was included as it was likely not to be a fictional work; the aim was to exclude foreign language fiction classified within subject categories dealing with “Language and Literature.” It was necessary to actively search in other data designations to ensure that the desired sample was as accurate as possible. For example, filtering English-language-only did not automatically remove all non-English works, and filtering for print and e-books did not eliminate all other formats in the initial file download. Paring each of these qualifiers down to achieve the desired set resulted in 334,544 titles (21.48 % of the data provided in the output file by Collection Evaluation as print/e-book format). The instances of “Subject Category” from this data set were then transferred to another spreadsheet. The individual Titles data was no longer of any use at this point and was retired along with all other criteria that had accompanied “Subject Category” in the file download.

The subject categories were sorted to create a hierarchy and the 334,544 titles were tabulated

in the 437 subject categories that emerged from the sample. The sample was divided into five tiers:

- 1% of the sample
- 0.5% - 1% of the sample
- 0.25% - 0.5% of the sample
- 0.1% - 0.25% of the sample
- < 0.1% of the sample

The tiers were then interrogated for their relationship to three factors:

- Number of subject categories in the tier
- Percentage of the sample titles in the tier
- Number of subjects in the tier as a percentage of total subject categories in the sample

An interpretive phenomenological method (hermeneutic phenomenology) was introduced to assess the subject agglomerations (or clusters) that were evident in the tiers to ascertain, in a preliminary way, what the sample might reveal about the selection decisions made by the collection development librarians who had created this combined collection. Hermeneutic phenomenology provides a well-defined ontological grounding in how we conceptualize the nature of the knowledge that an information expert (such as a collection developer in a public library) might be called upon to deploy and to engage — in a dialectical sense — with the community of users and the community of knowledge creators (Benediktsson, 1989; Bruce, 1999; Budd, 2005; Capurro, 1992; Hansson, 2005; Savolainen, 2008; Suorsa, 2015; Suorsa & Huotari, 2014; VanScoy & Evenstad, 2015).

Fundamental to this approach to knowing is an acknowledgment that human subjects are engaged, already and always, in a process of creation and co-creation of the knowledge environments in which they are cast. Budd (2008) outlines how this hermeneutic approach “introduces the realization that knowledge, information and searching are not solitary acts, but are undertaken in a communicative

relationship with another creator of knowledge and information. Information seeking and retrieval is, in short, dialogical” (p. 91). In this study, an attempt was made to use the results of the subject category structure to look to how civil society, through the public library, structures knowledge organization. In doing so, the approach sought a way to invoke what Rorty (1979) calls the “Kantian notion of philosophy as metacriticism of the special disciplines” (p. 166) and to join this with an equally Kantian approach which rehabilitates “intuitions and concepts” as tools with which we can rework not only a theory of knowledge, as Rorty hopes to do, but a theory of its organization. With these factors in mind, and with reference to the emergent knowledge organization tradition, and especially Svenonius’s (2004) explication of varieties of theories of meaning in this context, an amalgam of the operational, referential and instrumental approaches was sought in an attempt to graft an epistemological framework on to the sample results so as to uncover something of the design of knowledge representations in the setting of civil society library collections.

Results

The ranking of subject categories, their percentage of the total sample and their inclusion in one of the five tiers referred to above is outlined in Appendix A.

Taking the results as providing a symptomatic and indicative (rather than conclusive) referencing of the state of adult non-fiction collections in the Australian public library sector, it seems reasonable to acknowledge that there is a tendency for widely divergent level of emphasis on subject categories in the civil society knowledge context within which the public library operates. What this means is that a small number of subjects that are statistically insignificant when regarded against the entire matrix of possible subject categories contribute an inordinate amount of material to the libraries they serve.

The study found that 0.9% of possible subjects contribute 16% of the collection’s titles in the area and format (adult non-fiction books and e-books) under investigation. Assuming that the pilot study does reflect the generalized state of the sector, we should ask — and investigate — why this is not an acknowledged problem for librarians. The breakdown of how identified segments constitute the collection can be further schematized across tiers where we can see the bibliometric relationship of Subject Categories’ Share of Sample to The Proportion of Titles (Table 1). We see here that the most numerous

10% of subject categories in the sample give up 60% of the titles; the most numerous 20% of subject categories in the sample provide 77% of the titles, the most numerous 40% of subject categories in the sample account for 92% of titles, while the balance of 60% of subject categories in the sample provide only 8% of the titles. The Tier Weighting remedy in Table 1 is explained below.

