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I Simposio Internacional sobre Organizacion del Conocimiento, Bibliotecologia y Terminologia:

An Editorial

Richard P. Smiraglia, Editor-in-Chief

Knowledge Organization (KO) as a domain is evolving rapidly and its boundaries are being pushed amoeba-like in every direction as a consequence. All that readers of this journal need to do to find evidence of this evolution is to look at the journal itself, which moves from quarterly to bi-monthly with this issue. While the peer-review system serves a gate-keeping function on the intension of the domain, making certain that articles appearing in this journal align with accepted conceptual tenets, the system simultaneously serves a different function (perhaps we can align it with the opening of gates) for KO conferences, where it is the extension of the domain that is constantly being probed and tested by new research. Gate-keeping is an important function for any domain, which is why peer review is a hallmark of ISKO’s regional and international conferences as well as this journal. So it is even more impressive to consider these two functions together, which at once serve to intensify the core concepts of knowledge organization and simultaneously to stretch their application into new corners of the knowledge domain. It is a sort of inspiration-expiration dichotomous action, solidifying the core on the intake and pushing the boundaries (or axes, as Tennis (2003) has called them) on the outgo. Indeed, the new “Forum: Philosophy of Classification,” and occasional feature beginning with this issue, which has been generated by Birger Hjolleland, chair of ISKO’s newly active Scientific Advisory Council, is an example of this dichotomous action. For further examples we can turn to the contents of regional and international KO conferences, which provide interesting temporal glimpses of this evolutionary process.

In prior editorials I have applied domain-analytic tools to the proceedings of several KO conferences (Smiraglia 2008; 2007; 2006), and in a 2009 paper I used the same tools to create snapshots of KO from both North American and non-North American perspectives. At base the central research questions always are the same: what are the parameters of the intension and extension of KO as reflected in the particular conference? Sub-questions, of course, arise around clustering of research fronts and the reach (or impact, if you will) of segments of the common KO literature. In this editorial I will present a summary analysis of the August 2007 Mexico City conference.
"I Simposio Internacional sobre Organizacion del Conocimiento, Bibliotecologia y Terminologia," whose proceedings were just available in print in 2009.

1.0 The Simposio

This conference, announced as the First International Symposium on Knowledge Organization, Library Science, and Terminology, was held in August of 2007. The conference was held at UNAM’s Centro Universitario de Investigaciones Bibliotecologicas, whose headquarters are in magnificent space at the top of a tower providing exquisite views of the rest of the university and the city to the north. Conference organizer Catalina Naumis Peña graciously invited me to participate, and I was delighted to do so (the photo shows the neighboring parallel tower Torres II Humanidades). I was very graciously allowed the option to present in English. My ISKO colleague (then president) Maria-José López Huertas was gracious enough to sit with me at the lectern and translate for me so the audience could hear my talk in Spanish. Like most of the conferences I analyze in this space, I was a participant, which might color my interpretation. The conference was intense—42 papers over 3 days (38 of which appear in the proceedings). The geographical reach of the conference was impressive; papers came from authors affiliated with institutions in 7 countries, the majority from Mexico (Table 1). Twenty-one papers came from North America, 13 from South or Central America, and 6 from Spain. Only one paper (mine, of course) was given in English; all the rest were given in Spanish and are in Spanish in the proceedings.

<table>
<thead>
<tr>
<th>Country of Origin</th>
<th>Number of Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>16</td>
</tr>
<tr>
<td>Spain</td>
<td>6</td>
</tr>
<tr>
<td>Brazil</td>
<td>5</td>
</tr>
<tr>
<td>United States</td>
<td>5</td>
</tr>
<tr>
<td>Columbia</td>
<td>4</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>3</td>
</tr>
<tr>
<td>Uruguay</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1. Countries of origin

2.0 Citation analysis

Analysis began with citation counts per paper, per country of origin, and per thematic cluster. This was to see whether any geographic or cultural emphases might emerge. The mean number of references per paper was 10.975, with a range from 4-47. The mean varied from country to country (Table 2). The mean number of citations per paper was highest in Uruguay and lowest in Mexico. The means per broad subject area were calculated using the eight conference panel titles. The mean number of citations per paper was highest for informatics and lowest for semantics and digital standards.

<table>
<thead>
<tr>
<th>Country of origin</th>
<th>Mean</th>
<th>Thematic cluster</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uruguay</td>
<td>24</td>
<td>informatics in information retrieval</td>
<td>18.6</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>16.3</td>
<td>representation and information retrieval</td>
<td>13</td>
</tr>
<tr>
<td>Spain</td>
<td>15.83</td>
<td>translation for information transfer</td>
<td>12.6</td>
</tr>
<tr>
<td>Brazil</td>
<td>13.8</td>
<td>terminology in librarianship</td>
<td>11.6</td>
</tr>
<tr>
<td>United States</td>
<td>9</td>
<td>terminological analysis</td>
<td>9.75</td>
</tr>
<tr>
<td>Columbia</td>
<td>8.25</td>
<td>terminology and different areas of knowledge</td>
<td>9.2</td>
</tr>
<tr>
<td>Mexico</td>
<td>7.75</td>
<td>standards and use of language in a digital environment</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 2. Mean references per paper per country and thematic cluster

The mean number of citations per paper per country and per thematic group were tested using one-way ANOVA; in both cases there was no statistical significance observed, meaning the different means likely are the result of chance and therefore are not meaningful individually. One interpretation of the differences observed might be that they are dependent in every case on the particulars of the presentations, and therefore reflect the overall variability in referencing observed for the entire conference, which hovers roughly between the mode of 5 and mean of 11.

A cross-tabulation of country with theme suggested independence, but it probably is wise to be suspicious of the role of chance because most cells have low numbers. There was relatively strong interest in terminology and ontology, and in representation and language, with smattered interest in semantics, informatics, and digital standards. The contributions from Brazil were ontologically and representationally focused, from Columbia and Costa Rica the other thematic areas were the focus (Figure 1).
Age of cited works reveals clues about the immediacy of the domain, primarily by showing whether there is rapid absorption of new research or alternatively, whether there is a large quantity of classical material in the theoretical base. Typically information studies and its subdomains (including knowledge organization) resemble social scientific domains, falling somewhere between the two extremes. Papers cited by authors of the Mexico City conference had a mean citation age of 7 years, which places this group within the usual social-scientific range. Price’s Index (the percentage of citations to articles ≤ 5 years older than the citing article) was 44%, which is consistent with a “hard” science. Interestingly, only 459 of the 442 citations contained a date, so roughly 7% of the citations were undated. The majority of these appear to be references to informational websites, which, in all likelihood, should not have been cited (because they are not, strictly speaking, citations to source material). The mean age of citation ranged from 2 years to 18 years. There were a number of interesting near-anomalies—for example, works by both Cutter and Dewey dated in the 1960s. For the most part older cited works occurred in papers by librarians reporting metadata or cataloging standards. There were no statistically significant differences in citation age by either country of origin or thematic grouping. That tells us that there is a fairly consistent social-scientific rate of absorption of literature for this domain.

### 3.0 Most cited authors

The next step was to discover the list of most-cited authors in the domain. Names of these individuals are indicative of the research front in a domain, but in this case they also likely will tell us something about the fit between KO in general and KO in Latin America. There were 442 citations in the 41 papers, which were arrayed alphabetically by author (three papers had no citations). When single-occurrence authors were removed from the distribution 150 citations remained, meaning 292 had been single-occurrence citations. The 50 remaining multiply-cited authors were arrayed in a frequency distribution, the upper tier of which is shown here (Table 3).

<table>
<thead>
<tr>
<th>Author</th>
<th>Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hjørland, B.</td>
<td>8</td>
</tr>
<tr>
<td>Lima, Vania Mara Alves</td>
<td>8</td>
</tr>
<tr>
<td>Cabre, M. Teresa</td>
<td>7</td>
</tr>
<tr>
<td>Smiraglia, Richard P.</td>
<td>7</td>
</tr>
<tr>
<td>Kobashi, N.Y</td>
<td>6</td>
</tr>
<tr>
<td>Library of Congress</td>
<td>6</td>
</tr>
<tr>
<td>Lopez-Huertas, Maria J.</td>
<td>6</td>
</tr>
<tr>
<td>Naumis Pena, C.</td>
<td>4</td>
</tr>
<tr>
<td>Winkel, Lois</td>
<td>4</td>
</tr>
<tr>
<td>Aguilar-Amat, A.</td>
<td>3</td>
</tr>
<tr>
<td>Berners-Lee, T</td>
<td>3</td>
</tr>
<tr>
<td>Cintra, A. M. M.</td>
<td>3</td>
</tr>
<tr>
<td>Dubuc, R.</td>
<td>3</td>
</tr>
<tr>
<td>Lancaster, F. W.</td>
<td>3</td>
</tr>
<tr>
<td>Lara, Luis Fernandez</td>
<td>3</td>
</tr>
<tr>
<td>Moreiro Gonzalez, Jose Antonio</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 3. Frequency distribution of authors cited more than once

![Figure 1. Themes per Country of origin](image-url)
The table is somewhat surprising, given the breadth of authors cited in the entire distribution. For instance, from the traditional KO community we find Hjørland and López-Huertas. From the traditional cataloging and classification community we find Winkel and the Library of Congress. From the information retrieval or knowledge representation side we have Lancaster, from the Internet we have Berners-Lee. Lima, Cabre, Kobashi, and Naumis-Pena lead the list of frequently-cited Latin American authors. Interestingly, these clusters align with the subject clusters already observed.

3.1 Author co-citation analysis

Author co-citation analysis (ACA) is frequently used in domain analysis to help identify active nodes within a domain. ACA measures the perceptions of the authors who are most productive in the domain, about relationships among the researchers they cite, based on the assumption that there is some likelihood that two researchers who are co-cited might be working on similar problem sets. I have found two approaches useful in analysis of segments of the KO domain—1) ACA using a set of most-cited authors, with data derived from the entire KO domain via Web of Science (WoS); and, 2) ACA using the same author set, but with data derived from co-citation counts among the authors in the conference at hand. Table 4 is an MDS plot of author co-citation using WoS based on the author set produced above.

What we see here is the perception of the KO domain at large—in other words, author co-citation at large—of the set of authors identified by II Simposio contributors as key. One interpretation is that there are two large clusters, with Naumis Pena, Lara, Cintra, Moreira and Lima, at the left, and Hjørland, Smiraglia, Cabre, Dubuc, Lancaster and Kobashi in the larger cluster at the right. One Latin American, one not; one information science oriented, one librarian oriented, but likely with the perceived research front represented by the Latin American cluster at the upper left. Another approach perhaps is warranted as well, in which we consider four clusters, two within each of the larger clusters. These represent indexing and terminology, vocabulary control, linguistics, and thesauri. In this manner we see more differentiation; either way we have a reflection, or complementary picture, of the thematic analysis from section 1.0 above—terminology and ontology, representation and language, semantics, informatics, and digital standards.

Table 5 is a plot of the same author-set as they are co-cited within the conference by participant authors. There is obviously much less co-citation, so some names drop out of the analysis.

We see more clearly perhaps how the domain perceives itself. Cabre’s well-known and heavily cited classic work on terminology is clearly at some distance from the other two clusters, where there is some distinction between language and semantic issues (on the right) and translation and classification (on the left). Either way, we now have three pictures of the intention of the domain.
4.0 Co-word analysis points to conclusions

All paper titles from the proceedings were entered into WordStat to analyze term co-occurrence. Table 6 shows the top of the frequency distribution, which presents further triangulation of the results we already have seen.

<table>
<thead>
<tr>
<th>FREQUENCY</th>
<th>NO. CASES</th>
<th>% CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFORMACION</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>RECUPERACION</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>ESPECIALIZAR</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>TERMINOLOGIA</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>DOCUMENTAL</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>ORGANIZACION</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>INFORMACION, RECUPERACION</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>CONOCIMIENTO</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>LENGUAJE</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>CIENCIA</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>ANALISIS</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CONTROLAR</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TERMINLOGICO</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TERMINOLOGICOS</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 6. Frequency distribution of title keywords

That is, frequently occurring keywords are: information retrieval, terminology, documentation, knowledge organization and representation, and information science. Figure 2 is an MDS plot of the co-occurrence of these terms (Stress = .19; R² = .93).

What we see overall is a well-evolved, scientifically productive domain within the mainstream of knowledge organization. The Price’s Index remarkably conforms to a hard science in its depiction of absorption of new material, which is unlike most analyses of other regional KO domains. What is most remarkable is the citation imprint, which is unlike those we have seen before, because of the large influence of Latin American authors. That is not surprising, but it is telling—we do not find those authors cited outside the region. There is quite heavy reliance on classic authors, e.g. Dewey and Cutter, and classic KOS, e.g. LCSH, but in translated editions, which again influences the domain’s citation imprint.

With reference to our opening comments, we see that continued influence of gate-keeping through a double-blind refereed peer-review system. We see an evolution of a body of research that is linguistically bounded in Spanish and Portuguese, which is not highly cited in Western European or other North American publications, but which is, nonetheless, influential in the region. We see the incorporation of classical texts and therefore of their epistemic positions, which ground the domain in classical proportions within the defined extension of international KO. As for intensional axes, we see greater accommodation for knowledge representation, terminology, and natural language processing than is typically the case in KO at large.
We congratulate our colleagues on a successful conference. But more importantly, we encourage them to continue to develop their particular epistemic brand of knowledge organization and especially to help us bring it more fully to the fore in global KO research.

(An excel spreadsheet developed as the basis of this research, including the conference program and all citations, can be found on my blog at: http://lazykoblog.wordpress.com/).

References


1.0 Introduction: This debate

Thanks to Professor Eric Scerri for engaging in debate in this journal (Scerri 2011) by replying to my review (Hjørland 2008a) of his book (Scerri 2007). One of my points has been that we in our community (Knowledge Organization, KO / Library and Information Science, LIS) have been too isolated from broader academic fields related to classification and the organization of knowledge. The present debate is a step towards reversing this situation. Strangely enough, at the end of his reply, Scerri (2011) seems to question (even) this view. In this connection he seems, however, to confuse two different things: 1) I have never said that the periodic system has not influenced LIS-classifications. On the contrary, I mentioned in my review two examples (MEDLINE and UDC) which are clearly influenced by the periodic system. 2) What I did say was that books such as Scerri’s—and the broader field of the philosophy of classification—are mostly ignored by scholars in KO/LIS. That people in KO seem to consider themselves “the professionals” in classification (cf. Beghtol 2003), but that the relation to the philosophy of classification—as well as to specific scientific classification research—needs to be strengthened (cf., Hjørland & Nicolaisen 2004 and Nicolaisen & Hjørland 2004).

I would like to thank Professor Birger Hjørland for his generous review of my book on the periodic table of the elements (Hjørland 2008). As he states, the periodic table represents perhaps the strongest claim for a natural classification that one can find in any discipline. As such it is worthy of the attention of scholars of classification and knowledge organization in general. I in turn wish to compliment Hjørland for promoting this interdisciplinary activity via his review and many previous writings on the subject. I think that there is much that can be learned from taking this debate a little further.

I now turn to some specific responses to his book review. Hjørland claims that classification should be, and is in fact, based on pragmatic criteria and thereby insists that even in the case of the periodic table, classification is pragmatic rather than “natural.” He also claims that the classification of knowledge can be carried out by using one of four approaches that he identifies as empiricism, rationalism, historicism and pragmatism, of which he believes the last to be the most “advanced theory.” Hjørland concedes (2008, 253) that the periodic system is: “probably one of the most difficult classification systems to defend from a pragmatist point of view,” but adds that: “it is also important to test our views against the most pre-eminent classifications if our arguments should be convincing.”

I am very grateful to Professor Birger Hjørland for giving me the opportunity to comment on his exchange with Professor Eric Scerri on the periodic table of the elements. However, since Hjørland himself has provided a detailed commentary on Scerri’s response to his (Hjørland’s) review of Scerri’s book on the topic, and since I am not an expert on the philosophy of chemistry, I shall limit myself to a few comments on what Scerri says about my own views. (In fact one paragraph in a two page article on scientific classification, and one footnote from my 1993 book, The Disorder of Things, most of which are quoted in the discussion to date, as far as I can recall exhaust my published writing specifically on the topic of the periodic table.)

Scerri suggests that I am guilty of circularity in assuming that chemists aim at a structural analysis of matter and then find a classification based on structural elements suits this purpose. It seems to me that my assumption might be false, but hardly justifies a charge of circularity. I am happy to defer to Scerri’s far greater expertise if he tells me it is false. However, I cannot accept his claim that chemists aim for “the analysis of matter period.” I do not believe there could be any such thing. Matter has an enormous range of properties: macrostructural properties such as strength, elasticity or hardness; nutritional and toxicological...
Skerri points out that Hulme (1911) is outdated; I am not, however, supporting Hulme’s view about the irrelevance of the periodic system (and the philosophy of classification); on the contrary, I disagree, like Skerri, with Hulme on this point—it was just mentioned to underline my view about the critical attitude towards the philosophy of classification in KO. That Hulme’s paper is very old is an illustration of how difficult it is to identify more recent discussions about the periodic system in the literature of KO. Hulme was also named because he is known for the important principle of literary warrant in KO and as the founder of statistical bibliography, which is now known as bibliometrics.

If Skerri wishes to prove me wrong on this point, a proper argument would be to point to more recent texts and to demonstrate how writings about the periodic system, about other scientific classifications and about the philosophy of classification have influenced theory and writings in KO and LIS (e.g., checking citations in LIS to this literature, e.g., by using Web of Science), I do not believe Skerri knows the literature of KO/LIS and that his denial of my claim about the neglect of the larger field of classification research in KO is valid. Much more relevant is Skerri’s view about the nature of the periodic system (or periodic systems) and the implications for the theory of classification, which are considered below.

2.0 The emerging field “the philosophy of classification”

Classification research is not just done within KO/LIS. Below are listed some important scholars in the interdisciplinary field which may be termed “philosophy of classification” (or “theory of classification,” “classification theory,” “classification research,” “the science of classification,” etc.). There are some philosophers who work with classification theory in general (e.g. Bunge 1983; Dupré 1993; Sutcliffe 1993; Bryant 2001). A few philosophers who tend to specialize in the philosophy of chemistry, I suggest, that one should look for the more general nature of the periodic law and the periodic table (Skerri 2009).