This study indicated that there is a strong tendency for a limited number of subject categories to represent the varieties of knowledge considered suitable for civil society settings. The relationship of category to title holdings in this study showed a strong correlation to what is described in a statistical sense as a power law or a Pareto distribution. Bradford’s Law of Scattering is a representation of a similar statistical distribution. To date, there has been no specifically collection-oriented identification of a Bradford-style power law at work in library monograph collections (although

Table 1
Share of Categories vs Proportion of Titles & Tier Weighting Remedy

Subject Categories’ Share of Sample	Proportion of Titles	Proportion of Titles After Tier Weighting Applied	Result
Most numerous 10% of subject categories in sample	60%	44 %	Tiers 1 and 2 Reduced by 16%
Most numerous 20% of subject categories in sample	77%	64%	Tiers 1,2 and 3 reduced by 13%
Most numerous 40% of subject categories in sample	92%	82%	Tiers 1,2,3 and 4 reduced by 10%
Balance of 60% of subject categories in sample	8%	18%	Tier 5 increased by 10%

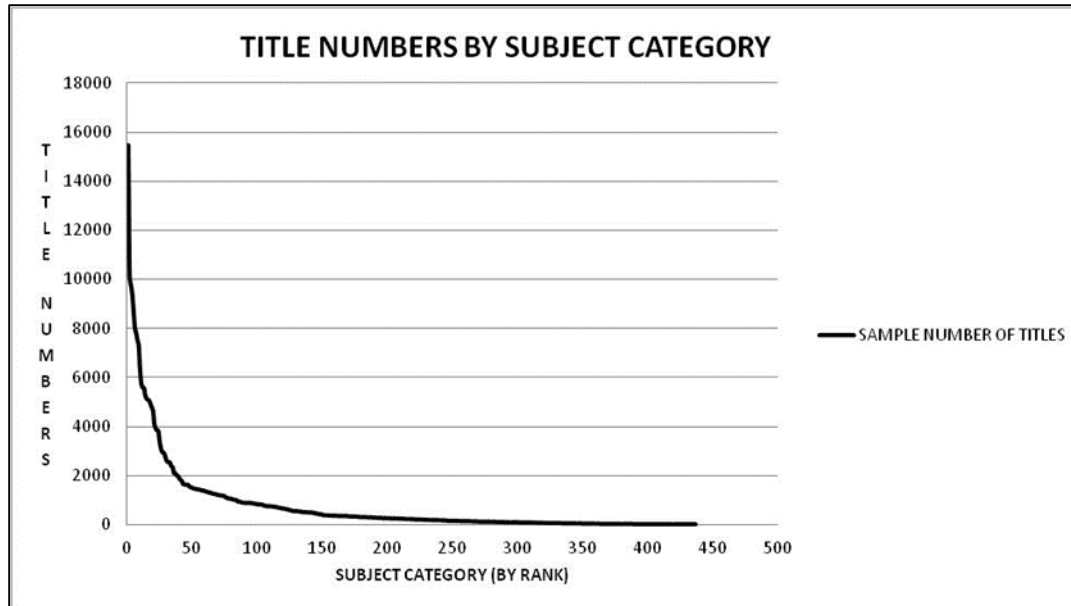


Figure 1
Title numbers by subject category.

a significant body of work exists on serials collection management with reference to Bradford's Law). The notion that this type of distribution is to be expected in a range of information environments is a common theme in early bibliometric (Buckland & Hindle, 1969; Fairthorne, 1969; Drott, 1981) and scientometric commentary (de Solla Price, 1976). In Figure 1, the heavy weighting of the Top 20% of subject categories is evident.

Once the structural nature of the collection is identified, it becomes possible to locate how a non-bibliometric selection technique creates significant imbalances in a collection's focus. In order to rebalance a collection, it is necessary to look to the best available method to ensure that the most representative collection, in terms of subject categories relevant to civil society users, is instantiated through *bibliometric planning*. A preliminary attempt was made to formulate such a methodology so as to flatten the distribution through a weighting technique. This involved:

- Multiplying the top subject category for Tier 1 by 0.25 and transposing the result

on the remainder of Tier 1 subject categories (the top 22 categories are reduced substantially while the bottom 3 categories increase marginally);

- Multiplying Tiers 2 and 3 by 1.2 and transposing the result on the remainder of Tiers 2 and 3 subject categories (a simple 20% increase);
- Multiplying Tier 4 by 1.25 and transposing the result on the remainder of Tier 4 subject categories (a simple 25% increase);
- Creating an artificially homogenous Tier 5 through multiplying the first number of the tier (the subject category ranked Number 173 in the sample) by 0.7, thus creating approximately a 30% differentiation from Tier 4. This differentiation, which was not evident in the sample (the last subject category of Tier 4 and first subject category of Tier 5 were numerically separated by only 9 titles) allowed all Tier 5 categories to move from a range of statistical significance that in the sample is in the range 2.98914E-06 to 0.09% to a constant 0.07% (42 Tier 5 subject categories

would lose titles while 224 would gain titles).

The visual representation of this process can be seen in Figure 2.

So while the changes that such a weighting approach might make are potentially significant to the makeup of a collection in Tiers 1 and 5, they are only relatively minor for the collection as a whole when conceptualized as a grouping of tiers. The general shape of the collection, with the exception of an activity that might profitably be described as “capping” (and which refers to the limiting of Tier 1 subject categories to one percent of the collection), remains essentially the same. What this approach promises is the ability to plan for collection development by identifying a percentage-based increase or decrease for each subject category based on its location within a particular tier of the collection (see Table 1).

The point here is not that particular tiers should have a nominated reduction or increase but that the analysis can be done so as to effect a more balanced collection and that the application of a tier-weighted approach is likely to ensure that the collection — assuming it is reasonably balanced — is able to be worked on to help to ensure that the broader domains that the tiers represent are not disturbed. There is, as yet, no ontological assumption built into the model which would see changes directed toward the themes or domains that each tier might represent. The tier-weighted approach makes the assumption that there are levels of tolerance that exist within each of the tiers, such that the addition or deletion of an entire subject category (and its commensurate level of titles holdings) would not substantially affect how a collection delivered the broader information domain.

Working with the idea that a tier-based breakdown might reveal a significant bibliometric relationship between types of knowledge in the civil society context, the sample revealed the following data regarding how collection tiers were constituted (Table 2).

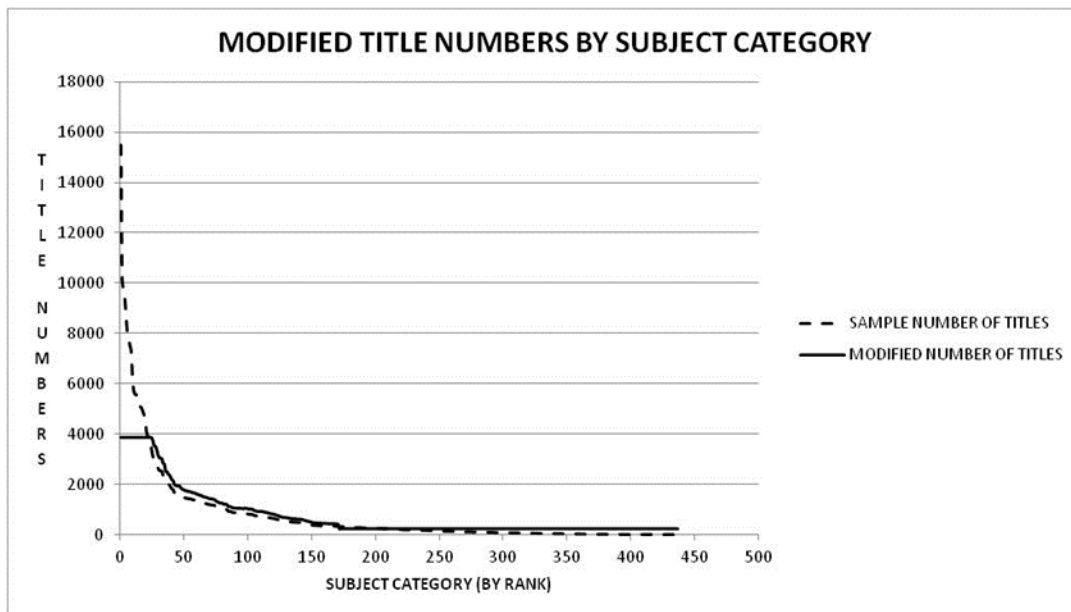


Figure 2 Modified title numbers by subject category.

Table 2
Collection Tiers and Relationships to Title and Subject Categories

Collection Tier	Subject Categories	Percentage of Total Titles	Percentage of Total Subject Categories	Percentage of Total Collection per Subject by Tier (Mean)
Tier 1: The Self: Home and Family	25	48.15%	5.72%	1.92%
Tier 2: Outside of the Self: The Civilized Mind	17	12.09%	3.89%	0.71%
Tier 3: Onward the Enlightenment: Specialized Science, History and Culture	58	20.50%	13.27%	0.35%
Tier 4: Democratizing Knowledge: The World of Generalities	73	11.33%	16.71%	0.15%
Tier 5: Deep Natural and Social Science: The Borders of Academic Knowledge	264	7.93%	60.41%	0.03%

Discussion

As “understanding always involves understanding from within a framework which makes sense for us” and that learning from the past involves a dialectical engagement with it through “posing questions to the past in light of our conceptual preoccupations in the present” (Benhabib, 1986, p. xi) we should not be surprised at the difficulty of aligning a collection to meet universal, worldly and pragmatic requirements. Such an analysis is cognizant of, but in no way driven by, the current needs of users. It can also never be more than the sum of knowledge aggregated by the non-fiction publishing industry over a given period of time.

This research takes heed of the need for its own foundation to be ultimately grounded, in a comparative sense, with the types of collection profiles that collecting libraries maintain. By comparing and differentiating “collect

everything collections” and “circulating collections,” it is possible to ensure that, where subject category priority can be identified in the latter, for instance in the practical arts of domestic life or the generalizable narrative of history, then these domains are more specifically articulated as knowledge that defines — perhaps more pertinently than other domains — the types of knowledge that civil society demands and deserves in its libraries.

But it also should be said that while the civil society library is to some extent a creature of its times, it also has an educative mission that should reject the relativist position that all knowledge is equally as valid and that no knowledge can deserve to be maintained in situ. While these questions are beyond the scope of this paper, it is worthwhile acknowledging that the types of knowledge that we do maintain in civil society libraries reflect the epistemic priorities that we set. Such priorities are,

surprisingly, rarely interrogated for what they represent about our critical or hermeneutic assumptions.