Hjørland turns to denying that elements are natural kinds more directly and quotes a recent book by Bryant as a source of support. Bryant (2001, 88) writes: “even in the case of chemical elements more than one kind of causal essentialism is scientifically legitimate.” Hjørland seems to counter Bryant’s claim by quoting from a review of her book in which Stamos has shown convincingly that she (Bryant) is mistaken. Hjørland nevertheless seems to side with Bryant and the pragmatist approach by further drawing upon the work of Dupré in order to adjudicate between Bryant and her critical reviewer, Stamos. Hjørland thus quotes from Dupré (2006) who is commenting specifically on the periodic table and who believes that there is: “much potentially wrong with the supposition that there is a right way of classifying things in the world,” and that: “the standard paradigm for such a successful properties; aesthetic properties; and so on. If there is such a thing as “analysis period” it is, as the Greek etymology suggests, the breaking down of things into parts. Of course, chemists might have found that there were no such parts, that all kinds of stuff were homogeneous and unanalysable, in which case they would have had to content themselves with a rather unilluminating natural cataloguing of stuffs. The point is that there are many different enquiries that could be launched about matter, and chemists are interested in matter from a specific, perhaps fundamental in some sense, perspective.

This is the point about jade—not that chemists don’t distinguish jadeite and nephrite, but that from another perfectly respectable perspective they need not be distinguished, thus showing that the perspective of chemistry is not the only one possible on matter.

If genalogy seems too unscientific an activity to be relevant, one need only look to geology for classifications of material stuff that follow a different path from those in chemistry. The min-

more philosophically speaking, the identity and properties of any class of entities are somewhat separate issues

To say that a kind is natural is to say that it corresponds to a grouping or ordering that does not depend on humans.

more philosophically speaking, the identity and properties of any class of entities are somewhat separate issues

"It is a classification system which, once discovered, seems inevitable."
The Periodic Table and the Philosophy of Classification
Birger Hjørland
(continued from page 10)

classification of a specific field, e.g. biology (Ereshefsky 2000; Hull 1998) or mental diseases (Cooper 2005). Then there are some scientists approaching the field from an interest in classification problems in their respective domains (e.g., in chemistry: Scerri 2007; in biology: Mishler 2000; Stevens 1994; in social science: Marradi 1990 and Wallerstein 1996). Then there are researchers approaching classification from mathematical, statistical or methodological angles (e.g., in mathematics: Mirkin 1996; in statistical clustering: Hartigan 2001). Also many researchers in psychology, sociology, linguistics and anthropology study how children and adults, languages, social groups and cultures classify the world (e.g., in psychology: Keil 1989).

We have also KO researchers such as Anderson (2003), Beghtol (2010), Gnoli (2006), Hjørland (2008d), Miksa (1994) and Szostak (2004) approaching classification from the perspective of library and information science, i.e. researching methods for arranging books on shelves, for the construction of subject catalogs, for information retrieval in bibliographical databases, for the construction of knowledge organizing systems (KOS). This field may be named bibliographical classification. It is about the classification of recorded knowledge (documents in a wide sense). Beghtol (2010) uses the term “knowledge organization classification” for this field, but LIS specialists are not the only professionals to deal with knowledge organization. Knowledge organization is primarily studied by scientists such as Scerri (the periodical system) or by philosophers, or by sociologists. When LIS professionals classify a given book, the concepts used are derived from the literature, not concepts and relations primarily constructed by LIS-professionals. As Hulme (1911, 46-47) said: “The real classifier of literature is the bookwright, the so-called book classifier is merely the recorder.”

Bibliographic classification has now expanded into concerns with technologies of automated classification and to principles of ontologies, bibliometric maps, folksonomies etc. Many computer scientists are also contributing to this field (not to say dominating it), among them Sebastiani (2005); and some philosophers such as Barry Smith (2004) are working in the intersection between computer science and philosophy in relation to principles of ontologies.

There are many more researchers in classification theory than those listed above. I have just tried to provide examples, not an exhaustive listing (there is a need for review articles in this interdisciplinary domain).

The periodic system has a privileged place in the philosophy of classification. Hubert Feger, for example, wrote (2001, 1967-1968; breaks with hanging indentations added):

A well known, still used, and expanding classification is Mendelejew's Table of Elements. It can be viewed as a prototype of all taxonomies in that it satisfies the following evaluative criteria:

(a) Theoretical foundation: A theory determines the classes and their order.
(b) Objectivity: The elements can be observed and classified by anybody familiar with the table of elements.
(c) Completeness: All elements find a unique place in the system, and the system implies a list of all possible elements.
(d) Simplicity: Only a small amount of information is used to establish the system and identify an object.
(e) Predictions: The values of variables not used for classification can be predicted (number of electrons and atomic weight), as well as the existence of relations and of objects hitherto unobserved. Thus, the validity of the classification system itself becomes testable.

The examination of the periodic system may thus illuminate core philosophical and theoretical issues in the philosophy of classification, which have largely been ignored by KO/LIS. They include:

- The concept of “Natural kind”
- The theory-laden nature of observations and its implication for classification theory
- The relation between classification and subject theory (such as, for example, the relation between the periodic system and theory of quantum mechanics (QM) or the relation between the theory of evolution and biological taxonomy)
- Whether classifications are “correct” representations or more or less purposeful constructions
- The methodological basis for construing classifications (different epistemological ideals such as observation, logical analysis, historical reconstruction or pragmatic analysis).
I wish to make the following observations and conclusions of this section:

- The field of Philosophy of Classification is today very scattered and still rather limited as to the number of researchers and papers. It should be an obvious goal to get it more integrated (by mutual citations). In all modesty I see my own book reviews (among other writings) as an attempt to establish such a platform (e.g., Hjørland 2000, 2008a, 2008b, 2008c, 2009a).
- Classification was downgraded by logical positivism because it was regarded as unscientific compared with measurement (see Marradi 1990, §3.2.1). If this is correct, then the fight for classification implies also a fight against these positivist tendencies.
- KO would benefit very much if we were better integrated with scholars in other fields and if journals such as Knowledge Organization could present more of this interdisciplinary research. Hopefully our field may contribute by connecting different fields.

### 3.0 Epistemology and scientific methods

Any scientific classification has to be constructed and verified by some methods. Even if we agree on the superiority of a given classification (say the periodic table) we may still disagree in our interpretation of the scientific methods that ended up producing it.

Today there is no consensus concerning epistemology and scientific methodology. In the beginning of the 20th century, logical positivism was the dominant view. After 1962 Thomas Kuhn among others challenged this view. It has also been challenged by hermeneutics, pragmatism, feminist epistemology, critical theory, postmodernism and other views. My main point here is that we cannot defend any claim properly unless our arguments are based in an epistemology (that again needs to be defended). Therefore, we have to consider which epistemology we find useful. Other researchers may oppose a given view and forward an alternative view. The point is that there is no neutral position, and it is not possible to argue from a neutral platform or from nowhere. The choice of epistemology is not a question of personal taste. It is a question of scientific truth. Therefore the task of working out a proper epistemology is a collective responsibility that involves all scientists.

Scerri is obviously skeptical regarding my view that historicism and pragmatism are the best answers; however, he does not discuss any alternative: if he revealed his own position I would be in a better position to demonstrate why I think that historicism and pragmatism are better grounded.

The pragmatic position is related to hermeneutics (cf., Heelan & Schultkin 1998), which I regard as a philosophy with the potential of contributing to the successful practice of science. If a philosophy does not have this potential, it seems difficult to justify it. (However, Heelan (1998) in a paper about hermeneutics in natural science said that “we do not ask of a philosophy that it contribute to the successful practice of science.” I disagree on this view, and I do think that Scerri also feels that his work on the philosophy of chemistry should indeed contribute to the development and to the successful practice of chemistry.)

Kuhn’s book (1962/1996) The Structure of Scientific Revolutions can be seen as an hermeneutic interpretation of the sciences because it conceives of scientists as governed by assumptions which are historically embedded and linguistically mediated activities organized around paradigms that direct the conceptualization and investigation of their studies. Scientific revolutions imply that one paradigm replaces another and introduces a new set of theories, approaches and definitions. According to Mallery, Hurwitz and Duffy (1992) the notion of a paradigm-centered scientific community is analogous to Gadamer's notion of a linguistically encoded social tradition. In this way hermeneutics challenges logical positivism. Observations are always made on the background of theoretical assumptions: they are theory dependent. It should be added that in my opinion pragmatism and hermeneutics are realist positions: People are developing their ideas in a world that exists independently. Pragmatism is at the same time fallibilist: No scientific method is able to guarantee the truth of knowledge claims.

Scerri’s skepticism towards historicism and pragmatism is not unique. In an informal communication, the Swedish Professor Anders Ekholm wrote (30-07-2009 11:37, translated from Swedish. Eckholm’s own view of classification can be seen in Ekholm (1996)): You identify four main traditions within epistemology: Empiricism, Rationalism, Historicism and Pragmatism. The first two are described by Bunge [1983a+b] as the two main views, while of epistemology the others should just be considered variations.... The discussion is interesting but I tend to follow the view expressed by Bunge that the first [historicism and pragmatism] after all are variations of the later [empiri-
cism and rationalism]. This is by the way also what Bunge says about his own view, which he describes in detail in vol. 6 [Bunge 1983b] under the label Scientific Realism (vol. 6:255).

I cannot in this place provide a full analysis of the views of Ekholm and Bunge. It would certainly be a good idea if somebody made an article in this journal which presented and examined Bunge’s view. In this place I can just say that I do not believe that historicism and pragmatism can be reduced to variations of empiricism and rationalism and that I consider the latter insufficient. Probably my best arguments have been put forwards in Hjørland (2009b).

Another criticism against (parts of) historicism could be based on a view that has been expressed by Cooper (2005, 48) based on Dupré:

Nor can the essential property of a species be its evolutionary lineage. John Dupré [1981] shows this in his paper “Natural Kinds and Biological Taxa”. Relationships of ancestry cannot be the essential properties of species because “Any sorting procedure that is based on ancestry presupposes that at some time in the past the ancestral organisms could have been subjected to some kind of sorting” (p. 88). The point is that in order to make sense of claims such as “Cats are the offspring of cats, while dogs are the offspring of dogs” one must have some way of distinguishing the ancestor cats from the ancestor dogs. Relations of ancestry are only of any use once the parent organisms have been sorted into kinds. As such, sorting on the basis of ancestry must always be a secondary, parasitic method of sorting. When we are seeking the essential properties of species it is thus more appropriate to look to the basis of the primary method of sorting, whatever it might be, rather than to relations of ancestry."

If this analysis is correct it seems to affect not just my view, but many others’ as well, e.g., Gnoli’s (2006) phylogenetic classification and Hull’s (1998, 272), who wrote: “Two fundamentally different sorts of classification are those that reflect structural organization and those that are systematically related to historical development.”

I cannot go much deeper into the specific implications for the scientific methods. The short reply is that the traditional views (empiricism, rationalism and their combination in logical positivism) are not satisfactory in describing scientific progress. Historicism and pragmatism (as I understand these positions) are more satisfactory interpretations of what eminent scientists have done. Another way to express this is, as, for example, Dupré (1993) says: Science is a human activity and in the end it is evaluated by its contributions for human beings. The implication is that a pragmatic factor is at play in science. On the other hand Kuhn (1962/1996) emphasized that nature cannot be forced into any conceptual structure that we provide. Nature makes resistance. Our conceptual structures therefore—in the long run—have to adapt to reality.

What is important for classification is that different methods tend to provide different classifications. If the different methods and epistemologies led to the same classification, there would be no problem, of course.

- Empirists’ principles of classification emphasize: Classifications based on many properties which have been described in theory-independent ways;
- Rationalists’ principles of classification emphasize: The classifications that are logical coherent and based on clear principles;
- Historicians’ principles of classification emphasize: a) (on the side of the objects): the classifications that are systematically related to historical development of their elements;† and, b) (on the side of the subjects): classifications connected to explicit theoretical views;
- Pragmatists’ principles of classification emphasize: The classifications that are best suited for the purpose for which they are intended. (In 6.0 below I’ll introduce two different kinds of pragmatism).

If these different approaches provide the same classification, we could speak of “natural kinds” in a sense of that term. They often provide, however, different classifications, as demonstrated in, for example, biological taxonomy. How do we then decide which classification is the best? The pragmatic answer is that stability in our theories may arise after several iterations involving empirical, rational, theoretical and pragmatic interacting considerations as a historical process.

One of Scerri’s objections to the pragmatic view was that the individual scientists are not motivated by pragmatic issues. This problem is addressed in 4.0.
†Scerri (2007, 250) presents Prout’s hypothesis, according to which all the elements are essentially made out of hydrogen, and he writes: “The elements are now believed to have literally evolved from hydrogen by various mechanisms.” Karpatschóf (2000, 105) wrote: “Paradoxically, the most basic of all sciences, the sciences of pre-biological matter (i.e., the disciplines of astronomy, physics and chemistry) were the latest to develop a theory of evolution... The idea of eternal, immutable laws is not easy to combine with the idea of development.” A simpler explanation may be that our knowledge of the evolution of the universe since the Big Bang is very recent and that this knowledge is a prerequisite for an evolutionary theory in these fields.

4.0 Individualism versus collectivism

Scerri argues that scientists are not motivated by pragmatic factors, they just want to find the truth. He also wrote: “Mendeleev, the chief architect of the periodic system, repeatedly expressed his dislike for atomic theories....” Well, I believe that Thomas Kuhn has something important to say about this. He wrote (1996, 200):

To understand why science develops as it does, one need not unravel the details of biography and personality that lead each individual to a particular choice, though that topic has vast fascination. What one must understand, however, is the manner in which a particular set of shared values interacts with the particular experiences shared by a community of specialists to ensure that most members of the group will ultimately find one set of arguments rather than another decisive.

The case for the pragmatic philosophy of science is not primarily about the individual motives of scientists. It is about whether there are pragmatic factors involved in theory acceptance in the scientific community. Whether, for example, astronomic theories were accepted because they helped construe better calendars? Whether medical progress is determined in part by its ability to cure people? In the case of the aim of chemistry: Whether there are divisions of labor between pure chemistry and, say, pharmacology, in which the first aims at describing more general features, whereas the latter, in particular, aims at describing medical effects and side effects? The claim made by John Dupré is that the periodic system may be extremely well suited to the tasks of general chemistry and that the general principle of the pragmatic nature of classification can thus be “saved.”

When Scerri writes: “More importantly, Dupré’s claim is somewhat circular. The aim of chemists is not necessarily the structural analysis of matter but rather the analysis of matter period” — I believe he disregards that many different sciences are studying “matter,” and therefore we should try to find out how they differ—and consequently how each of them conceives and classifies the world.

In conclusion of this section: The individual scientists’ view of the world is shaped in cultural-historical and disciplinary contexts which influence their criteria of, among other things, classification. The single scientist may be influenced by pragmatic factors whether or not this is admitted in his writings or whether or not it is a conscious choice. Traditionally it has been the ideal for science to be objective and free of pragmatic influences, and therefore such influences may be relatively hidden and thus hard to detect.

5.0 The concept of “element” in the periodic table

Scerri wrote: “Hjørland mentions the distinction between elements as simple substances (sense) and as basic substances (reference) but in a different context. As he sees it this distinction shows the coexistence of the empiricist and rationalist approaches to the classification of the elements. But in the very next sentence this dual nature in the meaning of the term ‘element’ also becomes an example of the importance of the historicist approach to knowledge, although no reason is given for this claim.”

Answer: I have formerly defined “concept” according to my pragmatic understanding (Hjørland 2009b, 1522-23):

Concepts are dynamically constructed and collectively negotiated meanings that classify the world according to interests and theories. Concepts and their development cannot be understood in isolation from the interests and theories that motivated their construction, and, in general, we should expect competing conceptions and concepts to be at play in all domains at all times.

In the same paper I argue that empiricist, rationalist, historicist and pragmatic concepts may compete in
any domain at any time. That implies that the notion of “element” in chemistry may vary. Scerri (2007) discusses two conceptions of “element,” as simple substances and as basic substances. My interpretation is that the first sense corresponds with the empiricist ideal of defining terms, the second perhaps with a rationalist ideal. It should not be difficult to see what I mean by the historicist and pragmatist view if you read my papers. It should not be difficult to follow the above definition of concept and apply it to “element.” The reason for my claim that Scerri asks for is this: Chemists cannot define “element” while disregarding the theoretical developments in chemistry. When a chemist (such as Scerri) looks at the world, he does so from the perspective of his chemical understanding.

I can add that the discussion of the concept “species” in biology (often considered the element of biological classification) is a really difficult discussion.

6.5 Classifications are theories (of what is being classified)

Philosopher Marion Bunge wrote about the relation between theory and classification (1983a, 330, emphasis in original):

Classing and theorizing are then mutually complementary activities. Categorization precedes theorizing if only because every theory is about some category of objects. In turn, theory allows one to refine the coarse and shallow pre-theoretical classifications. Moreover a classification is a theory of a kind.

Ereshefsky (2000) argued that the Linnaean Hierarchy is an obsolete classification because it is not based on the theory of evolution. In a similar way we should expect that any classification corresponds to a theory and vice versa: Any theory has implications for the classification of its objects. Ørom (2003) demonstrated how library classifications of arts are related to theories or paradigms of art. In the field of mental diseases different theories are related to different classifications (cf., Cooper 2005). A given classification (say DSMIV) may correspond to some views, but is a bad reflection of, for example, the psychoanalytic view (and thus a bad tool for psychoanalysts. Whether psychoanalysis itself is a bad theory is another matter that has to been considered separately.)

Concerning the periodic table, we may consider theories such as Einstein’s theory of relativity and quantum mechanics (QM) as a possible theoretical basis. Scerri writes about those theories (2007, 24-25):

The first of these [Einstein’s theory of relativity] has had a limited impact of our understanding of the periodic system but is becoming increasingly important in accurate calculations carried out on atoms and molecules;

and,

The interesting question raised here is the relation between chemistry and modern atomic physics and, in particular, quantum mechanics. The popular view reinforced in most textbooks is that chemistry is nothing but physics “deep down” and that all chemical phenomena, and especially the periodic system, can be developed on the basis of quantum mechanics. There are some problems with this view, however, which are considered in this book.

For example, in chapter 9 it is suggested that the quantum mechanical explanation for the periodic system is still far from perfect. This is important because chemistry books, especially textbooks aimed at teaching, tend to give the impression that our current explanation of the periodic system is essentially complete. This is not the case, or so it will be argued.