As this specifically epistemic concern was foundational to this research (in part, the research was designed to seek preliminary answers to such questions), it is worth acknowledging this briefly, so as to provide both proper context for the work conducted on the eight library collections and for a report on the findings to date for interested scholars and practitioners. This will also assist in explaining how the tiers received their thematic designations outlined in Table 2.

A process of investigation was conducted, using a hermeneutically-based phenomenological method. At its core such a method is a philosophically-oriented approach which seeks to "...acquire the essence of the research process as this is opened up in the philosophical literature... [the researcher seeks to] attune themselves towards the ontological nature of phenomenon while learning to "see" pre-reflective, taken-for-granted, and essential understandings through the lens of [existing] pre-understandings and prejudices." (Kafle, 2011, p.188)

A project to outline the significant elements of the researcher's pre-understandings in the area of public library collection development was undertaken and the results presented and published across a range of fora (Kelly, 2014, 2015a, 2015b, 2015c). In so doing, the prejudices that the researcher brought to the project relating to the theory and practice of collection development were made explicit to better facilitate dispassionate engagement with the qualitative issues at the core of the inquiry. Analysis commenced, using the following hermeneutic and phenomenological approaches:

1. The hermeneutic circle of "reading, reflective writing and interpretation" (Kafle, 2011, p. 195) within and around information science and philosophy;

2. A type of engagement that is extended, temporal and oriented toward development of provisional documents (the quantitative data delivered by OCLC's WorldCat union catalog) and how meaning develops for both the researcher and research participant (which in this case included the collection developers whose collection and epistemic choices were central to the study);
3. The nature of the rhetorical basis of types of language use pertinent to the theme investigated so as to link the subject categories together in a meaningful way.

With this framework as the basis for the qualitative aspect of the research, the subject categories that emerged from the bibliometric inquiry were assessed to attempt to link them together in a common theme.

Commencing the analysis with the most popular and continuing through to the least popular, a standout theme emerged for the Tier 1 results (>1% of subject categories and 25 out of 437 subject categories). This theme was identified as *Home, Family and Self*. Since cooking, sports, arts and crafts, family, sexuality, gardening, psychology and local history are all prominent, there should be no real surprise at the assignation. More than a quarter of all books and e-books, according to this study, involved the following 10 subject categories: Domestic Engineering (4.62%), Sports (3.02%), History – Oceania, South Seas (mainly Australian history) (2.91%), Handicrafts, Arts & Crafts (2.81%), Decorative Arts, Applied Arts (2.61%), History, General (2.40%), Family, Marriage, Women, Sexual Life (2.33%), History – Great Britain (2.25%), Plant Culture (2.18%), Individual Psychology (1.88%). It is argued here that seven of these ten subject categories fall within the ambit of the householder who has an interest in improving the quality of their own life and that of their immediate family, whether in terms of recipes for meals, maintaining the home,

engaging in a craft-oriented hobby or gardening. This also links with the importance of sport to households as a recreational, social, activity. The psychology of family life is prevalent here as well. Two of the three history subject categories can be considered parochial in nature. Taken together, these 25 subjects comprised 48% of the sample and it is not unreasonable to start to build a picture, albeit it a speculative and preliminary one at this stage, of how 6% of the possible topicality equates to nearly half of the sampled collection. This leads to the question, "Is this all that civil society cohorts are interested in reading?" or is there a more or less unstated assumption by librarians that they should be selecting very heavily in the Home, Family, Self space?

The interpretive label *Outside of the Self: The Civilized Mind* was chosen for Tier 2. The term "the civilized mind" is not meant to carry any baggage but is used in the same way that Raymond Williams uses it to refer to "an achieved state or condition of organized social life" (1976, p. 57). This tier constituted a grouping of topical interests that demonstrated a tendency towards inquiry into matters that were less likely to be easily linked just with the world of home and family. Connections could, however, be made. While the importance of Motion Pictures and The Theater could be linked to the notion of entertainment, they are a specific type of skilled entertainment that does not generally link with the orientation of the hobbyist that links so many of the Tier 1 topics (in Tier 2 Games and Amusements might be emended to this Tier 1 group). English Philology and Language, along with Literature — Collections, covered a wide range of literary technique and anecdote. The presence of the so-called Occult Sciences and of Psychiatry within this list abutting one another was a serendipitous aid in orienting the Tier 2 topicality and showed similar concerns for the mind conceived of beyond the normative realm. Similar levels of title holdings were evident for Social Work/Social and Public Welfare and for Therapeutics and Pharmacology, which were

also present in this tier. Geography and the four separate subject categories of History of Africa, History of the Middle East, History of Italy, History of France (Ancient History has no conspectus category) were a prominent grouping. The separate subject categories of Genealogy and Biography can be reasonably linked with the notion that readers (and selectors) want to be able to discover the self through engagement with the selves of others. The subject category Practical Theology while effectively only dealing with Christianity, deals with its social articulation and practice (which is the notable thematic expression that the research identifies in this tier). Without wishing to psychologize the process, the Tier 2 group, in contrast to the Tier 1 group, might reasonably be said to deal with topicality that touches on the Enlightenment movement into disciplinary knowledge and "the civilized mind." While it might surprise some, it might well be argued on the basis of this research that this process of moving the locus of the major considerations of civil society knowledge away from the home and into an "open world" is still in the process of development, even in Western countries.

The description of the general domain evident in Tier 3 takes the Enlightenment metaphor developed above a stage further. Designating this category "Onward the Enlightenment" in reference to the emergent themes in the Tier 2 domain, this tier was further qualified as "Specialized Science, History and Culture." It seemed to deal with specialized knowledge and, with a handful of exceptions, does not touch upon the topicality of home, family, health, spirituality, hobbies, customs and personal/spiritual matters. Tier 4 was designated "Democratizing Knowledge" and is identified as dealing with "The World of Generalities." While most can be identified as having a humanistic or social scientific base with the balance comprising natural sciences or technical/applied sciences, further delineation has not been attempted. The final tier, Tier 5, was designated "Deep Natural and Social Science" in recognition that a majority of the subject

categories might be seen as quite reasonably likely to match an identifiable specialization in natural or social science. The tier was further qualified as “The Borders of Academic Knowledge” in recognition that the titles included in these subject categories might reasonably be expected to comprise not only introductory works dealing with these fields but also works that assume significant foundational knowledge to be of use to a reader. Not all subject categories fitted this description and the delineation between Tier 4 as *specialized* and Tier 5 as *deep* knowledge is somewhat arbitrary. With further refinement in methods for sorting the large data sets it is expected that the “long tail” – that is, the Tier 4 and 5 set of subject categories – may reveal more about how individual libraries select for this type of deeper or specialized knowledge that constituted 73% of subject categories but only 18.5% of the titles.

Conclusion

Just as the methodology outlined here offers promise to improve the practice of collection development, it also provides a starting point for assessing how the epistemic role of collection tiers can inform our understanding of knowledge organization. While the approach was designed to aid public libraries in their quest to meet the information needs of all of civil society it may in fact have applicability in more specific knowledge spheres as well. While many of these findings remain provisional in nature (such as the apparent identification of a power law at work in such collections) and will require further verification, the tier-based method outlined here offers the following benefits: it is simple, replicable, rigorously defined and enables, through providing a relatively objective methodology for making decisions in various parts of the non-fiction collection, the important interpretive aspects of selection and evaluation of information resources to be grounded in the hermeneutic and critical faculties of the librarian. It offers the promise that the inevitably subjective decisions that are made in support of quality collection

development might also be referenced to a scientifically-based approach to managing the knowledge resources underpinning these important deliberative activities. Such a process offers a considerable opportunity for growth, in terms of the ability to better target resources to the communities who need them, but also, in promoting the level of scientific and informetric engagement of the public librarians tasked to facilitate this.

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Appendix A

Subject Category Percentages Subject Results

Subject Category	Sample %
Domestic Engineering	4.62%
Sports	3.02%
History - Oceania, South Seas	2.91%
Handicrafts, Arts & Crafts	2.81%
Decorative Arts, Applied Arts	2.61%
History, General	2.40%
Family, Marriage, Women, Sexual Life	2.33%
History - Great Britain	2.25%
Plant Culture	2.18%
Individual Psychology	1.88%
Business, Business Administration	1.71%
Literature on Music	1.67%
Painting	1.66%
Graphic Arts, Drawing, Design	1.57%
Motor Vehicles, Aeronautics, Astronautics	1.53%
Economics - Industries, Land Use, Labor	1.52%
English Philology & Language	1.51%
Visual Arts in General	1.47%
Animal Culture	1.43%
Criminology, Criminal Justice	1.38%
Photography	1.22%
Architecture	1.17%
Public Health, Public Aspects of Medicine	1.15%
History - Eastern Asia, S.E. Asia, Far East	1.14%
Religions, Mythology, Rationalism	1.01%
Motion Pictures	0.93%
Occult Sciences	0.88%
Psychiatry	0.88%
Geography, General	0.84%
The Theater	0.79%
History - S.W. Asia, Middle East	0.76%
Social Work, Social & Public Welfare	0.76%
Therapeutics, Pharmacology	0.75%

Subject Category	Sample %
History - Africa	0.71%
Finance, General	0.70%
Genealogy	0.63%
Practical Theology	0.63%
Literature - Collections	0.60%
Games & Amusements	0.59%
History - Italy	0.57%
Biography	0.54%
History - France, Andorra, Monaco	0.53%
Building Construction	0.49%
Law of the Pacific Area & Antarctica	0.49%
Manners & Customs, General	0.48%
Libraries - Library Science	0.48%
Pediatrics	0.48%
Computer Software	0.46%
Sociology, General & Theoretical	0.45%
Astronomy	0.44%
Literature - Authorship & Criticism	0.44%
Transportation & Communication, General	0.43%
Parapsychology	0.43%
Doctrinal Theology	0.43%
Economic History & Conditions	0.43%
Electrical Engineering	0.42%
Physical Training	0.42%
Bible	0.41%
Labor, General	0.41%
Roman Catholic Church	0.40%
Special Industries & Trades, General	0.40%
History - Southern Asia, Indian Ocean	0.39%
Diseases of Organs, Glands, Systems	0.39%
Ethnology. Social and Cultural Anthropology	0.39%
Vocal Music	0.38%
Manufactures	0.37%