Scerri also considered the influence of chemists, or rather of inductive conclusions (p. 224):

All this work was achieved without any arguments based on theoretical physics or, more specifically, without using quantum theory. The chemists’ configurations were obtained inductively on the basis of the chemical properties of the elements. This aspect of the history of the periodic system is seldom emphasized, with most accounts promoting the view that electronic configurations resulted entirely from the work of theoretical physicists such as Bohr. In truth, Bohr had also reached electronic configurations inductively, frequently drawing on chemical evidence, at the chemists themselves had done.

Where does this leave us regarding the question of the relation between a classification and a theory? It seems that the periodic system has been constructed by the
interaction of, in particular, chemists’ “inductive” view and quantum mechanics. I make the claim that this is not fact versus theory, but that this is (at the least) two competing perspectives or “theories” (although they are interacting, mutually overlapping and probably still developing theories). My argument is based on the premise that the idea of theory-neutral observation is hardly ever supported today; by implication chemists—when making their observations and inductions—are conceptually mediated by the research tradition in which they have been trained. Chemists’ views, I suppose, are influenced by the properties which have been seen as most important in chemistry. The periodic law is itself a part of chemists’ theoretical luggage (the periodic law is a profound achievement in chemistry and physics because it links the internal structure of the atoms with their bondage into molecules, their chemical interaction properties as well as with (some) physical features).

In the overall pattern these views tend to support each other, but, as Scerri argues, our current explanation of the periodic system is not essentially complete. Could it be that there is not one perfect periodic system satisfying all views? And could it be that these disagreements are related to different theories about chemical elements and the importance of different properties? Some authors emphasize the large number of periodic tables. Stewart, for example, wrote (2004, 156):

Of the making of Periodic Tables there is no end. No version can ever be definitive because there are various incompatible objectives. Some authors provide a schematic version that is readable and easily reproduced, while others exploit devices such as the third dimension to express complexity. Some aim at simplicity or grace while others want to convey detailed information on such things as relative atomic mass, valency, electronic structure, melting and boiling points, electronegativity, radioactivity, metallic or non-metallic nature, geological affinities and so on.

The chemist Henry A. Bent wrote (2006, 108; emphasis in original):

**Best periodic table?** Because analogies among the elements are many-sided (Mendeleev), no periodic table is superior to all other tables in all respects “There is no single best form of the periodic table since the choice depends on the purpose for which the table is used” (1, 3 p.136). The question “Which periodic table is best?” is like the question: “Which table of data in a Handbook of Chemistry and Physics is best?” “Best for what purpose(s)?” Display of<. Chemical valencies? Trends in electronegativity? Atomic structure? Secondary Periodicity? Secondary Kinships? Tertiary Kinships? Gapless Periods? Periods’ complements of shells and subshells? Periodicity’s dyadic character? Madelung’s Rule? Locations of “problems elements”? Block-to-block trends? The unique character of the s-block? No periodic table has all the features listed in Appendix XV. The question “Which periodic table is best?” is as impossible as unnecessary to answer.

Scerri (2009) in an article, the title of which has the following ending: “the Optimal Form of the Periodic Table, if any” (emphasis added). This title thus opens the door for the possibility that there is not one optimal form of the periodic system. What is interesting is whether a specific theory such as quantum mechanics tends to correspond better to a specific version?

In Wikipedia (2010) there is an article “Alternative periodic tables”. These tables are based on the fact that not all correlations between the chemical elements are effectively captured by the standard periodic table:

**Alternative periodic tables** are developed often to highlight or emphasize different chemical or physical properties of the elements which are not as apparent in traditional periodic tables. Some tables aim to emphasize both the nucleon and electronic structure of atoms. This can be done changing the spatial relationship or representation each element has with respect to another element in the table. Other tables aim to emphasize the chemical element isolations by humans over time.

And an example:

Timothy Stowe's physicist's periodic table [1988] is three-dimensional with the three axes representing the principal quantum number, orbital quantum number, and orbital magnetic quantum number.

My question—as a non-expert in chemistry and physics—is: Could it be that the Stowe Periodic Ta-
ble, for example, simply is a better match with QM? Scerri (2007) asks how well QM explains the periodic table, to what degree the periodic table can be reduced to QM. His way of asking— it seems to me— presupposes that the periodic table is “given,” not something still being discussed and negotiated by scientists (in spite of what I quoted above about the best form). If it is correct that different theories (such as QM) tend to imply different versions of the periodic system, could this explain some of the alternative versions? Scerri does address this problem (2007, 282), when saying:

Although one can partly agree with the view that different representations can help to convey different forms of information, I believe that one may still maintain that one particular representation reflects chemical periodicity, regarded as an objective fact, in the best possible manner.

And (2007, 286):

It is with some trepidation that I advocate the general adoption of the left-step periodic system since I am well aware of the resistance that this proposal will meet, especially from the chemical community, which, rightly or wrongly, regards itself as the sole proprietor of the periodic system.

It is important to say that I agree with Scerri that classifications should be based on the properties of the elements (i.e. the principle of realism). The possible disagreement is about whether different sets of properties of the elements may provide fruitful different classifications for different perspectives. Whether 1) chemical periodicity is only one classification criterion among other and 2) Whether different kinds of chemical periodicity could be at play? It seems to me that Scerri makes a choice by giving priority to some kinds of properties and regularities as compared to others. If so, it confirms my pragmatic understanding. (The quote above even reads as if the social constructivists may have a point: The struggle about the periodic system seems partly to reflect the interest of different social groups!). In the final page of Scerri (2007, 286) the criteria of beauty, elegance and utility are briefly mentioned (but considered difficult and not discussed). Again, this is opening a door to the pragmatic perspective.

In his letter Scerri (2010) wrote:

Hjørland points out that although there may only exist one periodic law, there have been over 700 periodic tables published, which depend upon the particular pragmatic interests of any designer. My response to this point would be to shift the discussion to the periodic law rather than periodic tables.

If we substitute the expression “the periodic law” with “periodic theory,” I would expect that this is (at least one) classification for which we are searching. (But again: Chemical periodicity might be just one among more criteria by which it is relevant to construe a classification of chemical elements – and the concept of element might itself be a problem depending on the perspective.) Scerri suggests that “chemical periodicity” is an objective fact and that one true classification corresponds to this fact. But is everything about chemical periodicity clarified today? (The formulation of the periodic law in Scerri (2007, 16) seems rather vague and thus open: “The periodic law states that after certain regular but varying intervals the chemical elements show an approximate repetition in their properties.”) Why not say that there are theories of chemical periodicity and that a given theory of chemical periodicity corresponds to a certain classification? If it turns out that one theory may fully explain chemical periodicity, then this theory implies a certain version of the periodic table. In other words: Chemical classifications are implications of chemical theories (just as biological classifications, art classifications, psychiatric classifications are implications of subject theories in their respective fields). Scerri’s search for one true classification should thus be understood as the search for one true theory of chemical periodicity. In this perspective the goal of the classification is to correspond to a theory, and the search for one true classification is thus a trivial implication of the demands that Scerri puts to it.

6.1 The narrower and broader form of pragmatism

At this point it seems important to make a distinction between pragmatism in a narrow and in a more fundamental sense. Scerri (2010) did express that:

It may just be that the current attempts at representation are infused with pragmatism since individual chemists may indeed be interested in putting the periodic table to particular uses rather than arriving at one correct representation that reflects a natural classification.
I agree that some versions of the periodic table may be short-term pragmatic for some purposes, but not pragmatic in the way of producing a better tool designed for basic science. The broader form of pragmatism should of course be linked to fundamental findings and theories and should be pragmatic for the further advancement of science. (I do not believe that there is a great risk that pragmatism may be proven wrong. If there is a risk, it probably is that pragmatism may turn out to become trivial or circular. Pragmatism cannot be opposed to the search for truth, but implies that truth and relevance for the conduct of life are the same, that universals are to be understood as both something ontological and pragmatic (see also Karpatsch 2000, 317-18, 366, and 447).)

6.2 Conclusion of this section

The strength of the periodic system is, in particular, based on the periodic law, according to which properties of elements are periodic functions of their atomic numbers. Some of the open questions may be “how many properties?” “which properties?” and “properties important from which perspective?” Are the properties relevant for the classification of chemicals theory independent or reflecting a particular theory and interest? In the last case: Which competing perspectives/theories are at play, and which criteria should be used to decide and negotiate among them?

7.0 Natural classification, realism, natural kinds and essentialism

The concept “natural kind” is important in the philosophy of classification. To say that a kind is natural is to say that it corresponds to a grouping or ordering that does not depend on humans. The idea of natural kinds may also be expressed by Plato’s metaphor “carving nature at its joints.” Again chemical elements play an important role because other candidates for the term (such as biological species) have turned out to be problematic examples. In the periodic system there may be different claims about natural kinds:

- That the single element (such as gold (element #79) or iron (element #26)) are natural kinds;
- The extension of this view to more complex chemical structures (such as molecules); and,
- That the elements group naturally into classes of elements (such as noble gases, alkali metals and the halogens).

Scerri (2007, 280) finds that the elements are natural kinds (and thus not a matter of convention), but that “the criterion for membership to a group is by no means as clear-cut as that which distinguishes one element from another.” He continues: “However, one may also argue that the placement of the elements into groups is not a matter of convention. If periodic relations are indeed objective properties, as I argue here, it would seem to suggest that there is one ideal periodic classification, regardless of whether or not this may have been discovered.”

John Dupré is probably one of the leading critics today of the view of natural kinds and natural classifications as ordinarily understood. He writes, for example (1993, 274):

Atoms are often suggested as example of natural kinds, with atomic number serving as an essential property. But the fate of cars driven over salted roads for any time provides a reminder that iron atoms are not at all the same as ferric ions, although both have atomic number 26. Atoms are also said to vary with respect to transitory states of orbital electrons, properties said to be of great significance to their chemical behavior.

It is important to realize that Dupré is also a realist in the sense that he classifies objects on the basis of their objective properties. He is however a pluralist (or “promiscuous”) realist in claiming that there is more than one way to “carve nature at its joints.” This seems to be related to the view expressed by Marradi 1990, 3.1):

The opposition between “natural” and “artificial” classification is a recurring theme in the last two centuries. Cohen and Nagel have cogently argued that “any division ... according to some actual trait arbitrarily chosen is perfectly natural ... [but it] may also be said to be artificial, in the sense that we select the trait.

Traditional accounts of natural kinds centre on ideas of “essences” or “essential properties”. Wikipedia (2010-06-06) defines “essence” the following way:

In philosophy, essence is the attribute or set of attributes that make an object or substance what it fundamentally is, and which it has by necessity, and without which it loses its identity. Essence is contrasted with accident:
property that the object or substance has contingently, without which the substance can still retain its identity.

Cooper (2005, 47) wrote:

In recent years traditional essentialist accounts of natural kinds have come in for fierce criticism. A major difficulty is that for biological species, which are traditionally considered amongst the best examples of natural kinds, no plausible candidates for the essences can be found. Several different criteria may be employed by biologists seeking to delineate species: morphological features, evolutionary lineage, the criteria of reproductive isolation, or genetic features. On examination none of these appear suitable candidates for being the essential properties of biological species.

A reasonable position may be that “essential properties” are essential from a given theoretical perspective. To the degree that there are competing perspectives, there will be competing views of which properties are essential.

8.0 Conclusion

In Hjørland (2008d) I provided the following model for “the traditional view of classification” in KO:

Scientific Classification → Library classification (KO)

This view may be expressed by stating that there is only one way in which nature has joints or by saying “nature itself has supplied the causal monistic essentialism. Scientists in their turn have simply discovered and followed (where ‘simply’ ≠ ‘easily’)” (Stamos 2004, 138-139). Library and information scientists in turn have to study scientific classifications and “simply discover and follow” scientific classifications. This view has, however, almost disappeared in KO in the second half of the 20th century (to be ousted by, for example, facet-analytic and use-oriented perspectives). (My own position is thus closer to this traditional view compared to, for example, facet-analytic, user-oriented and cognitive views.)

Against this traditional view may be put the view that classifications are reflecting the purposes for which they are designed and that different sciences, theories and human activities classify the world (more or less) differently. Both the practice of science and the practice of information science are thus seen as more constructive. The periodic system seems to be the ultimate challenge to this view. I do not believe the last word has been said about this important problem, but this article has tried to bring the KO-community up-to-date in relation to what I see as a fundamental problem in our field.

References


What is the Nature of the Periodic Table as a Classification System?

Eric Scerri

(continued from page 10)

scientific classification is the periodic table of the elements.” Dupré claims that the chemists’ belief that they have arrived at an ideal classification is an illusion, “because of the specific aims implicit in the history of chemistry.”

So what are these specific aims that chemists apparently possess and that have rendered their classification system biased in some way? Dupré considers that it is because chemists aim at the structural analysis of matter and: “If, as appears to be the case, all matter is composed of a small number of structural elements, a classification based on those elements will be best suited to those purposes.”

I think that Dupré as well as Hjørland, who quotes him approvingly, are incorrect for two reasons. First of all, the periodic system of classification was arrived at completely independently of any conception of structure, atomic or otherwise. Mendeleev, the chief architect of the periodic system, repeatedly expressed his dislike for atomic theories and never accepted the discovery of the electron that took place in 1897, a full ten years before his death in 1907.

More importantly, Dupré’s claim is somewhat circular. The aim of chemists is not necessarily the structural analysis of matter but rather the analysis of matter period. It so happens that the analysis of matter in general later revealed that a structural approach, in terms of atoms, protons and electrons, was a fruitful path to adopt. The chemists did not impose a structural prejudice upon chemical analysis. The latter is a feature that arose, presumably because the world itself contains discrete structural components such as atoms and electrons. Dupré further confuses the issue by quoting from LaPorte’s well known article on natural kinds where LaPorte reports that the Chinese jade carvers refer to two quite distinct chemicals as “jade.” I regard this as irrelevant since it is not the views of Chinese carvers that are under discussion but that of scientists. Scientists do not refer to the two kinds of materials as “jade” but as jadeite and nephrite as LaPorte readily acknowledges.

Hjørland proceeds to discussing what he calls “four possible ways” to defend the pragmatic view of
classification. The first is that at least certain features of the periodic system are still open to debate, a claim made with no further elaboration. But surely this is a weak argument since there is no field of science that is devoid of debate. The mere presence of debates, of some form or other, does not provide sufficient warrant for believing that one must hold a pragmatic view of knowledge rather than believing in the existence of natural kinds in a particular field of science.

The second of Hjørland’s reasons is a direct appeal to Dupré as quoted above, namely that the pragmatic nature of the periodic system is due to the purpose of chemistry which Dupré takes to be the structural analysis of matter. I would counter this by rephrasing what I said earlier. The aim of chemistry is to understand the nature of matter by whatever means necessary. It is not to impose a structural conception at the very outset of the enterprise.

The third reason given by Hjørland (2008, 253) reads as follows: “The third [reason] is to operate with very general purposes for the sciences, in which case an ideal classification can be understood as the best tool with which mankind can control nature.” Once again this conclusion is too quick since it does not argue for science being a tool, or that science aims to control nature, but merely asserts these claims as facts.

The fourth and final way in which Hjørland regards the periodic system as a being pragmatically driven, rather than a reflection of natural kinds, is by questioning what he terms, “the generality of the periodic system’s organization of similar elements.” Hjørland claims that different chemical specialties such as agro-chemistry or food chemistry may be somewhat opposed to each other in seeking to highlight different aspects of the behavior of the chemical elements. He says that the periodic system seems somewhat opposed to such “social classifications” by different kinds of chemists, which he takes to a limit to the prediction of properties by the periodic system itself.

This conclusion is rather puzzling to the present author since it is precisely because the periodic table seeks the most general possible description and relationships among the elements that it may not immediately yield the kinds of predictions that are useful to agro-chemists or food chemists. But if this situation is the case, then I would say, so much the worse for the demands of these professions and that it is not a reason for questioning the generality of the periodic table. If anything it is a graphic demonstration in favor of its generality rather than specificity. Hjørland even questions whether atomic number should be considered as a criterion of natural kinds because, “not all properties are predicted by atomic number.” This is of course true but irrelevant. Whether or not an element is a superconductor, for example, cannot be predicted from its atomic number but this has little bearing on whether or not elements are identified via their atomic numbers. Why should all properties of an element be predictable directly from just atomic number? As I just mentioned, some properties including superconductivity cannot be predicted from a knowledge of the element’s atomic number. This fact does little to shake the confidence that chemists and physicists have in the notion that the identity of a particular element resides in the value of its atomic number.

More philosophically speaking, the identity and properties of any class of entities are somewhat separate issues. In the modern understanding of the term ‘element’ for example, the identity of gold does not reside in its being a certain color or possessing a shiny appearance or indeed in displaying any particular ‘property’ as such but just it its having an atomic number of 79. Many philosophers of science who espouse the causal theory of reference are in agreement with this view in claiming that identity is given by focusing on ‘reference’ rather than ‘sense,’ or on the essential qualities rather than the properties of an element (Putnam 1975; Scerri 2005).

Hjørland mentions the distinction between elements as simple substances (sense) and as basic substances (reference) but in a different context. As he sees it this distinction shows the coexistence of the empiricist and rationalist approaches to the classification of the elements. But in the very next sentence this dual nature in the meaning of the term ‘element’ also becomes an example of the importance of the historicist approach to knowledge, although no reason is given for this claim.

Fourthly, we are told that the pragmatist view is exemplified by another aspect of the periodic table, namely, “the weight attributed to chemical respective physical properties when determining the similarities among the elements.” I hope that Hjørland might be prepared to explain this statement more fully as I am confused as to its meaning. Similarly, I would ask the author to clarify the meaning of the next claim, namely that the attempts to reduce chemistry to quantum mechanics, that I discuss in my book, are indicative of the pragmatic approach to knowledge.
Finally, Hjørland examines whether a classification, such as the periodic system, that is first developed in science, can then spread into the public media and into library classification systems. His conclusion seems to be that the periodic system has had no influence in these fields because books on the periodic table, such as the one he is reviewing, are largely ignored in the field of knowledge organization. Hjørland quotes from a rather outdated source, written no less than 99 years ago, in which the originator of the principle of “literary warrant” bemoans the fact that the periodic system is merely a classification by the names of elements which was of course incorrect then as it is now. This quoted author, Hulme (1911), also contends that, practically no literature in book form exists concerning the elements because, “no monograph, for instance has yet been published on the chemistry of iron or gold.” These days there are literally dozens of books on these two elements alone and so would seem to preclude any conclusions on the nature of classification based on Hulme’s writings of 1911.