Subject Category	Sample %
Computer Networks	0.37%
Recreation	0.37%
General Technology	0.36%
Broadcasting	0.36%
Gynecology & Obstetrics	0.36%
History - United States, Since the Civil War	0.35%
History - United States, Colonial, Special Topics	0.35%
Buddhism	0.35%
Physiology	0.34%
Science, General	0.33%
Botany, General	0.32%
Natural History	0.31%
Military Science, General	0.31%
Economic Theory	0.31%
Islam, Bahaism, Theosophy, etc.	0.30%
Chemical Technology	0.30%
Christianity	0.30%
Neurosciences, Neurology	0.30%
Ethics	0.28%
History - Germany	0.28%
Philosophy - Modern (1450/1600-)	0.28%
Botany, Specific Fields	0.27%
Special Aspects of Education	0.26%
History - Russia. Soviet Union	0.26%
Folklore	0.26%
Birds	0.26%
Prose Technique	0.26%
Communities, Classes, Races	0.26%
Journalism, the Periodical Press	0.26%
Office Automation	0.26%
Philology, Linguistics	0.26%
Computer Programming & Programming Languages	0.25%
Arts in General	0.25%
Protestantism	0.24%
History - South America	0.24%
Naval Architecture, Shipbuilding, etc.	0.24%
History - Greece	0.24%
Zoology, General	0.23%

Subject Category	Sample %
Air Force	0.23%
Agriculture, General	0.22%
Medicine, General	0.22%
Mechanical Engineering & Machinery	0.22%
Early Childhood, Preschool, Kindergarten & Primary	0.22%
Mathematics, General	0.22%
Theory & Practice of Education	0.22%
Political Inst. & Public Admin., General	0.21%
Environmental Technology	0.21%
Political Inst. & Public Admin. - Asia/Africa/Australia	0.21%
Social History, Social Problems, Social Reform	0.20%
Political Theory, Theory of the State	0.20%
Biology, General	0.19%
Dancing	0.19%
History of Civilization & Culture	0.19%
Music Instruction & Study	0.19%
Special Topics in Computer Science	0.18%
History - Americas, General, Indian, North America	0.18%
History - Balkan Peninsula	0.17%
Neoplasms, Tumors, Oncology	0.17%
History - Spain	0.17%
Meteorology	0.16%
Philosophy - Ancient, Medieval, Renaissance	0.16%
Sculpture	0.16%
Print Media, Printmaking, Engraving	0.16%
Speculative Philosophy	0.16%
Practice of Medicine	0.16%
State & Local History - N. England, Atlantic Coast	0.15%
Invertebrates	0.15%

Subject Category	Sample %
Armies - Organization, Distribution, etc.	0.15%
Physics, General	0.15%
Writing	0.15%
Military Engineering	0.15%
General Engineering	0.14%
Atlases. Globes	0.14%
Printing	0.14%
Special Computers & Systems	0.14%
Surgery	0.14%
Instrumental Music	0.13%
Psychology	0.13%
Commerce, General	0.13%
History of Europe, General	0.13%
State & Local History - Pacific States. Territories	0.12%
History - United States, Slavery & Civil War	0.12%
Economics - Industry, General	0.11%
Animal Behavior, Anatomy, Embryology	0.11%
French Language, Provençal Language & Literature	0.11%
Law, General	0.11%
Railroad Engineering	0.11%
Environmental Sciences	0.11%
International Relations	0.11%
Subject Bibliography	0.11%
Computers, General	0.10%
Veterinary Medicine	0.10%
Socialism, Communism, Utopias, Anarchism	0.10%
Local Government	0.10%
Bookselling & Publishing	0.10%
Law - United States, Federal	0.10%
Naval Science, General	0.10%
General Bibliography	0.10%
Military Administration	0.10%
Navigation, Merchant Marine	0.10%
Pathology	0.10%
Judaism	0.10%
Anthropology, General	0.10%
Spanish Language	0.10%
Nervous System	0.10%
History - Asia, General	0.09%

Subject Category	Sample %
History - Mexico	0.09%
Public Finance, General	0.09%
School Administration & Organization	0.09%
Ecology	0.09%
History - Northern Europe, Scandinavia	0.09%
Heraldry	0.09%
State & Local History - South, Gulf States	0.09%
Special Aspects	0.09%
Major Theories & Systems	0.09%
Prehistoric Archaeology	0.09%
Mining Engineering & Metallurgy	0.09%
Encyclopedias	0.08%
History - British/French/Dutch America. Canada	0.08%
Social Usages, Etiquette	0.08%
Archaeology, General	0.08%
History - West Indies. Caribbean Area	0.08%
Italian Language, Sardinian Language & Lit	0.08%
Human Ecology, Anthropogeography	0.08%
Aquaculture & Fisheries	0.08%
Political Inst. & Public Admin. - United States	0.08%
Japanese Language	0.08%
Computer Science - General	0.08%
Immunologic, Nutritional & Metabolic Diseases	0.08%
Reptiles & Amphibians	0.08%
History of Medicine	0.08%
Other Systems of Medicine	0.07%
Political Inst. & Public Admin. - Europe	0.07%
Forestry	0.07%
Fishes	0.07%
German Language	0.07%
Nursing	0.07%
History - Central America	0.07%
Public Health	0.07%

Subject Category	Sample %
State & Local History - Midwest, Old Northwest	0.07%
Health Professions	0.07%
Musculoskeletal System	0.07%
History of Scholarship & Learning	0.07%
Societies - Secret, Benevolent, etc.	0.07%
Constitution & Properties of Matter	0.07%
Immigration & Emigration	0.06%
Collections	0.06%
Dictionaries, General Reference	0.06%
Higher Education	0.06%
History of Education	0.06%
Circuses, Carnivals, etc.	0.06%
Genetics	0.06%
History - Hungary, Czechoslovakia	0.06%
Gynecology	0.06%
Paleozoology, Paleobotany, Palynology	0.06%
Statistics	0.06%
Chinese Language	0.06%
Political Science, General	0.06%
Military Science - Maintenance & Transportation	0.06%
Infantry	0.06%
State & Local History - The West	0.06%
Special Types of Drama	0.06%
Medical Centers, Hospitals, Clinics	0.05%
Navies - Organization, Distribution, etc.	0.05%
Dermatology	0.05%
Algebra	0.05%
Dynamic & Structural Geology	0.05%
Geology, General	0.05%
Law of the United Kingdom and Ireland	0.05%
Special Situations & Cond. - Geriatric, Sport	0.05%

Subject Category	Sample %
Individual Institutions - Asia, Africa, Oceania	0.05%
History - Netherlands, Low Countries & Belgium	0.05%
Human Anatomy	0.05%
Oceanography	0.05%
Numeration, Arithmetic, Elementary Mathematics	0.05%
Probabilities, Math. Stats., Interpolation, Numeri	0.05%
Geriatrics. Chronic Disease	0.05%
Parlor Magic & Tricks	0.04%
Endocrine System	0.04%
History: Austria, Austro-Hungarian Empire, Liechtenstein	0.04%
Pharmacology	0.04%
Numismatics	0.04%
Internal Medicine, General	0.04%
Biochemistry	0.04%
Latin Literature	0.04%
International Law, International Relations	0.04%
Paleontology	0.04%
Superintendent of Documents Publications	0.04%
Mineralogy	0.04%
Legislative & Executive Papers	0.04%
Secondary & Middle School Education	0.04%
Information Resources	0.04%
Electricity, Magnetism, Nuclear Physics	0.04%
Poetry, General	0.04%
Hunting Sports	0.04%
Mathematical Analysis	0.04%
Infectious & Parasitic Diseases	0.04%
Obstetrics	0.03%
Ophthalmology	0.03%
History - Eastern Europe, General	0.03%
Geomorphology	0.03%
Philosophy - Periodicals, Societies, Congresses	0.03%
Hydrology	0.03%

Subject Category	Sample %
Animal Biochemistry	0.03%
Digestive System	0.03%
Hydraulic Engineering	0.03%
Central Asian & Far Eastern Republics	0.03%
Artillery	0.03%
Geometry, Topology	0.03%
Museums, Collectors & Collecting	0.03%
Cardiovascular System	0.03%
Iranian Philology & Literature	0.03%
Communicable Diseases	0.03%
Conservation of Natural Resources, Land Conservation	0.03%
History - Latin America, Spanish America, General	0.03%
History - Portugal	0.03%
Greek Language	0.03%
Metabolic Diseases	0.03%
Microbiology	0.03%
History - United States, 1790-1861	0.03%
Russian Language. Belarusian Language & Literature	0.03%
Homeopathy	0.03%
Urogenital System	0.03%
Plant Ecology	0.03%
Cartography	0.02%
State and Non-U.S. Government Documents	0.02%
History - Mediterranean Region, Greco-Roman World	0.02%
Drama, General	0.02%
Logic	0.02%
Toxicology	0.02%
Pharmacy & Materia Medica	0.02%
Aesthetics	0.02%
Plant Physiology	0.02%
History - United States, Revolutionary Period	0.02%
History - Switzerland	0.02%
Social Sciences - General	0.02%
International Law & Relations	0.02%
Latin Language	0.02%