To conclude, I thank Hjørland for his complimentary remarks about my book in the course of his review but I must disagree with his characterization of the periodic system as being the result of pragmatism rather than the way the world of the chemical elements is actually ‘carved at the joints.’ I am looking forward to his response and to his clarifying the parts of his review that I did not fully comprehend.

References


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A Note on the Debate Between Hjørland and Scerri on the Significance of the Periodic Table
John Dupré
(continued from page 10)

sitions, for example jadeite, NaAlSi2O6. Although this last looks like an exact chemical formula, it would be a mistake to suppose that jadeite was, primarily or essentially, the name of a chemical kind. To be a jadeite (or jadeetite) rock is to be a rock with a specific predominant composition produced through a characteristic metamorphic process at certain ranges of pressure and temperature. Relatively small differences in composition produce a variety of colours as well as difference in physical properties such as density. It would be quite wrong to think that a piece of jadeite with particular chemical traces that imparted to it a particular shade of green was thereby impure jadeite (or, indeed, impure jade). The presence of such traces is characteristic of jadeite and particular colour-producing traces might, indeed, make a piece of jadeite an exceptionally fine piece of jade rather than an impure one. The point, of course, is that jadeite is a geological term not a chemical term. Many of its properties may be explained by (more or less constant) features of its chemical composition. But the category, as with olivine or pyroxene, is shaped by the concerns of geology. The point would be even clearer for such much more chemically variable substances as magma (from which the rocks just discussed are originally formed), tephra, or lava.

Analytic chemistry, then, is not the only basis for the classification of kinds of stuff. Scerri is right to see the periodic table as the hardest test case for pluralistic accounts of kinds, and it has generally been recognised as such by pluralists including myself. It is a classification system which, once discovered, seems inevitable; it strikes many as embodying the discovery of that feature of a material stuff whereby, in Locke’s memorable phrase, it is what it is. A possible response by the pluralist is to acknowledge that this is an exception to the pluralism that becomes irresistible for the more
complex domains of biology and society. (As David Hull once chided me, a pluralist should not be committed to a monistic (i.e. monistically pluralist) metaphysics.) Nevertheless, I think there is no reason for the pluralist to be so concessionary). The chemistry based on the periodic table is a rightly admired scientific project, one of the landmark successes of modern science. Nonetheless, it does not provide the only way of classifying material stuff. Geology, I have suggested, provides a clear example of a science the concerns and classifications of which do not align exactly with those of chemistry. Metallurgy, as I briefly mentioned, is another. Crystallography and parts of astronomy or fluid mechanics may be others. And most important, we should not rule out the possibility that we will in the future develop quite new interests in the classification of matter.

In short, then, I concur fully with Hjørland’s insistence that the periodic table, for all its power and elegance, is no threat to a thoroughgoing pluralism, or to the pragmatist attitude that inspires it.

References


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Proclaiming Intellectual Authority Through Classification: The Case of the Seven Epitomes

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1.0 Introduction

According to extant historical records, the Seven Epitomes (Qilue; sometimes translated as the Seven Summaries) was the first classified library catalog in China. This catalog was one of the by-products of a large-scale collation project commissioned by Emperor Cheng (r. 33-7 B.C.E.) of the Former Han dynasty (202 B.C.E.-9 C.E.). The project aimed to salvage deteriorating books stored in the depository of the inner court, to search widely for other “lost” books from around the country, and to organize the collated books into a usable dynastic library collection. (The “book” evolved over a long period of time in ancient China. As
a matter of fact, this collation project resulted in many books as we know them today that did not exist before that time. For a history of early Chinese books, see Tsien (2004). In his attempt to organize the library collection, Liu Xin, the second principal on the collation project who completed the work, created the classified catalog. The classification of this catalog established a bibliographic philosophy and a model classificatory structure that influenced other Chinese bibliographic tools for approximately two millennia. To understand the Chinese bibliographic classification tradition, it is imperative to make the study of the classification in the Seven Epitomes a first priority.

Unfortunately, the knowledge about the classification theory of this 2,000-year-old tool with such a broad influence is inadequate. The common postulate of Chinese bibliographers is that modern classicism was the guiding ideology behind this classification. Beyond this, other theoretical and methodological issues have yet to be systematically explored and analyzed. Some thus come to view the classification as crude, unscientific, biased, inferior, and no longer relevant. Even those who recognize its positive value have only stated the obvious without providing a detailed analysis of how the classificationist planned the structure and categories to achieve his intended goal. Such a superficial treatment of the classification has become an enormous roadblock to an informed understanding of the intellectual force of bibliographic classification and how this tool played a role in shaping the intellectual discourse of the time.

The current study takes on the task of investigating the main structure of this classification with special attention to its main classes and their order. More importantly, it intends to examine and theorize, through the use of the partially extant text of the catalog, other historical records and secondary sources, how the classificationist used an ideology (i.e., classicism) to guide the structuring of the classification and, as a result, successfully exalted the ideology as the intellectual authority. It is worth noting, however, the classification under consideration is complex and no longer extant in its original form. To arrive at a comprehensive knowledge of it requires a research approach that is multidimensional and takes into consideration a plethora of historical, social, intellectual, and technological factors. The current study represents a first step toward that comprehensive knowledge by examining one of the fundamental dimensions of the classification.

To provide context, the next section presents a brief introduction to the Seven Epitomes. It includes the circumstances surrounding the compilation of the catalog, the personal background of its author, and its classificatory outline. Section 3 reviews the literature on the catalog’s classification. Section 4 considers methodological issues pertinent to the study. The following section examines the classificatory structure of the catalog at the level of its main classes and attempts at a reconstruction of the classification’s theoretical and methodological basis. Finally, the study concludes with a reiteration of the classificatory philosophy established by the Seven Epitomes, considers the social and cultural significance of the classification model in Chinese history, and reflects on its likely relevance in broad classification research. In this article, we use pinyin for the Romanization of Chinese characters and follow the United States Library of Congress’s periodization of Chinese history.

2.0 The Seven Epitomes and Its Classification

In the present day, traditional Chinese bibliographic classification is virtually unknown to most people; even Chinese librarians and information scientists are unfamiliar with the Seven Epitomes. It is thus necessary to first provide some background information about the catalog and its classification. The Seven Epitomes is generally recognized as the first national library catalog in China, and its classification the first broad bibliographic classification scheme documented in Chinese history. According to the literature, Liu Xin compiled the Seven Epitomes on the foundation of his father Liu Xiang’s Separate Résumés (Bielu). The completion of the Seven Epitomes was dated to sometime during the reign of Emperor Ai (7-1 B.C.E.) of the Former Han.

2.1. The Han Imperial Library Collection and the Collation Project

Chinese books went through two man-made disasters before Liu Xin’s time. The first was a ban on books decreed by Shihuangdi (i.e., First Emperor, r. 221-210 B.C.E.) of the Qin dynasty. As part of the ban, the classics, historical records from former states other than the Qin in the Spring and Autumn period (722-481 B.C.E.) and the Warring States era (403-221 B.C.E.), and other nontechnical writings were burned; only technical books on medicine, divination, agriculture, and forestry were spared. The state became the sole place to keep all kinds of writings and the only source of learning and education. When the Qin fell in 207 B.C.E., the imperial library, together with the palaces, was burned to the ground. This was the second disaster in the fate of early Chinese texts.
After overthrowing the Qin, the Former Han lifted the ban on books in 191 B.C.E. Then, the Han emperors continuously collected writings and records for the imperial library. The Preface to the “Bibliographical Treatise” (Han Treatise or Treatise hereafter) of the History of the Former Han Dynasty (one of the twenty-four canonical histories of China, written by Ban Gu) concisely described the official book collecting activities during that time (Translated by Lewis 1999, 327; bracketed insert in the original translation. This is a partial quote from the Preface generally believed to be either the original or a modified form of the original in the Seven Epitomes):

The Qin ... burned and destroyed writings in order to make idiots of the common people. The Han arose and reformed the damage wrought by Qin. On a large scale they assembled texts and strips, and they broadly opened the path for the offering up of documents. When it reached the time of Emperor Wu ... he established a policy of storing writings and set up officials to copy them, including even the [writings of] the various masters and transmitted sayings. They were all stored in the secret archives. When it reached the time of Emperor Cheng, because the writings were dispersed or lost, he sent the Internuncio Chen Nong to seek for missing books throughout the empire.

Meanwhile, people were encouraged to donate or offer the texts or records they owned, all hidden by their ancestors from the reach of Qin officials, to the imperial depository. As a result, the collected and donated texts, mostly on bamboo or wooden slats, piled up like “hills” in the imperial library, and it became obvious that these texts needed urgent care. In 26 B.C.E., Emperor Cheng summoned Liu Xiang and other scholars to collate and manage these texts. They developed and employed a series of procedures to collate the texts and to put them in order. It became a tradition since then that most dynasties in the Chinese history took on such a collation/cataloging project to build a dynastic library and to exert government’s control over written texts.

As mentioned above, the collation project led by Liu Xiang and Xin produced two bibliographic tools, the Separate Résumés and the Seven Epitomes. Both regrettably are no longer extant. Some scholars suspect that the Seven Epitomes was lost during the first half of the tenth century (e.g., Lai 1981). However, there is little doubt that an abbreviated and somewhat altered version of the Seven Epitomes has survived as the Han Treatise, with most of its titles and its classificatory structure intact. See Figure 1 for the textual history of these three related works. Some aspects of their relationships pertinent to the study are addressed in the following sections. For additional information in English about the Seven Epitomes and its relationships with the other two works, see Lee and Lan (2009).

2.2. Liu Xiang and Liu Xin

Liu Xiang (79-8 B.C.E.) was a famous scholar, editor, and bibliographer. In 26 B.C.E., Emperor Cheng (r. 32-7 B.C.E.) of Han commanded Liu Xiang to lead a team of scholars and specialists to collate and organize texts stored in the imperial depository. The texts belonged to six broad categories: 1) the six so-called Classics (i.e., Changes, Documents, Odes, Rites, Music, and Spring and Autumn Annals) and their commentaries, 2) texts written by the masters, 3) poetry, 4) military texts, 5) divination manuals, and 6) medical texts. (Although the six Classics were mostly regarded as

![Figure 1. Timeline of textual history of the Separate Résumés, the Seven Epitomes, and the Han Treatise (not to scale)](image_url)
part of the general heritage by the educated elite in earlier times, they became the state canon a century before Liu Xin's time (Nyland 2001). The *Music* was already lost when the other five were canonized and made the textual basis for "official learning" by Emperor Wu in 136 B.C.E.) For each text in the collection, Xiang not only established an authoritative version with help from other expert collators, but also wrote a résumé to describe the text, its collation details, author's background if known, intellectual lineage, and its value and weaknesses. Individual résumés, some quite lengthy and informative, were later assembled into what is believed to be the first annotated bibliography in China, titled *Separate Résumés*.

Liu Xin (53 B.C.E.-23 C.E.) was Xiang's youngest son. Just like his father, Xin was multi-talented and known as a distinguished scholar, bibliographer, and astronomer. When the collation project began, he was an assistant on the project. After Xiang's death, Xin took his father's position and completed the work, including writing the last résumés. Some scholars speculate that Liu Xin was the one who gathered all the résumés from the collation project to produce the *Separate Résumés* (Lai 1981). Near the completion of the collation, all finalized texts were to be moved into the imperial library. Liu Xin then created a retrieval aid, or catalog, for the collection, by condensing the *Separate Résumés* into a concise version. To organize entries in the catalog and the library collection, the original six text categories were expanded into a full-fledged classification. The *Seven Epitomes* was thus born.

This father-son team played a decisive role in shaping the early Chinese textual heritage, being credited with creation of the canonical forms of classical texts. Shaughnessy (2006, 2) concludes:

> It was they [i.e., Liu Xiang and Xin] who actually rewrote the texts stored in the imperial library, sorting them into discrete books and chapters, deleting redundancies, translating the various archaic characters into a standardized script, and producing definitive fair copies on which all subsequent editions of these earliest texts have been based.

### 2.3. The Classification Scheme in the Seven Epitomes

Since the *Seven Epitomes* is long lost, the following description is based on a version of it reconstructed by Yao Zhenzong, derived mainly from the Treatise and supplemented with fragments of the catalog cited in other sources (Liu 2008). The title of the *Seven Epitomes* seems to suggest its classification to have seven classes. In fact, it comprised six main classes (i.e., epitomes) and 38 divisions or subclasses. Ruan Xiaoxu (2002), who had access to the catalog, counted the total number of volumes in the catalog as 13,219. However, readers must keep in mind how difficult it is to gain accurate counts given the history of the catalog. Table 1 displays estimated volumes in individual classes and divisions in the Treatise (Zhang Shunhui 1990) and in the *Seven Epitomes* (by Wen-Chin Lan), respectively.

Preceding the six classes was the Collective Epitome—thus the title *Seven Epitomes*. The Treatise included no indication of this epitome and provided no explanation for it. Because those who had seen the extant *Seven Epitomes* gave very vague descriptions of the Collective Epitome (e.g., Ruan 2002), a consensus of the nature or content of this "lost" epitome has not been reached yet. One thing indisputable is that the Collective Epitome was not a class. A commonly accepted opinion says that the contents of the Collective Epitome became the Preface to the catalog and the introductory summaries (xiaoxu) scattered under individual classes and divisions in the Treatise (Chang and Pan 1986). And the name of the epitome seemed to be indicative of the epitome being a collection of introductory summaries.

### 3.0 Literature Review

Research on traditional Chinese bibliographic classification seems to have remained a predominantly regional activity. Besides Chinese works published in China and Taiwan, a search on WorldCat resulted in no books on the topic in other languages. Only one dissertation produced in the United States covers the development of modern Chinese classification in Communist China (Li 1992). Also, there have been few relevant scholarly articles in international library and information science journals. The few in English either give narrow attention to modern systems (e.g., Liu-Lengyel 1987), or provide a historical overview summarizing opinions from the Chinese scholarship (e.g., Jiang 2007). Thus, for the purpose of the current study, this literature review focuses on what has appeared in Chinese that deals with the classification in the *Seven Epitomes* or the Treatise.

### 3.1. Research in Chinese

The Chinese literature on traditional bibliographic classification has a long history. Before the last dy-
<table>
<thead>
<tr>
<th>Epitome (Class)</th>
<th>Division</th>
<th>Han Treatise Volumes</th>
<th>Seven Epitomes Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Six Arts</td>
<td>Changes</td>
<td>294</td>
<td>294</td>
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<tr>
<td></td>
<td>Documents</td>
<td>422</td>
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<td>Odes</td>
<td>416</td>
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<td>Rites</td>
<td>607</td>
<td>452</td>
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<td></td>
<td>Music</td>
<td>165</td>
<td>172</td>
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<td></td>
<td>Spring and Autumn Annals</td>
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<td>905</td>
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<td>Analects</td>
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<td></td>
<td>Book of Filial Piety</td>
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<td>Masters</td>
<td>Ru Classicists</td>
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<td>Daoists</td>
<td>801</td>
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<td>Mohists</td>
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<td>Diplomatists (Strategists)</td>
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<td>Eclectics (Syncretists or Generalists)</td>
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<td>Diverse Prognostications</td>
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<td></td>
<td>Longevity</td>
<td>201</td>
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<tr>
<td>Total</td>
<td></td>
<td>13,269</td>
<td>13,510</td>
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</table>

* According to the Han Treatise seen today, the name of this class in the Seven Epitomes was the “Epitome of Divination and Numbers” but the “Epitome of Numbers and Divination” in the Treatise itself. The switch might be done intentionally by Ban Gu or could be an unintentional mistake in hand copying that occurred sometime in history.

*Table 1. Main classes and divisions of the Treatise and the Seven Epitomes with estimated counts*
nasty (the Qing, 1644-1912), however, the effort to study classification was sporadic. Even since then, classification research has been mostly a marginal field, often a secondary topic within the study of bibliography in general, despite the importance of classification in bibliography. Studies that have an exclusive interest in bibliographic classification are limited in numbers. It is also necessary to note that Chinese writers do not view intellectual properties as privately owned and customarily reiterate others’ opinions without citations. As a result of all these issues, the progress in Chinese classification research is slow and without citations. As a result of all these issues, the progress in Chinese classification research is slow and without citations. As a result of all these issues, the progress in Chinese classification research is slow and without citations. As a result of all these issues, the progress in Chinese classification research is slow and without citations.

First, acknowledgement is due to generations of scholars whose diligent work in annotating and providing critical and exegetical notes leaves us an incredibly rich and useful body of information for understanding and decoding the Seven Epitomes and traditional Chinese bibliography, much of which might not be intelligible to current researchers without those notes. Yan Shigu (6th-7th centuries), for example, quotes from a resume written by Liu Xiang as a note under the entry “daizhaochenraoxinshu” in the Han Treatise (i.e., six characters with no punctuation) that helps the reader interpret the entry (meaning roughly, “Xinshu written by an Expectant Official named Rao”). The quote is deemed credible because the Separate Résumés was, without a doubt, extant in Yan’s time. Another type of contribution made by these scholars is their numerous citations of other related historical texts for supporting or challenging statements in the catalog (Fu 2007). This kind of contextualization of the Seven Epitomes and cross-referencing are especially valuable to those studying the classification.

An overwhelming majority of scholars recognize the classification of the Seven Epitomes as the first to establish the traditional classificatory model in bibliography that distinguished various branches of learning and traced their origins and developments. Notable texts and prominent scholars to have expressed such a view include the Suishu (1868) in the 7th century, Zhang Xuecheng (1965) in the 18th century, and Xu Youfu (2009) in the 21st century. It is common for them to praise this approach to classification as the most helpful in guiding students to pursue a step-by-step course of study. In their descriptions, they use a number of random examples or go over a class in the scheme one at a time to explain the intellectual appropriateness of a class or division without applying a systematic framework. The best example of this group of works is a recent book by Xu (2009) that devotes an entire chapter on the six main classes of the Treatise, pooling together a wealth of textual evidence and opinions with regard to issues of intellectual origins and developments. Standing in opposition are a few who criticize the catalog’s haphazard classification (Yao 2005) or condemn its emphasis on intellectual history as deviating from the “real” function of bibliography (i.e., information organization and retrieval) and driving Chinese bibliography in the wrong direction for too long (Wang Guoqiang 1991). This latter position advocating a narrow definition of bibliography has been rightfully denounced (Wang Xincai 2008). Disappointingly, both Yao and Wang evaluate the classification out of its historical and cultural context.

The catalog’s emphasis on delineating intellectual history was, Chinese scholars all agree, guided by an ideological principle. Evidently, the catalog’s classificatory structure reflected the perspective of ru classicism (i.e., Confucianism). Yu and Wang (1998), among others, refer to two facts to illustrate the classicist principle in Liu Xin’s classification. The first was Liu’s placement of the Classics at the beginning of the scheme and the second the listing of Classicists (rujia) as the lead division in the Epitome of the Masters. Commonly called a Confucian in sinology, a classicist was one who devoted himself to the learning based on the Classics. Nylan (2001, 364) discusses various connotations of ru in length; the definition used here is the most suitable one in this case.) This classicist overtone in the Seven Epitomes has elicited both praises and criticisms from Chinese scholars since then. On the one hand, traditional classicist bibliographers understandably view this approach positively (e.g., Zhang Xuecheng 1965). On the other hand, Marxists are critical of the ideology, pointing out that proponents of classicism like Liu Xin aimed to assist Han rulers in dominating and controlling people (e.g., Wang Zhongmin 1984).

A small number of authors attempt to provide an integrated framework for the main structure of the classification in question. Li Guoxin (1991), for example, suggests that the yin-yang and Five Phases theories formed the basis of this classificatory structure. His premise states that the Epitome of the Six Arts leads the other five epitomes in the classification just like yin-yang leads the Five Phases in the natural law. Unfortunately his idea has no textual base, for the
Seven Epitomes itself did not link its own structure to yin-yang and the Five Phases. Li also offers no explanations for how the five lesser epitomes match the Five Phases and how the relationships among these five epitomes resemble the relationships among the Five Phases. Additionally, three other authors have proposed different hypotheses. Fu (2003) argues that six was a popular number in the Han, and it was common for Han people to categorize by six. Zhang Sheng (1994) asserts that Liu Xin got the idea of the six classes from the six offices (liu guan) in the Zhou Rites (Zhouli), one of the three parts of the Book of Rites (Liji, i.e., one of the Classics). On the other hand, Zou (2008) proposes that the six classes originated from the “six rules” (liu dian) in the Zhou Rites. None of them have presented corroborative evidence from any extant texts including the Treatise. In other words, they use speculations that are difficult to prove or disprove. There is nevertheless strong consensus in recent scholarship refuting Zhang Sheng’s accusation that Liu Xin forged the Zhou Rites (Shaughnessy 1997), which is supposed to bear out Zhang’s hypothesis. (The claim that the Zhou Rites was a forgery by Liu Xin started in the late 19th century and has generated continual controversy.) It has thus become clear that his hypothesis is unwarranted.

“Was the six-fold scheme Liu Xin’s own creation?”—is a central question asked by many. Some of the cited authors above obviously believe so. On the other hand, other scholars hold the opposite opinion. A statement in the Preface to the Treatise (believed to be part of the original Collective Epitome) is the key to answering this debate (Translated by Lewis 1999, 327; bracketed inserts in the original translation):

Emperor Cheng ... summoned the Imperial Household Grandee Liu Xiang to check the canons, their commentaries, the masters, lyric verse, and rhapsodies; the Commandant of Infantry Ren Hong to check the military writings; the Grand Historian/Astrologer Yi Xiang [sic] to check [writings on] numbers and divination ... and the Attendant Physician Li Zhuguo to check [writings on] formulae and techniques.

A few scholars posit that the text after the word “summoned” was part of the original imperial decree (Zhang Sheng 1994). Except for the first one, the other five categories of texts mentioned in the decree were identical to the terms used as the labels of the second through sixth classes. (Lewis uses slightly different wording to make the statement read more smoothly in English.) The first only differed slightly from the label of the first class—“jing zhuan” (i.e., the Classics and their commentaries) as opposed to “liuyi” (i.e., the Six Arts, referring to the six branches of learning centering on the Six Classics). It is then said that the six main classes of texts could not have been an invention of Liu Xin, or even his father. Regardless of whether the statement is an extraction from the decree or not, one fact remains—one scholar and three specialists were summoned by the emperor to collate texts in six categories, indicating that some categorization of texts existed before the beginning of the collation project and Liu Xin did not start from scratch.

The Seven Epitomes was indisputably the catalog of the Han imperial library and its classification was no doubt a library classification. However, the catalog was at the same time used outside the library as a bibliography because the imperial library was accessible only to the emperor and, on rare occasions, a few government officials given special permission by the emperor. In fact, the ancient Chinese often made no distinction between library classification and classification applied in other types of bibliography precisely because catalogs of imperial and private libraries, all in the book form, were indeed circulated as bibliographies. This indiscrimination also blurs the line between library classification and classification of knowledge for some. The problem with this view, especially in the case of the Seven Epitomes, is that a library classification is meant to organize only books stored in the library, thus never a true classification of knowledge. Besides the matter that the unit for this classification was an individual book rather than a topic, the Han imperial library did not even collect texts on all subjects in the written culture of the time. Liu Yizheng (1982), for one, has pointed out the omission of elementary mathematical texts from the Seven Epitomes (more advanced mathematical texts for calendar making and harmonics were in the Epitome of Divination and Numbers). In the 1980s, archeologists excavated a bamboo text, which they named the Writings on Reckoning (Suanshu shu), from an early Han tomb—the very first such text that is currently extant and dated before Liu Xin’s time (Cullen 2007). It and many extant fragments of other mathematics texts are solid evidence that elementary mathematical texts indeed existed then and were excluded from the Seven Epitomes. Mathematics (or arithmetic) is said to be part of general elementary education for aristocrats in early China, and the Writings on Reckoning seems to be a text used by government employees at low ranks to learn basic skills needed for tax collection and other
accounting purposes. Obviously the absence of such texts from the catalog and the imperial library was not accidental. Another category of texts, legal codes and documents, was also excluded from the catalog; both newly excavated texts and historical records have proved that there were many written legal codes in Han and pre-Han times (Hulsewé 1986). Without a question, the imperial library collection, by design, had a limited scope which served as the literary warrant for drawing up the boundary of the classification being studied.

Some believe that literary warrant also influenced the balance among the main classes and divisions. The first person to bring up this point was Ruan (2002), who suggested that Liu Xin did not establish a “history” class because there were few writings of history and that the large number of poetic texts made it necessary to have a separate class for them. For over 1,400 years since Ruan suggested it, this opinion has been accepted by some and countered by others. A few scholars even consider the lack of a class devoted to history to be a weakness of Liu Xin’s classification as the later mainstream classification schemes in China all included such a class (Tan 2003). In enumerating many works of history from the division of the Spring and Autumn Annals (traditionally believed to be where history texts belonged in the Seven Epitomes) and from various divisions of the other classes, Wang Zhiyong (1998) refutes the premise of literary warrant. His own view is that Liu Xin failed to recognize the new landscape of scholarship, as history was only an emerging field of study in the Former Han. Another Chinese historian (Lu 2000) holds a similar point of view, but dates the maturing of the field of history towards the end of the Later Han (around 200), suggesting that Liu Xin could not have foreseen it. On the other hand, all these arguments for literary warrant’s function to balance the main classes become irrelevant because the same six categories of texts already existed before the collation began.

The order of the main classes and divisions is a prominent theme in the literature. Besides the discussion above of the classicist influence on the choices of the Six Arts as the lead class and Classicists as the first division in the following class, there have been many more opinions on the topic. Chinese scholars by and large agree that the value of a category and age of a text were two major factors in arranging the classes and divisions in the Seven Epitomes (e.g., Lü). Classicism had its hand in both assessing values and establishing timelines—the latter often problematic when dealing with early texts. For instance, Han classicists were convinced that the Classics were not only the most valuable, but also the oldest texts, thus deserving the top spot in the classification. In their attempt at fathoming the class order, researchers seem to consider a couple of classes at a time. Rarely has a single, integrated framework emerged for understanding the classification as a coherent scheme. It is thus not difficult to detect contradictions in their opinions. For example, Xu Youfu (2009) cites some scholars hundreds of years before him to explain that the last three classes could in fact also be considered writings by the masters. The reasons for their separation from the Epitome of the Masters were, according to Xu and others like him, that the large volumes of the texts in the three latter groups justified their becoming individual classes and that three other teams collated the latter texts. A question then arises: why did the class for poetic writings come between the Epitome of the Masters and the other three classes that were closer to the masters’ writings in nature? The implication seems to be that the labor division in the collation project trumped the nature and values of text contents in ordering the classes—a position that surely contradicts traditional thinking.

3.2. Discussions in English

Although traditional Chinese bibliographic classification is an overlooked subject in Western classification research, the scheme in the Seven Epitomes has received considerable coverage in works on early Chinese intellectual history, written in English. One work by Lewis (1999) deserves special attention in this review. Despite the fact that the book is not about classification or even bibliography, its short section on the Seven Epitomes provides some useful thought. The Seven Epitomes, he notes, exhibits five features; four are relevant here (Lewis 1999, 326-27):

First, it presumes unity of knowledge as the ideal .... Second, it sets apart the official canon and related texts as uniquely authoritative. These texts are granted a hierarchical and a temporal preeminence, as both models for all forms of writing and the origin from which the lesser categories derived. Third, the structure of the textual field is derived from the state apparatus. The canons are identified with the sage king and each category of texts traced back to a department or office .... Fifth, the account of the composition of the catalog emphasizes its collective nature, and it reproduces the division between the general,
encompassing skills claimed by the philosophical traditions and the specific, limited skills attributed to the technical ones.

Emerging from these statements are several suppositions that are instructive for our study of the classification:

– The scheme was intended to present knowledge as a unity.
– Classicism informed the scheme and the scheme validated the Classics as the intellectual authority.
– The state apparatus also influenced the classificatory structure.
– There was a discernible division between the first three classes (i.e., the philosophical traditions) and the later three classes (i.e., the technical traditions).

None of these are new ideas. But Lewis anchors his discussion in a thoughtful analysis of the introductory summaries found in the Seven Epitomes and, appropriately, in view of the intellectual development of the time. It is hence uniquely insightful and inspirational for the current study.

Numerous English writers have studied the intellectual landscape in early China, often with an emphasis on the philosophical traditions as described in the Epitome of the Masters in the Seven Epitomes. Typically their analyses of original texts lead them to draw conclusions differing from that of Liu Xin. Csikszentmihalyi (2002, 90), for example, argues, “Because the [bibliographic] categories of the Han dynasty reflect various earlier institutional and interpretive categories filtered through a generic framework determined by Han organizational forms, they are clearly not a reliable guide to the sociology of Han thought.” His approach is representative of those taken by intellectual historians who try to emancipate themselves from the received categories of philosophical texts imposed by Liu Xin’s scheme. While this scholarship provides helpful information about the intellectual development of the time, it does not shed much direct light on the theoretical foundation of the classification.

To summarize, previous research has covered a rich variety of interests and issues germane to classification research. What is clearly needed in the next stage is an analytical framework for examining a classification that was a result of a monumental project sponsored by the throne. Because the project took more than twenty years to complete, the personnel involved were the most renowned scholars and specialists in the empire, and the catalog itself demonstrated outstanding scholarship, the classification must have taken a great deal of thought and planning. This investigation, and any further inquiries, of the classification in question must not treat it as a haphazard invention.

4.0 Methodological Considerations: The Text and Context

Two perennial problems have plagued research on the Seven Epitomes: one associated with the catalog itself and the other with the context. First, the catalog is no longer extant. Scores of scholars have chosen instead to study the Treatise. Second, researchers often neglect to place the catalog in its own historical context. The aforementioned controversy concerning a history class is a telling example.

In this study, we follow mainstream scholars, taking the position that the Treatise indeed was a simplified version of the Seven Epitomes with the major features and components intact. The text we use for analysis is a nineteenth-century reconstruction of the Seven Epitomes by Yao Zhenzong, heavily based on the Treatise, newly edited and supplemented by Deng (Liu Xin 2008). Due to our inability to find any explanation for the classification by the classificationist himself or by his contemporaries, we constantly refer to the catalog’s own text, in English translation, for support or justification of our points and postulates. The reader may also want to consult the timeline of the three interrelated works presented in Figure 1.

The catalog by itself is a limited source because of its age and condition. Any serious research on its classification must consult additional sources. To avoid potential mistakes in studying the catalog out of the appropriate historical context, we apply a systematic framework to contextualize the data from secondary sources. The multidimensional framework consists of four types of contextual information: 1) Liu Xin’s biography (and to some extent his father’s as well); and, the 2) intellectual, 3) political, and 4) technological history up to the Former Han.

5.0 Foundation of the Main Classes

We begin with a few aspects of the classification of the Seven Epitomes on which scholars across the board generally agree. First, the collation project was initiated and commissioned by the throne; as one of
the end-products of the collation project, the Seven Epitomes and its classification were thus intended to serve the emperor and government. Second, the classification’s basic structure consisted of six main classes originating from six categories of texts in the collation project. Third, the six classes and their divisions were placed in a well-planned order, with the most valuable on top. Fourth, Liu Xin was a distinguished ru classicist, and the entire Seven Epitomes had a distinctive overtone of classicism, exemplified by having the Six Arts as the lead class and Classicists as the lead division in the second class.

Built on this rudimentary and partial understanding of the classification, the following analysis takes the approach that views the classification as one holistic scheme consisting of six classes as well as a systematic expression of the relationships among the classes. A careful examination primarily focusing on the target classification plus introductory summaries of the catalog and secondary sources finds compelling evidence of two principal methods of classification working jointly; one of them is dichotomy and the other ranking. Both are common in human categorization behavior across time and civilizations.

5.1. Dichotomy

Oxford English Dictionary (OED) defines “dichotomy” as “division of a class or genus into two lower mutually exclusive classes or genera; binary classification.” Chen Guoqing (1983, Preface), among others, maintains that the Treatise clearly expresses a dichotomy in its title, “Yi wen zhi”—yi referred to the Classics and wen was for all other writings represented in the Treatise (literally, zhi) itself (in Chinese, there is no differentiation made between singular and plural nouns). Even if this claim is accepted, it indicates only the intention of Ban Gu who was born nine years after Liu Xin’s death. Lacking extant historical records to prove that Ban followed Liu’s exact rationale, this dichotomy should be more appropriately considered as one of the probable theories for interpreting the design behind the classification of the Seven Epitomes. From the classicist point of view, a straightforward dichotomy like such made perfect sense. As a matter of fact, formal education systems in the Han dynasty, either at the Imperial Academy (tai xue) or in local schools, focused primarily on the learning of the Classics and their commentaries once a man passed elementary education (Yu and Shi 2000). The Classics indeed enjoyed a special status above all other texts.

In an attempt to better interpret the classification in the Seven Epitomes, we propose an expanded view based on a careful examination of the reconstructed text of the catalog (Liu Xin 2008) and other historical records about the catalog and its surrounding context. Our hypothesis contends that three dichotomies, instead of one, underlay the main structure of the classification (Figure 2). This view, however, is not a negation of the dichotomy between the Classics and the others. Rather, it builds on the as-

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**Figure 2. Three dichotomies in the Seven Epitomes**
sumption that the Classics were the principal factor in structuring the classification and expands to consider more complex issues.

5.1.1. The First Dichotomy and Its Historical Context

The first of the dichotomies (D1) in Figure 2 reflects the labor division created in the collation project. According to the Preface to the Han Treatise, Emperor Cheng ordered Liu Xiang and three others to collate texts stored in the depository of the inner court. The wording of the Preface identified six main categories of texts and four groups of collators, led by a scholar (Liu Xiang), a military officer, a scribe/astrologer, and a physician, respectively. However, it was really Liu Xiang and the others, or, the scholar team versus the specialist team. The three categories of texts collated by Liu Xiang’s team differed from the other three categories in one critical regard—texts in the first three categories were central in the education and intellectual pursuit of a statesman and scholar, and the other texts, collated by the teams led by the three specialists, recorded applied, technical skills. Such a dichotomous theory has been accepted by Chinese bibliographers at least since Zhang Xuecheng (1965, originally written in the 18th century). Lewis (1999) describes the division as one “between the general, encompassing skills claimed by the philosophical traditions and the specific, limited skills attributed to the technical ones” (327). The texts in the first part of D1, including the Classics, philosophical writings of the masters and poetic compositions, were said to all have roots back to the teachings of the sage kings in idealized ancient times while the other texts could not claim such roots.

In fact, Liu Xin explained the close connection between the canonical texts and the writings of the masters (The introductory summary for the Epitome of the Masters, translated by Lewis 1999, 328-29):

The masters form ten traditions, of which nine can be observed … Now the different traditions all cling to their own strong points. They know them thoroughly and reflect on them exhaustively in order to make clear their meanings. Although they are obstructed or weak, if you join their essential conclusions they are all branches or channels of the Six Canons. If their followers encounter an enlightened king or sage ruler who finds their common points, then they all have the ability to serve as his limbs … If one can cultivate the methods of the Six Arts and observe the words of the nine traditions, eliminate their weakness and take their strong points, then one can thoroughly comprehend the epitome of the myriad methods.

Liu Xin also tied poetic writings in the Epitomes of Lyrics and Rhapsodies to the *Odes* in the canon (The introductory summary for the Epitome of Lyrics and Rhapsodies, translated by Lewis 1999, 329; emphases in original):

In ancient times when the feudal lords and hereditary officials had interchanges with neighboring states, they used subtle words to move one another. When saluting with bows, they invariably cited an *Ode* to make known their deepest aspirations, and they thereby separated the worthy from the unworthy and observed flourishing or decline. After the Spring and Autumn period, the Way of Zhou was gradually ruined, and odes of paying respects and making inquiries were no longer practiced among the states. Men of honor who studied the *Odes* were lost among the commoners, so the *fu* of worthy men disappointed in their aspirations arose. The great *ru* Xun Qing and the Chu minister Qu Yuan were separated [from rulers] by slanderers and worried for their state, so they wrote *fu* to covertly criticize or influence. They both had a righteousness that included concern for the ancient odes.