Subject Category	Sample %
Academies & Learned Societies	0.02%
Physical & Theoretical Chemistry	0.02%
Plant Anatomy	0.02%
History - Poland	0.02%
Minor Services of Navies	0.02%
Law of Africa	0.02%
Regional Geology	0.02%
Cybernetics	0.02%
Proverbs	0.02%
Highway Engineering	0.02%
History - Central Europe, General	0.02%
Diplomatics. Archives	0.02%
National Bibliography - Asia/Africa/Australia/Oceania	0.02%
Eastern Christian Churches & Ecumenism	0.02%
Reproduction & Life	0.02%
Wildlife Management	0.02%
Cytology	0.02%
Online Data Processing	0.02%
Performing Arts & Show Biz	0.02%
Education & Training of Teachers	0.02%
Optics, Light, Radiation	0.02%
Portuguese Language	0.01%
Microbiology and Immunology	0.01%
Bridge Engineering	0.01%
Otorhinolaryngology	0.01%
Petrology	0.01%
Otolaryngology	0.01%
Natural Disasters	0.01%
Immunologic Diseases. Collagen Diseases.	0.01%
Law of Asia & Eurasia	0.01%
Organic Chemistry, General	0.01%
Marines	0.01%
Forensic Medicine	0.01%
Korean Language	0.01%
Physical Geography	0.01%
Law of Europe, except UK & Ireland	0.01%

Subject Category	Sample %
Colonies & Colonization	0.01%
Respiratory System	0.01%
Old Norse Literature: Old Icelandic & Old Norwegian	0.01%
Dutch Language	0.01%
Inorganic Chemistry, General	0.01%
Individual Institutions - Europe	0.01%
Military Science - Other Services	0.01%
Copyright, Intellectual Property	0.01%
Cryptography. Manuscripts. Paleography	0.01%
Chronology	0.01%
Yearbooks, Almanacs, Directories	0.01%
Weights & Measures	0.01%
Cavalry, Armor	0.01%
Gypsies	0.01%
Dentistry	0.01%
Naval Administration	0.01%
National Bibliography - America, United States	0.01%
Hospitals and Other Health Facilities	0.01%
National Bibliography - Europe	0.01%
History of Books	0.01%
Medical Geography & Climatology	0.01%
Personal Bibliography	0.01%
Management Information Systems	0.01%
Dentistry. Oral Surgery.	0.01%
Modern Languages (General)	0.01%
Swedish Language	0.01%
General Music	0.01%
Analytical Mechanics	0.01%
Individual Institutions - United States	0.00%
Classical Literature, General	0.00%
Hemic and Lymphatic Systems	0.00%
Heat	0.00%

Subject Category	Sample %
Acoustics, Sound	0.00%
Stratigraphy	0.00%
Political Inst. & Public Admin. - Canada, Latin America	0.00%
African Languages	0.00%
Semitic Philology & Assyrian & Sumerian Language & Literature	0.00%
Optical Data Processing	0.00%
Chordates - Vertebrates	0.00%
Nutrition Disorders	0.00%
Radiology	0.00%
Experimental Mechanics	0.00%
Naval Maintenance	0.00%
Mixed Languages - Creole, Pidgin English, etc.	0.00%
U.S. States & Territories	0.00%
Maps	0.00%
Textbooks	0.00%
Germanic Philology & Languages (General)	0.00%
Microscopy	0.00%
Norwegian Language	0.00%
General Education	0.00%
Clinical Pathology	0.00%
Oriental Philology & Literature (General)	0.00%
Parasitology	0.00%
Virology	0.00%
Geophysics, Geomagnetism	0.00%
American Indian Languages & Literature	0.00%
Artificial Languages & Literature. - Secret Languages, Esperanto	0.00%
Classical Philology	0.00%
Military Astronautics, Space Warfare	0.00%
Periodicals	0.00%
Indo-Aryan Languages	0.00%
Mathematical Geography	0.00%
Danish Language	0.00%
Plant Poisons	0.00%
Epigraphy, Inscriptions	0.00%
Crystallography	0.00%

Subject Category	Sample %
Analytical Chemistry	0.00%
Auxiliary Sciences of History, General	0.00%
Seals	0.00%
Diseases of Regions of the Body	0.00%
Indo-Iranian Philology & Literature (General)	0.00%
Animal Poisons	0.00%
Economic Biology	0.00%
Government of Canada Publications	0.00%
Machine Theory, Abstract Automata	0.00%
Student Fraternities & Societies, United States	0.00%
Tuberculosis	0.00%
Individual Institutions - America, except U.S.	0.00%
Naval Ordnance	0.00%
Botanic, Thomsonian, Eclectic Medicine	0.00%
Law of the Americas, except the US & Canada	0.00%
Diseases & Injuries Caused by Physical Agents	0.00%
Law of Canada	0.00%
Indexes	0.00%
College & School Magazines & Papers	0.00%
National Bibliography - Mexico, Central & South America	0.00%
Newspapers	0.00%
Modeling & Simulation	0.00%
Constitutional Diseases (General)	0.00%
Naval Seamen	0.00%
Congenital Disorders	0.00%
Law of the Sea	0.00%

Note. Subject categories showing 0% were actually represented by 1-16 titles. The level of 80% of the titles in the sample was achieved at subject category No.99 (Philology, Linguistics) and 80% of the subject categories were represented after that.