In his *Zhongguo sixiangshi* (Chinese intellectual history), Ge (2001) asserts that Chinese intellectual activities went through a gradual shift in ancient times (roughly starting in the 8th century B.C.E.) from archaic mysticism controlled by a small group of rulers and diviners to more rationalized knowledge pursuit undertaken mostly by an intellectual elite (i.e., *shi*). The latter were a new social group whose emergence was a catalyst for the intellectual shift. Borrowing from Max Weber, Chen Lai (2005) calls this shifting process “rationalization.” Ge (2001) points to several differences between the two traditions. One of the differences was the phenomenon in the new tradition that separated abstract thinking from technical skills.

In discussing the origins of “science” in ancient China, Sivin (1995) and Harper (1998) describe its practitioners after the rationalization took place but before the Warring States Era (403–221 B.C.E.) as mostly illiterate people outside the *shi* group (for example, craftsmen, government clerks, astrologers, and shamans/physicians) who learned their skills as a
family trade orally and passed down what they knew from father to son over generations. Some of the practitioners put their skills down in writing as literacy further spread in the Warring States Era. The so-called “science,” labeled as “natural history and occult thought” by Harper, consisted precisely of the topics represented in the last two classes of the Seven Epitomes: the Epitome of Divination and Numbers and the Epitome of Formulae and Techniques. This helps explain how technical writings differed from philosophical and literary writings composed by the elite, especially in the eyes of the latter.

5.1.2. Dichotomies 2 and 3

The second dichotomy (D2) is the Classics/non-Classics divide within the texts collated by the scholar team. However, Part One of D2 incorporated more than the Classics. People in the Han period were unable to comprehend the Classics without the help of exegetical notes and commentaries written by scholars who had studied one or more of the Classics for years. Taking an approach based on individual Classics, Liu Xin created six divisions in the foremost class for the Classics (Epitome of the Six Arts), each of which contained the text (or various versions of the text) of a Classic as well as its interpretations, commentaries and other related works. Liu Xin also augmented this class of texts with three other divisions. Two of them were designated for two other collections of texts (i.e., the Analects and the Book of Filial Piety) that were said to be recordings of Confucius’s teachings by his disciples and the interpretations and commentaries of the two collections. The last one was the division of philology. Some have speculated that the texts in these three divisions formed the basis of elementary education at Han times, and Liu Xin’s inclusion of them with the Classics indicated his belief that all men must acquire basic skills of philology and a mastery of the Analects and the Book of Filial Piety (obviously the foundation of classicism) before they could embark on a study of the Classics (Wang Guwei 1959; Yu Jiaxi 2004). Another general assertion is that the inclusion of the two texts associated with Confucius in the Epitome of the Six Arts was an attempt by Liu Xin to elevate the status of Confucius (Wang Mingsheng 1992). The summaries of the six divisions for the six Classics also unequivocally connected Confucius to all the Classics, claiming that he had either edited or transmitted individual Classics.

Part Two of D2 formed a third dichotomy (D3) between texts that pertained to expositions of the sage kings’ teachings in various perspectives and those that applied literary or poetic expressions. The former became the Epitome of the Masters and the latter the Epitome of Lyrics (shi) and Rhapsodies (fu).

Lastly in the second branch of D1 (i.e., the so-called technical writings), the texts—about one third of the total count—fell into three specialty areas: military strategies, skills dealing with divination, and medicine. The introductory summaries of these three classes traced the origins of those texts to a number of government offices in earlier times, pointing out a history of technical specialization in the political machine. Because their contents were technical, Emperor Cheng appointed three specialist practitioners to lead their own teams in collating those texts. The three specialties thus naturally resulted in three classes of texts. Interestingly, both Liu Xiang and Xin were polymaths whose works on chronology, just to name a subject belonging to the Epitome of Divination and Numbers, were well known (Xu Xingwu 2005). So why did they not participate or even lead the collation of the texts on chronology? This could seemingly be further support for the theorization of the first dichotomy in asserting the split between the scholar team and the specialist team taking precedence over consideration of expertise.

5.1.3. Concerning a Missing “History” Class

Interpreting the basic classificatory structure of the Seven Epitomes through the preceding three sets of dichotomies centered on classicism is especially useful for addressing the controversy over the so-called “history” class. As discussed in the literature review section, some researchers criticize the Seven Epitomes for failing to establish a history class. Others have come to Liu Xin’s defense. One group says that there were not enough writings of history in Liu’s time to justify such a class. On the other hand, a couple of scholars argue that Liu did not do so because history was not an established field of study. It is the authors’ contention, however, that “fields of study” were never an intended consideration of Liu Xin for classifying texts.

In the Epitome of the Six Arts, the first eight of the nine divisions were centered on eight important texts respectively. Liu maintained in the introductory summaries that the ten divisions in the Epitome of the Masters originated from individual government offices and represented various and fragmented perspectives for interpreting sage kings’ teachings. Although it is difficult to know exactly how the divisions came about in the Epitome of Lyrics and Rhapsodies due to
One such topic that has puzzled researchers is the through dichotomies is also useful for addressing a particular approach to explaining the main classes of the catalog.

5.1.4. Dispersion of Some Topics

This particular approach to explaining the main classes through dichotomies is also useful for addressing a criticism concerning the dispersion of some topics. One such topic that has puzzled researchers is the yin-yang and Five Phases theories. “Why were they dispersed in three classes?” they wonder. Even the Seven Epitomes itself adds to the perplexity by stating that the masters propagating the yin-yang theory (the third division of the Epitome of the Masters) originated from the offices of Xi and He, two among those in charge of divination (the Epitome of Divination and Numbers). By viewing the classification through the three sets of dichotomies above, Liu Xin’s rationale for classifying yin-yang writings becomes abundantly clear. He must have seen the texts in “Theorists of yin-yang” as being philosophical and the rest as technical, i.e., those in “Military yin-yang” as applied specifically to military strategies and those in “The Five Phases” as applied specifically to divination.

Similarly, we may consider mathematics through the same framework. Mathematics appeared only as applied to astronomy, chronology, and harmonics in the class on divination. Its absence from the first three classes suggests its detachment from ethical concerns and reflects its role as only a servant to technical knowledge in early Chinese intellectual development (Sivin 1995). In other words, not including elementary mathematical texts with elementary literacy texts (belonging to the Epitome of the Six Arts) might be related to the idea that mathematics was regarded as not relevant to dao learning but only a tool in qi learning (see below).

5.2. Ranking and Binary Opposition

The common dictionary definition of “dichotomy” usually mentions no preference given to one part or the other in a dichotomy (see OED definition given in Section 5.1). Thus the two parts may simply be different. A circle, for example, can be divided into two equal halves by a straight line down in the middle, one half with the curved side to the left and the other to the right. In real life, or more pointedly in classification, it is often not the case. Classification theorist Henry Evelyn Bliss (1929) defines “dichotomy” as a divide between those that have a distinguishing characteristic and those that do not (151). Depending on the nature of the distinguishing characteristic, one part of the dichotomy may, and often does, become preferred to the other. In the Western tradition, such “binary oppositions” are popular in language and thought (Goody 1977). Each binary opposition comprises two parts that are opposite of each other, one being the preferred (or superior) and the other not preferred (or inferior). Frequently used examples of binary opposition include: self/other, masculine/feminine, present/absent, and inside/outside. The first in each pair is the preferred or superior in traditional Western culture. The opposition between self and other has especially been important in recent years for identifying social processes by which a group of people exclude or marginalize others ( Beauvoir 1953; Said 1978).

In Chinese intellectual history, classicism is particularly recognized for its emphasis on moral hierarchy (Liu JeeLoo 2006). The Seven Epitomes’ introduction to the Rites division in the Epitome of the Classics states “husband/wife, father/son, ruler/subject, top/bottom;” the first in each pair is the dominant or superior. Classicists believed that this type of hierarchy (or ranking) was essential in maintaining social and political order. Throughout the classification of the Seven Epitomes, classicist hierarchical thinking is evident, and it demonstrates characteristics very similar to that of binary opposition in the West. Figure 3 exhibits the same three dichotomies in Figure 2 with added consideration of ranking; so the order of the six main classes is unambiguously top down. In other words, the preferred part is placed above the other in each dichotomy: teachings of the sage kings came before technical skills; the Classics before the non-Classics; and expositions before non-expository writings.

Generations of scholars, especially classicists, maintained that all scholarship should be dichotomized as the learning of dao (the Way or the ultimate truth) and the learning of qi (the vessel or the skills for practical functions). By tradition, the former was always considered superior to the latter. Zuo (2004) cites this ranked dichotomy as the basis of the classification in
If read more closely, the summaries by Liu Xin quoted in the previous section also revealed the rankings within D2. In his words, writings by the masters were fragmented, and the points they each emphasized, though meaningful, were only branches or channels of the knowledge contained in the six Classics. He also made it clear that poetry in the Epitome of Lyrics and Rhapsodies was considered inferior to those in the poetic Classic, the Odes. By speaking of “[m]en of honor … lost among the commoners” (referring to the fact that they lost their official positions at court) and those lost men’s writing of fu (rhapsodies) “to covertly criticize or influence” (emphasis added), Liu Xin unmistakably pointed out this type of poetry’s loss of important political functions at court (Connery 1998). In the same passage, Liu also asserted that the last group of works in the poetry class, including folk songs from various regions, provided useful information about the state of morality among regional commoners—obviously not the same kind of moral expressions made by the legendary kings. The texts in the second part of D2, in Liu’s opinion, were unquestionably inferior to those in the first part.

Within D3, the ranking between the two parts was also straightforward for one reason. The masters’ writings, “obstructed or weak” as they were, still “all have the ability to serve as his [i.e., the enlightened king’s] limbs” in Liu’s words. In contrast, lyrics and rhapsodies had lost their court functions, were merely “beautiful phrases” with moral inferiority, or embodied regional rather than universal values. It is thus apparent that Liu placed this type of poetry below the rank of philosophical and expository works by the masters, for he viewed the former as morally and politically inferior to the latter—an opinion also expressed by later Chinese scholars such as Zhang Xuecheng (1973).

All of these preferences undoubtedly exalted the Classics and classicist values. With the use of ranked dichotomies, Liu Xin was thus able to convey the key message through his classification that classicism was the canonized “self” and the other textual traditions were simply the marginalized “other.” Ranked dichotomies in the Seven Epitomes operated under a presumption: the dominant does not exist without the dominated (or, the dominant and the dominated are interdependent). That is, ranked dichotomies assist us in identifying the preferred or superior and, in the meantime, labeling the rest as the less preferred or inferior. The very approach was taken broadly by the Han government to consolidate its ruling through intellectual control which was a marked departure from the destructive policy advocated previously by some legalists in the Qin dynasty (221-207 B.C.E.) who had many books burned. Over time, it proved to be a more effective means of intellectual control than book burning as the state sanctioned canons and their encompassing values became entrenched in the ranks of the intellectual, social and political elite.
This does not mean, however, that the main classes of the Seven Epitomes were a unique and original creation by Liu Xin or his father Xiang. As suggested, those categories were in the general perception about scholarship at the time. The contribution made by Liu Xin, and possibly Xiang, was his consistent and persistent application of the classicist principle to articulating the classificatory structure through subcategories, introductory texts, and annotations. Namely, Liu Xin accepted an existing categorization of scholarship as the foundation of the classification and enhanced it with a classicist perspective.

5.3. The Last Three Epitomes

Bibliographic scholars have paid only cursory attention to the last three epitomes. In Xu Youfu's (2009) chapter on the Treatise, the review of issues concerning the classification spreads over thirty-four pages and only three of those pages cover the last three classes. Another obstacle particularly hindering better knowledge of the three technical classes is the fact that most works in them were lost long ago—only 2 out of 56 titles in the Epitome of Military Texts (partially; another two are uncertain), 1 out of the 110 titles in the Epitome of Divination and Numbers, and 1 out of the 36 titles in the Epitome of Formulae and Techniques have survived today. A few facts about these three classes are known today. First, the catalog itself clearly associated the writings in the last three epitomes with three types of government offices: military, divinatory, and medical. Second, texts in these epitomes were collated by three specialists: a military officer, a scribe/astrologer, and a physician. With regard to the order of these three epitomes, a general supposition is that military texts appeared before the other two technical classes, because “science” (i.e., topics in the last two classes that might or might not fit the modern definition of science) were considered least important in the Chinese perception of the knowledge universe before the modern era (Yu and Wang 1998). A different scholar claims that frequent military activities during the time contributed to the prioritization of military texts over other technical writings (Xu 2009). To understand these three epitomes and the order among them, an in-depth interrogation of the nature and history of those subjects and the bureaucratic offices during Han and earlier times is needed. This is a quest beyond the scope of this study.

6. Discussion and Conclusions

There is an old Chinese saying “gang ju mu zhang”—pulling up a net by its head rope opens all its meshes in an orderly manner. Often applied in bibliography, it means that upholding a principle will create a discernible (also implying plausible) order in the classified arrangement of a bibliography. This particular thinking in bibliography led to an approach with two requirements: 1) individual texts must be seen as all interrelated (like meshes in a net); and, 2) delineations of interrelationships among texts must be guided by a principle. The Seven Epitomes was the very first bibliographic tool that established such philosophy.

As demonstrated in this analysis, the catalog treated the entire library collection as one net. Its classification was a careful sorting and organization of the interrelationships among individual texts, and the principle guiding the sorting and organization was classicism. Expanding on the single dichotomy theory asserted by others, the study identified three sets of ranked dichotomies, all centering on classicism, as the classificatory basis of the Seven Epitomes. Texts for dao learning, some fragmented or implicit, were separated from and took priority over texts for qi learning (D1). The Classics, believed to have originated from sage kings, took priority over expository writings of the masters and poetic compositions by “lost” noblemen (D2). The expository writings of the masters took priority over poetic compositions (D3). With such philosophy in mind, this classification placed all texts stored in the dynastic library into a meticulously designed net to indicate the proper position of each text in the net and its relationships with other texts. In the mind of the classificationist Liu Xin, the arrangement of the classes and divisions would be abundantly clear and sensible to catalog users who were familiar with the classicist principles.

It needs to be kept in mind that the Seven Epitomes exhibited the dominant worldview of the Han elite in both government and intellectual discourse. The dao-qi dichotomy betrayed such elitism. Additionally, the endowment of moral and intellectual authority upon particular types of written knowledge reserved learning and power exclusively for the literate ruling class. Thus, researchers of Chinese classification must not consider this classification approach as the only one in Chinese culture.

Liu’s scheme is said to have become the model for later bibliographic classifications in the following two thousand years in imperial China. This model dictated the perpetual placement of the “Classics” (or the “Six
In their now famous 1903 essay about “primitive” classification, Durkheim and Mauss (1963) conclude their study by saying that categories and their relations in logical classifications “are represented in the form of familial connections, or as relations of economic or political subordination, so that the same sentiments which are the basis of domestic, social, and other kinds of organization have been effective in this logical division of things also” (85). Our findings seem to echo their theory. The origin of Liu Xin’s classification, however, was a mix of the social/institutional reality of his time, and the idealized polity as conceived by Han classicists through a partisan interpretation of early texts (Lewis 1999). The classification did not arrive at the classificatory structure through an observation of nature or the social world. Instead the scheme resulted from authoritarian, ideological and political thinking with a calculated purpose to shape minds. One can easily dismiss this approach to classifying as a thing in the distant past and in a remote culture. What will be more interesting is to use the insight learned from the study to examine intellectual culture. What will be more interesting is to use the classification in question. Many dimensions and other related issues, some already mentioned, remain in need of investigation. One of the priorities in further research on the Seven Epitomes should be given to the last main classes that have been neglected by Chinese bibliographers and only superficially treated in the current study. Besides a thorough analysis of the nature of the three classes, future inquiries may include questions such as: Do these classes resemble in any way disciplines or fields of learning as perceived today? What factors did Liu Xin consider in determining the order of these three classes? In addition to the three technical classes, there are other aspects of the catalog calling for more study. For example, what were the determining factors in creation and ordering of subclasses? Besides dichotomy and ranking, what other classificatory methods were applied in the scheme? With the design of classes and subclasses, this scheme was obviously hierarchical to some extent. What was the nature of the hierarchies? Finally, how did this sixfold scheme evolve into other schemes? It is hoped that the tradition of Chinese bibliographic classification draws increasing attention from classification theorists internationally and an improved understanding of its features and achievements in turn significantly enhances classification theory.

Appendix

Some Chinese works cited in this article were originally written long ago, but republished recently. To help readers get a better sense of the timeline of these works, the following table provides the names and life spans of those authors whose cited works were first completed or published before 1949:

<table>
<thead>
<tr>
<th>Name</th>
<th>Life Span</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ban Gu 班固</td>
<td>53 B.C.E.-23 C.E.</td>
</tr>
<tr>
<td>Liu Xiang劉向</td>
<td>32-92</td>
</tr>
<tr>
<td>Liu Xin劉歆</td>
<td>32-92</td>
</tr>
<tr>
<td>Liu Yizheng柳诒徵</td>
<td>1880-1956</td>
</tr>
<tr>
<td>Ruan Xiaoxu阮孝緒</td>
<td>479-536</td>
</tr>
<tr>
<td>Wang Guowei 王國維</td>
<td>1877-1927</td>
</tr>
<tr>
<td>Wang Mingsheng王鳴盛</td>
<td>1722-1798</td>
</tr>
<tr>
<td>Yan Shigu 颜師古</td>
<td>581-645</td>
</tr>
<tr>
<td>Yao Mingda姚名達</td>
<td>1905-1942</td>
</tr>
<tr>
<td>Yao Zhenzong姚振宗</td>
<td>1843-1906</td>
</tr>
<tr>
<td>Zhang Xuecheng章學誠</td>
<td>1738-1801</td>
</tr>
</tbody>
</table>

References

Authors of Chinese works are presented with the family name first followed by no comma in pinyin because it is the Chinese custom to place the fam-
ily name before the given name. In the same token, full Chinese names cited in the article also conform to the Chinese custom.


Chen Lai

Chen Guoqing

Chen Lai 陈来

Chen Guoqing 陈国庆


Fu Rongxian 傅榮賢

Fu Rongxian 傅榮賢


Topic Maps from a Knowledge Organization Perspective

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ABSTRACT: This article comprises a literature review and conceptual analysis of Topic Maps—the ISO standard for representing information about the structure of information resources—according to the principles of Knowledge Organization (KO). Using the main principles from this discipline, the study shows how Topic Maps is proposed as an ontology model independent of technology. Topic Maps constitutes a ‘bibliographic’ meta-language able to represent, extend, and integrate almost all existing Knowledge Organization Systems (KOS) in a standards-based generic model applicable to digital content and to the Web. This report also presents an inventory of the current applications of Topic Maps in Libraries, Archives, and Museums (LAM), as well as in the Digital Humanities. Finally, some directions for further research are suggested, which relate Topic Maps to the main research trends in KO.

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1.0 Introduction

Topic Maps is an ISO standard for representing information about the structure of information resources (ISO13250). The origin of Topic Maps dates back to 1991 when the Davenport Group started a project to develop DocBook, which had the purpose of facilitating the exchange of UNIX documentation using SGML/XML. A byproduct of this work was Topic Maps, a model and syntax (XTM) whose original purpose was to enable the merging of back-of-book indexes of various systems of computer documentation. The creator of Topic Maps, Steven Newcomb, believed that back-of-book indexes are actually a rendition of an underlying structure that could be represented explicitly and merged on a single superstructure over the documents. The initial model was consolidated and became an ISO standard in the year 2000. It immediately proved applicable to other domains, such as Information Architecture and Web publishing. It is also considered to be one of the few mechanisms that facilitate semantic integration and structuring information on the Web.

Nowadays, Topic Maps is used in a variety of fields and for a variety of purposes. Garshol (2007) summarizes them as, including but not limited to, Semantic Portals, eLearning, Business Process Modelling, Product Configuration, Information Integration, Metadata Management, Business Rules Management, IT Asset Management, and Asset Management (Manufacturing). In the United States of America, Topic Maps has been used by the Internal Revenue Service (IRS) of the Department of the Treasury (the “tax map”), the DOE (Department of Energy), and Lexis-Nexis and in different E-Gov proceedings (Newcomb and Biezunski 2003). In Europe, it has mainly been used in
the public sector, although it has also been used in pharmaceuticals, automobiles, and publishing (Newcomb and Biezenski 2003). Its use is widespread in Germany and even more so in Norway. In Norway, there are numerous small and large scale projects using Topic Maps, including: "forskning.no" (the Norwegian government portal to popular science and research information), "Kulturnett.no" (the Norwegian public sector portal to cultural information), "Bergen Kommune" (the city of Bergen citizen portal), "Apollon" (University of Oslo research magazine), and "NRK/Skole" (a curriculum-based browsing).

Given that its original purpose was to create a model to integrate back-of-book indexes, Topic Maps seems to be a development aligned within the principles of KO. However, its relatively new appearance and its origins in the SGML community, (document description languages from the point of view of computer scientists) suggest a need for reviewing the literature which addresses the relationship between Topic Maps and KO. In addition, it would be helpful to understand the Topic Maps principles and also review its applications from a KO perspective, because almost ten years have passed since the first appearance of Topic Maps in KO literature.

2.0 Previous Research

The Topic Maps community has already tried to align the principles of its model with those of KO. The best example of this is exemplified in a study done by Garshol (2004), which describes Topic Maps in relation to what he refers to as the “techniques from library science” in considering its potential application to Web site design. This work examines the relation of Topic Maps to indexing languages, authority files, and metadata schemas, concluding that Topic Maps can not only represent, but extend all these systems.

In KO literature, Topic Maps appeared around 1999, with an article that has been, until now, the only one about Topic Maps published in the Knowledge Organization journal (Sigel 1999). In 2000, the XML Europe conference in Paris, France, brought together many different groups interested in Topic Maps and initiated its widespread use in the LIS and KO communities (Stringer-Hye 2005, Sigel 2003). A paper published in that conference is “Towards Knowledge Organization with Topic Maps” (Sigel 2000), one of the first articles found in the literature exploring the relation of Topic Maps with knowledge organization. In 2007, Topic Maps was mentioned for the first time in the Annual Review of Information Science & Technology, as part of a section on “ontologies on the Semantic Web” (Cronin 2007, 430).

The main conclusion from the KO perspective seems to be, according to Sigel (2003, 425), that Topic Maps is “a new enabling technology for KO.” Sigel states that Topic Maps offers new possibilities for the enhancement of information organization and, more specifically, for semantic integration of heterogeneous systems and information sources. It also allows flexible indexing views, scope filtering, and ontology-based modeling in KO. But Siegel also points out that KO can contribute to Topic Maps by bringing extensive expertise, solid principles, and tested methods to help solve the problems of organizing knowledge which arise in the Topic Maps’ design.

In addition, the Korean professor Sam Oh has suggested numerous ideas on how to apply Topic Maps to the different models and schemas currently in use and under discussion in the LIS community: Functional Requirements for Bibliographic Records (FRBR), Resource Description and Access (RDA), Simple Knowledge Organization System (SKOS), and Dublin Core (Oh 2008b, Oh 2008c). Iglesias and Stringer-Hye (2008) studied the applications of Topic Maps to Integrated Library Systems (ILS); they observed that, in this area, Topic Maps is still an ‘undelivered promise,’ because, even though the possibility of implementation exists, there have not been any vendors implementing the model in their products. In terms of usability studies, Yi (2008, 1902) observed that of the few studies that have been done, most have employed RDF instead of Topic Maps. Oh (2008a), Dalmau and Walsh (2007), and Bockman (2006; 2007) refer to having done usability studies using Topic Maps-based systems, and showed generally positive results in their use.

Finally, regarding the comparison of Topic Maps with other KOS, Kongsbak (2004) made a detailed study of the similarities and differences between Topic Maps and thesauri, both from a theoretical and a practical perspective. The study analyzed each model from different angles (background, purpose, structure, relationships, linguistic treatment, and standards) and concluded, among other things, that thesauri and Topic Maps cannot be compared directly because of the distinct nature of each model.

3.0 Methodology

This study tried to answer two questions: What has been said, conceptually speaking, on the relation between Topic Maps and KO?, and what are the existing applications of Topic Maps to the Libraries, Ar-
chives, and Museums (LAM) field, as well as to Digital libraries in the Humanities?

For this purpose, an extensive literature review was done using the following sources:

**Databases**: EBSCO – Academic Search Premiere, Library Information Science Technology Abstracts (LISTA) –, EMERALD, the Web of Science, and the Library and Information Science Abstracts (LISA).

**Conference proceedings and presentations**: Conference on Topic Maps Research (TMRA) and the Topic Maps Conference.

**The main websites of the Topic Maps community**: Topicmaps.org, Topicmaps.com, Coolheads.com, Techquila.com, Infoloom, Versavant, Ontopia, Ontopedia, Networked Planet, and Topicmapslab.de.

**Representative websites of the LIS and KO communities**: The Online Computer Library Center (OCLC), the American Library Association (ALA), Dublin Core, The International Federation of Library Associations and Institutions (IFLA), the Digital Library Federation, the DELOS Network of Excellence on Digital Libraries, and “Lifeboat for Knowledge Organization” by Birger Hjørland.

**Mailing lists**: Topic Maps mailing list, Topic Maps in LIS mailing list, Next Generation of Library Catalogs (NGC4LIB), and the Digital Libraries Research mailing list (DIGLIB).

**Blogs**: Alexander Sigel, Lars Marius Garshol, and Alexander Johannensen.

**Books**: Park and Hunting (2003), Passin (2004), and the Annual Review of Information Science and Technology (ARIST).

Within the LIS or KO sources, the words “Topic Maps,” “topic map,” and “ISO 13250” were employed in the searches. For searching the sources from the Topic Maps community, since its terminology is not consistent, common expressions were used such as “library techniques” and “information organization techniques,” as well as more generic terms like “library,” “archive[s],” “museum[s],” “humanities,” and “digital library” or “digital libraries.” The documents selected were those that dealt with the relation of Topic Maps and LIS and KO; all the documents retrieved that fulfilled this criterion were reviewed.

To analyze these sources a technique applied in the Grounded Theory (GT) approach was used. For Corbin and Strauss (2008, viii) GT means “building theory grounded in data.” Pickard (2007), however, makes the distinction between GT as a method of qualitative research and as a qualitative data analysis technique. In this literature review, GT was used in the latter sense mentioned by Pickard and not for building theory from the data. The data analysis technique utilized in this study consisted of coding and annotating selected sources in order to observe the emerging categories. The codes were then grouped into families, which resulted in the main concerns on the application and relation of Topic Maps to LIS and KO. This also provided direction in choosing which conceptual framework to use for the conceptual analysis, which, in this case, was Information Organization (from the work by Elaine Svenonius, cited by the Topic Maps Community) (see section 5.1.2). After identifying the preliminary categories, some additional and more specific searches were carried out, using, among others, terms such as “Dublin Core,” “MARC,” “FRBR,” and “FRBRization.” Finally, to complement and discuss some of the topics, unstructured interviews were conducted with three select people who had worked on the applications of Topic Maps to LIS: Prof. Sam Oh, Suellen Stringer-Hye, and Aki Kivelä. There were around sixty documents included in this literature review, including journal articles, conference presentations and papers, student reports and theses, some blog and mailing lists’ posts, as well as a book chapter.

4.0 Conceptual Framework

4.1 Topic Maps


**Basic concepts.** The basic conceptual building blocks of topic maps are topics, associations and occurrences. The model they belong to has been referred to as the TAO of Topic Maps (Pepper 2000 rev. 2002).

**Topics and subjects.** The Topic Maps’ concept of a subject is anything (physical or abstract, real or fictional) that the author of the topic map wishes to make assertions about, i.e., assign a name, a property, or a role in some relationship with another subject. The subject is defined in ISO/IEC
13250-2:2006 (the Topic Maps Data Model) as follows (8):

A subject can be anything whatsoever, regardless of whether it exists or has any other specific characteristics, about which anything whatsoever may be asserted by any means whatsoever.

A topic is the symbol or surrogate that represents the subject within a topic map. Topics are informally referred to as the “proxies” of subjects in a computer domain (Pepper 2010). By definition, every topic represents a single subject. The goal of any Topic Maps application (often referred to as the “collocation objective”) is to ensure that every subject is represented by one and only one topic. All constructs in a topic map (topic, association, association role, occurrence, or name) can be typed. All such types are also topics, called informally typing topics. This set of typing topics that is used within a topic map is what defines its ontology (Pepper 2010).

Identity. In order to achieve the collocation objective, Topic Maps encourages the use of explicit identifiers rather than names. Identifiers usually take the form of URIs (Uniform Resource Identifiers). These can either be subject identifiers or subject locators, and they are the basis for merging, a capability which is often described as the most powerful feature of Topic Maps.

Subject locators are URIs that identify subjects that are “network addressable information resources” and that have a location (an address) in an information system. The network addresses of such subjects can be used to identify them directly.

A subject identifier is a URI that identifies an arbitrary subject that may or may not have a location in an information system. It identifies its subject indirectly via a subject indicator (sometimes called a subject descriptor).

A subject indicator is simply a human-readable resource (i.e., document) to which a subject identifier resolves, and which is intended to convey the identity of the subject to a human being. As the Topic Maps Data Model (TMDM) defines it, a subject indicator is an “information resource that is referred to from a topic map in an attempt to unambiguously identify the subject represented by a topic to a human being.” Figure 1 exemplifies this ‘indirect identification’.
Subject identifiers and indicators (or descriptors) can be “published,” in other words, made available, for use outside the scope of a specific application in order to achieve wider interoperability. They are then known as published subject identifiers (PSIs) and published subject indicators, respectively, or collectively as published subjects (Pepper 2010).

Names. Topic names are properties that have naming semantics. A topic can have multiple names, each of which consists of a base name and zero or more variant names. Each name is typed (i.e., assigned a name type) and may also be scoped. A base name is the base form of a name, an alphanumeric string used as its default label.

Variant names are the alternative forms of base names that are optimized for particular computational purposes, such as sorting or display. The main examples cited of uses for variant names are sort key, plural forms, pronunciation, common misspellings/alternative spellings, and alternative orthographies.

Occurrences. Occurrences relate topics to relevant information resources that describe them. According to Pepper (2010), the resource in question may be very small, such as a string representing a date. In this case, the resource is normally included in the topic map and known as an “internal occurrence.” Or else it may be stored externally, because of its size, notation, provenance, or an additional characteristic, and referenced via a locator – normally a URL—which corresponds to a page number in a back-of-book index (which is, itself, a locator for any piece of information relevant to the subject in question).

Associations and roles. Associations express relationships between subjects by relating one topic to (zero or more) other topics. They were originally meant to represent the “See also” references that appeared in back-of-book indexes.

Each topic that participates in an association is said to play a role in the relationship that is expressed by the association. The nature of the subject’s involvement in a particular relation is expressed using a role type, e.g., Puccini plays the role of pupil in the teacher/pupil relationship with Ponchielli. This mechanism obviates the need for associations to have a specific direction, and all associations are therefore inherently multidirectional.

Scope is a set of topics that is used to qualify a statement (i.e., a name, occurrence, or association) with the purpose of indicating the context in which a certain assertion may be considered valid. If no scope is explicitly specified, the scope is said to be “unconstrained.” Topics that are used for scoping are informally referred to as “scoping topics.”

Merging is a process or operation and as such is different from the previous elements, which are constructs in the Topic Maps model. Merging can take place both within a single topic map (to eliminate redundancy) and when combining two or more topic maps. This process lies at the core of the Topic Maps view, and can be traced back to the original motivation (merging indexes) that gave rise to the model. While merging is an operation performed by an application, its procedures are strictly defined in the standard, and it is based on the concept of identity described above.

Reification is the process of instantiating as a topic some Topic Map construct (a name, occurrence, association, role, or even the topic map itself) that, itself, is not a topic. Once this is done, whatever is represented by the construct in question becomes a subject in its own right, about which statements can be made. Reification is most often used to assign metadata to a topic map.

Figure 2 exemplifies some of the previously outlined Topic Maps concepts.

4.2 Knowledge and information organization

Within the LIS community, there are two disciplines that have to do with organizing information: Information Organization and Knowledge Organization (KO). They come from different traditions and are usually referred to as Knowledge and Information Organization. In this study, the term Knowledge Organization (KO) is used to refer to both disciplines. However, Information Organization is taken into account separately because its conceptualization of the elements of bibliographic languages is used to analyze Topic Maps (section 5.1.2).

Information Organization originated in the tradition of Anglo-American descriptive and subject cataloging. Svenonius (2000, 53), which is repeatedly cited by Topic Maps communities, synthesizes the main principles of this discipline. Information Organization, she suggests, is a body of knowledge with principles, objectives, and techniques that employ the use of a specific “special-purpose” language to describe the information and its physical embodiments with the idea of accessing both. The languages used for that purpose are called “bibliographic languages,” as opposed to “natural languages.” In a later work, Svenonius (2004) changes the word “bibliographic languages” to “retrieval languages,” preserving the
same interpretation of these languages as artificial languages, a subset of natural language, designed for the specific purpose of embodying knowledge representations.

According to Svenonius (2000, 31), the purpose of a bibliographic language is to describe “bibliographic entities,” which are basically “works, editions, authors, and subjects” divided into two realms. The first realm, described by what she calls “work languages,” is that of “information” and is equivalent to “the content of a message.” The second realm, described by what she calls “document languages,” is that of “information entities,” or the physical embodiments of the former.

The components of a bibliographic language (as well as a natural language) are its vocabulary, semantics, syntax, and pragmatics. The vocabulary of bibliographic languages refers to the expressions used to name the values of three variables: entities, attributes, and relationships (in other words, the terms or codes of the bibliographic languages that are available for use (Svenonius 2000, 55). For example, the descriptors in a thesaurus and also the acronyms (BT, NT, RT, USE, UF) are elements of the vocabulary of bibliographic languages.

The semantics, in Svenonius’ terms, refers to the “different meaning structures found in languages” (2000, 56). She identifies three of these structures, relational semantics, referential semantics, and category semantics. Relational semantics refers to the meaning of relationships between terms, i.e., the types of associations established in a thesaurus. Referential semantics covers the “techniques used to limit the meanings or referents of terms”, i.e., the use of disambiguators (57). Category semantics, “has to do with the facets or grammatical categories into which the vocabulary is partitioned” (57) to indicate that the terms that belong to them have the same or similar type of referents. The syntax is the system of rules that indicate how to structure the terms in a bibliographic language, due to its artificiality (for example, term-string composition and citation order).

Pragmatics deal with the use or application of the language with the “rules for making descriptions” (58). An example of this is the cataloging or indexing procedures that specify which elements should or should not be included in a description, when to create a new element, and how many elements to include in a description (indexing depth). From a KO perspective, this would correspond to Knowledge Organization Processes (KOP).

Besides the elements of bibliographic languages, Svenonius describes the bibliographic objectives, those objectives that the bibliographic systems need to pursue: finding, collocating, navigating, choice, and acquisition.

Knowledge Organization (KO) comes from a long tradition derived from Information Science, a discipline with which Topic Maps shares common theoretical principles (Colmenero 2005, 78). For the purpose of this work, KO is considered to be what Hjørland (2008, 1) defined as the narrow meaning of the term, that is the:

activities such as document description, indexing and classification performed in libraries, bibliographical databases, archives and other kinds of ‘memory intuitions’ by librarians, archivists, information specialists, subject specialists, as well as by computer algorithms and laymen.
These activities are accomplished through the use of "knowledge organization systems (KOS)" (Hjørland 2008, 86). The term KOS was coined by the Networked Knowledge Organization Systems Working Group (NKOS) in 1998. A KOS is thought to be a tool for vocabulary control, a term sometimes even used as a synonym of KOS (Leise, Fast, and Steckel 2003). KOS systematize or arrange knowledge structures according to certain organizing principles. Topic Maps has been considered as a KOS or as an evolution of them, which will be discussed later in section 5.1.3.

5.0 Findings

5.1 Topic Maps principles from a knowledge organization perspective

5.1.1 The concepts of topic maps and knowledge organization

Even though the terminologies differ, Topic Maps' concepts seem to relate to various KO concepts. Sigel (2006a) and Hjørland (2006) equated a few of the main concepts of Topic Maps to existing concepts in KO, for instance topics to "concepts," associations to "relations," and occurrences to "information resources" or "documents." However, on closer examination, these are not completely equivalent. For example, depending on how the term "concept" is understood in the KO community, it would or would not equate to that of topic. In a topic map things which are not concepts, like a person’s name, a date, an entire paragraph, or even a full text, can become a topic.

In addition, it would be inappropriate to equate occurrences and "information resources" as they are only equal in the case of external occurrences. This is due to the fact that an information resource or a document has different meanings for the Topic Maps and KO communities respectively. In a topic map, an occurrence is actually a relationship between an information resource and a topic; the information resource can be either an externally stored document or a string (or another data value) stored internally in the topic map. In a topic map, all occurrences are considered as information resources, whereas, from a bibliographic perspective, only external occurrences would be considered as information resources (in the KO sense of "documents"). An exception would be the case of an internal occurrence, which contains a full text.

Even more than the concept of information resource or document, the concept of subject and the mechanisms used to identify subjects are central to the Topic Maps model. This approach is referred to as "subject centric" by the Topic Maps communities. They consider it to be in opposition to the "document centric" view, which is represented by the LIS community and, in some ways, the Semantic Web (W3C) RDF. The different focus on traditional documents (i.e., articles, books) by the Topic Maps communities and the problems of direct and indirect identification (explained in section 4.1 and discussed further in section 6) are two aspects of the Topic Maps model that make it unique in its approach to KO.

When a document (in the sense of a bibliographic entity) is an object of description, it is regarded in Topic Maps as a subject, as any other entity in real or possible worlds. In a topic map, a "subject" (as a property, for example, "History") can also exist. However, it would be expressed as an occurrence of another topic (the document in this case), or as a topic on its own which itself can then be the object of description (if it is defined as a topic and not as an internal occurrence). Thus, in a topic map, subjects and documents (from the KO perspective) coexist at the same representation level.

There are additional comparisons which have been made between Topic Maps and KO concepts which have not been analyzed here. For instance, it has been suggested that topic types are the same as "categories," and occurrence types are the same as "document types" (Hjørland 2006, Hjørland 2008). Moreover, the term facet conflicts in its original use in Topic Maps with its use in "faceted classification" in the KO realm (as noticed by Hjørland 2006 and Pepper et al. 2000), but neither the term nor the concept is part of the latest version of the ISO standard. Another difference in jargon was noted by Hjørland (2006), who found that the term theme has a completely different meaning in the Topic Maps terminology than in KO terminology. In Topic Maps, the term theme was used to denote a member of the set of topics used to specify a scope; however, the term was jettisoned in recent versions of the standard, in favor of scoping topic.

5.1.2 Topic Maps and the Elements of Bibliographic Languages

Several characteristics of Topic Maps can be explained using the components of bibliographic languages – vocabulary, syntax, semantics and pragmatics – which were conceptualized by Svenonius (see 4.2.):
Vocabulary. The authorized forms of terms in bibliographic languages have been the central element upon which all the systems in the KO tradition are built. Topic Maps, on the other hand, doesn't specify any terms or vocabulary; that task is left to the topic map author. The reason for this flexibility is that Topic Maps doesn't use names, but emphasizes the use of entity identification.

It is for this reason that Topic Maps characterizes itself as “concept-centric”; it is focused on anything “signified” and the entity identification rather than on the normalization of names. However, if we think about how to make common use of the same identifiers for the purpose of interoperability, or how to attach all the variant names to the identified subject, we see that the nature of the problem of identity is similar in both KO and Topic Maps: one term per concept = one topic per subject = one URI per “proxy.” The problem seems to be not how to say that these are identical (a term string or a URI) but knowing when they are identical; it is a problem of semantics. From a Topic Maps perspective, the model provides some features for allowing semantic identification. Knowing when two subjects should have the same subject identifier would be given by the use of subject indicators.

Subject indicators are meant to aid in the negotiation of meaning (when they are shared in the form of PSIs). They are intended to be read by humans (as opposed to the subject identifiers, which are meant to be interpreted by computers). Subject indicators give humans evidence of the meaning that will allow them to “unambiguously identify the subject represented by a topic” (ISO/IEC 13250-2). From the bibliographic languages perspective, this identification principle isn’t new. For instance, scope notes in the thesauri, definition notes, and the other five types of notes in DDC are intended to serve the same function (Batley 2005, 35). Their purpose is to provide information about the identity or the meaning of concepts to allow the user of a bibliographic language to select the appropriate term (or, in Topic Maps terms, to aid the topic map author in selecting an appropriate subject identifier for a topic).

However--and this could be applied further on--the major difference between Topic Maps and bibliographic languages is that Topic Maps provides a standardized model and interchange syntax for addressing the issue of identity and meaning in a digital environment and on a global scale. These characteristics are not, however, exclusive to Topic Maps; RDF also provides the means for these purposes. A comprehensive comparison of RDF and Topic Maps is not made in this article, but some general issues are pointed out in the discussion part.

The so-called “term-based” mechanism of bibliographic languages is limited and inadequate for our times, because a single name or form of a name is given more importance, and this results in the passive use of ‘authorized’ forms. Technologies like RDF and Topic Maps that use identification for Web-sharing based on the URIs, need unambiguous identifiers to interoperate and be shared. For that purpose, in order to achieve the goal of common sets of subject identifiers that would make merging possible, the Topic Maps community has presented different points of view, approaches, and implementations. One example is the distributed identity management service Subj3ct (www.subj3ct.com).

Syntax. It is important to notice that the meaning of the term “syntax” from the perspective of “bibliographic languages” is different than that of the Topic Maps community. In the Topic Maps community, “syntax” refers to the interchange format of the topic maps, i.e., XTM. The traditional cataloging rules provide guidelines for such vocabulary constructions. The AACR2, ISBD, ISAAR (CPF), the ALA and Library of Congress Filing Rules, the ISO, and ANSI/NISO standard for thesaurus construction are a few examples. On the contrary, Topic Maps specifies neither vocabulary nor “syntax” in the sense used by Svenonius. Some “rules of thumb” have been developed in order to accommodate the need to agree on base name forms (for sorting and displaying purposes). Among the many features related to the construction of the ontology, the Topic Maps Constraint Language (TMCL) formalizes a number of these aspects by specifying which data types and forms of names are valid. For example, TMCL rules state that “Topics of type person must have two explicit names, the full name and a nickname,” but they don’t go to the same level of detail in specifying the exact form of the nickname or the full name. Even though the need for complex syntaxes is reduced with the use of Topic Maps elements, this is one of the areas where Topic Maps could benefit from KO and bibliographic languages expertise and history of building vocabularies. Not to mention, Topic Maps could serve as a potential experiment in current research in KO on how to use the existing syntax of bibliographic languages to create facets from subject headings or UDC notations.

Referential semantics. Bibliographic languages have primarily used disambiguation techniques for
clarifying the meaning of identical terms. Svenonius (2000, 148) reports that some of the methods in use are: domain specification, qualifiers, notes, and hierarchy. According to Garshol (2004), disambiguation in Topic Maps "is not necessary, because the types, occurrences, and associations of the topics will generally give enough information to distinguish them" (385). For example, in the case in which two topics have the same name (for example, "Paris"), the most common way to disambiguate (as natural languages do), would be its category (topic type): "Paris (city)," "Paris (god)." If it is the case that there are two cities with the name "Paris," a third step in disambiguating would be the association type "located in": Paris (city-France), Paris (city-United States). If there are two cities in France with the name "Paris," an occurrence type could be used as a third disambiguator, and so on. However, the difference in the mechanism used by Topic Maps and bibliographic languages to provide qualifiers is that, in bibliographic languages, they are part of the name string [as it is, for example, in the names of author names that have an added date of birth as qualifier or in the case of the General Material Designations (GMD)]. In Topic Maps, the different blocks correspond to different elements of the model (topic type, association type, occurrences) and can be automatically displayed when they correspond to the same string in the base name. Scope is used as well, as in the example showed above, to add specify the context and validity of the assertions when the three mentioned elements are not enough.

Category semantics. Examples of this type of semantics are: personal names and corporate names (in authority lists); classes, facets, subfacets (arrays), and foci (in analytico-synthetic languages); topic, place, time, and form (in alphabetic languages such as LCSH); and top term –TT– (in thesauri). In document languages like Dublin Core (DC), category semantics correspond to the “classes,” such as an agent (for person, organization, and software agent) or a bibliographic resource (for book, article, or other documentary resource). The potential use of the categories employed in bibliographic languages would make it possible to eventually indicate one part of its ontology (the typing topics) in a topic map, or, in other cases, indicate the types of relational structures to be modeled through association types.

In considering a particular element of category semantics, the typing topic or association type depends on whether or not it belongs to a genus-
comes from its subject-centric view. In traditional KOP, the center is the document, which is described through the use of a set of “properties” that come from a controlled vocabulary, as well as from the item itself (assigned terms). The subject-centric view of Topic Maps implies a change in those processes, from starting the process of cataloging based on the “item at hand” (as recommended by the AACR2) to starting with the “subject at hand;” from cataloging physical embodiments of information to describing “works” and concepts. This seems to suggest a collaborative perspective through the establishment of global mechanisms for the use of published identifiers, such as for works. Sigel (2000, 10) noticed that the characteristics of Topic Maps represent important possibilities for the decentralized creation and exchange of metadata (enhanced with mechanisms such as scope). This would present a challenge to “redesigning” KO methodologies for “collaborative knowledge building activities on distributed resources.”

5.1.3 Topic maps and ontologies: topic maps as a bibliographic meta-language

Because of its capacity to express any relational semantics, Topic Maps has been referred to in a variety of ways. Among the many names it has been given, it has been called a “metadata format” (Walsh and Dalmau 2006), a “metamodel” (Kaminsky 2002, 83), a “metadata model” (Johannesen 2006), “both a conceptual model and an XML exchange format” (Johannesen and Pearce 2004), an “ontology framework for information retrieval” (Garshol 2004), and simply “a framework” (Johannesen 2007); in 1999 Topic Maps was included in a conference called “Metastructures.”

One of the creators of the model even referred to it as a “neutral envelope[s], hospitable to any existing or future schema for knowledge representation” (Newcomb and Biezunski 2003, 3). Johannesen (2006) agrees with this and says that “you can do any classification scheme and structure inside Topic Maps.” Ahmed (2003), also in line with this idea, proposed the use of “design patterns” (a term used in Computer Science) to represent bibliographic languages and KOS. These design patterns would be based on the generalizations that can be made about solutions that are recurrent in the topic maps design of KOS.

The main reason that explains this fact is that Topic Maps, as said before, is not name-based; in other words, any type of relational semantics can be expressed. This need to make the nature of the relationships explicit is a tendency that emerged with the development of terminological ontologies, and is well known in the KO community (Fischer 1998, Sigel 2006b). Figure 4 shows a familiar taxonomy of KOS, in which Topic Maps is placed, according to the described view, at the top of the semantic ladder, together with other models that express ontologies, such as RDF:

![Figure 4. Topic Maps as an ontology model for KOSs. The original figure from: Zeng, M. L. (2008). Topic Maps and RDF in red added by the author of this article.](image-url)
According to this figure, Topic Maps from a KO perspective, could be defined as an ontology model for KOS, and/or as a bibliographic meta-language.

Auillans et al. (2002) have actually defined Topic Maps as “a meta-language for structuring meta-data” (70). However, this seems to be a partial view, given that, in Topic Maps, not only metadata schemes (or document languages) can be represented, but rather, all existing KOS (and work languages) can be represented. There are already efforts being made within the Topic Maps community to represent the existing KOS, for instance, to represent thesauri (Ahmed 2003), to represent faceted classification (Garshol 2004), and to represent hierarchies (Ahmed 2003). Topic Maps can also represent synonym rings and taxonomies (Garshol 2004).

All KOS seem to be built on the relational semantics between terms (equivalence, hierarchical, near-relatedness) as well as on relational structures (term list, synonym ring, taxonomy, faceted structure, thesaurus structure and, in metadata schemas, the property-value structure). Basically, those three types of relational semantics can be expressed in Topic Maps with the use of association types and topic types. Topics and topic names and the relational structures can be expressed through a certain combination of association types and topic types.

Finally, Topic Maps can also be used to represent codified texts, given it was originally designed to merge back-of-book indexes, as in the case of the TEI documents (which will be addressed shortly). In addition, as mentioned previously, metadata schemas or “document languages” (such as Dublin Core) can also be represented with Topic Maps. For instance, Pepper (2008a) and ISO/IEC DTR 29111: 2007 present proposals for expressing Dublin Core using Topic Maps. Lee et al. (2006) also proposed MARCXTM, an XTM way to model MARC21 bibliographic elements. That said, however, the difficulty in representing these document languages is the lack of categories or conceptual structures, which could be provided by FRBR or the CIDOC/CRM conceptual models and can also be represented with Topic Maps.

The most obvious conclusion derived from these facts is that Topic Maps facilitates the creation of a model to bring existing structures in KOS and document languages one step further in their abstraction level and, mostly, to integrate them all. Because of this, Topic Maps is known as a language for expressing ontologies, as “an ontology framework for information retrieval” (Garshol 2004, 378), and as a standard for representing ontologies (Pharo 2008).

The term “ontology” is used in Knowledge Representation (KR), Computer Science and LIS with different meanings, which could be explained by the degree of formalization, their scope and purpose. In KR, ontologies are (Sowa 2000, 492 emphasis added):

the categories of things that exist or may exist in some domain ... a catalog of the types of things that are assumed to exist in a domain of interest D from the perspective of a person who uses a language L for the purpose of talking about D.

This definition is in accordance with that which is commonly agreed upon in Topic Maps literature; ontology is defined as the kinds of topics, occurrences, and associations that constitute a topic map (Pepper 2000 rev. 2002). When Topic Maps function as a bibliographic meta-language, the term “ontology” would then refer to the “kinds of things” present in the bibliographic realm, i.e., the entities, attributes, and relations that are defined in the conceptual frameworks of metadata schemas and in the semantic structures of the special KOS.

With respect to semantic networks, Topic Maps, sometimes confused with the term “concept map,” also involves knowledge representation formalisms or the ways to represent knowledge graphically: mind maps, conceptual graphs, concept maps, semantic networks, etc. The main difference between semantic networks and Topic Maps, as explained by Pepper (2000 rev. 2002), is that Topic Maps adds the topic/occurrence axis to the topic/association model. It is important to add that, like semantic networks, topic maps relate to knowledge representation formalisms, but, unlike semantic networks, they incorporate the ability to search.

In summary, Topic Maps is one of the possible models to represent ontologies, in which everything (a property, a value, a name, a note, a subject entry, a document, etc.) is able to be represented as a topic and can become an “object” of description by itself. This links KO with KR and Computer Science, as well as with digital and Web technologies. But the fact that Topic Maps is a model of KR makes it independent of any specific technology and also, in principle, able to be transmitted, reused and shared across space and over time.
5.2 Applications of topic maps to the libraries, archives and museums (LAM) and to the digital humanities

Topic Maps has been applied for a variety of purposes in the LAM field, mainly for digital libraries in the Humanities, integration and FRBRization of library catalogs, web publishing, content delivery, and other small applications for specific purposes, which are briefly covered below:

Enhancement of existing KOS. The first obvious application is the enhancement of existing KOS, which involves their integration and migration to digital environments and to the Web, by using the current standards and syntaxes to be machine-understandable. Colmenero (2005) found this adaptation to be one of the main uses of Topic Maps (78). For instance, thesauri applications are already making it possible to export them as XTM files. Tools like “Tema Tres” have been developed in Argentina for the creation of thesauri. Leuenberger et al. (2006) also used a topic map in the “Living Memory” project, a cooperative effort of various institutions in Germany to give access to visual resources in different media. The original idea was to document a big scale urban planning project. The topic map served both to design a specific thesaurus for the application, which was based on the Getty Art and Architecture Thesaurus, as well as design the navigation and searching tools for the user. All that said, in a key text on how to migrate existing KOS to ontologies expressed with semantic web technologies (RDF, OWL, Topic Maps), Sigel (2006b) points out the still limited use of the enhancement of semantic tools.

Navigation of TEI encoded full-text collections: This seems to be the most fruitful application field of Topic Maps to date. The main examples in this area are The New Zealand Electronic Text Centre (NZETC) of the University of Wellington, Australia and the Swinburne Project. The NZETC was recognized as the most successful application of Topic Maps to digital libraries in cultural domains at the Topic Maps Users Conference in Oslo in 2008. This project makes use of Topic Maps as a tool for presenting TEI-encoded texts given the limitations of HTML in presenting information that is highly structured (Tuohy 2007). In 2005, Indiana University professors, John A. Walsh (a researcher in the areas of Digital Humanities and Digital Libraries) and Michele Dalmau (a Usability librarian) created The Swinburne project, a topic map-based digital collection devoted to the life and work of Victorian poet Algernon Charles Swinburne (Walsh and Dalmau 2006).

Digital libraries. The Finnish National Gallery (FNG), the largest art museum organization in Finland, developed its digital library through the use of Wandora (a general purpose knowledge extraction, management, and publishing application based on Topic Maps and Java). It was developed in 2000 at Grip Studios Interactive, with the idea of applying Topic Maps to museum collections in Finland. It is a free and open source tool, which, since then, has been successfully used in Finland for projects at the FNG and in other areas (Kivelä and Lyytinen 2007). Topic Maps has also been considered one of the fundamental elements of digital library architecture, to provide the association of Structured Digital Objects (SDOs) with information resources that can be located in existing digital libraries or in a global digital library, as proposed by Li and Ishizuka (2004).

FRBRization of library catalogs: Since FRBR is a conceptual model, in other words, an abstract specification of conceptual structures, there is a need for its specific implementation through a data model and technology. For this purpose, MARC bibliographic records are converted into FRBR by creating the association between the entities (there have been several efforts to do this conversion, one of them was the algorithm released by OCLC). This FRBRized MARC is formalized into an ontology, using Topic Maps or W3C OWL (Aalberg 2005). This has been the main use of Topic Maps to Integrated Library Systems (ILS) reported in literature (Aalberg 2005; Aalberg, Haugen, and Husby 2006; Oh 2008a, b, and c) with respect to conceptual models in LIS. These ideas of FRBRizing library catalogs through Topic Maps appear to date back to 2002, as suggested by Sigel (2004), who reports on the visions of Art Rhyno and the “PHYTEAS project” of Topic Maps as a suitable model to implement the FRBR associations. Other conceptual models, such as CIDOC/CRM, are also possible to model with Topic Maps, as was done by Kivelä and Lyytinen (2007) in the creation of a topic map for the Finnish National Gallery. Norrish and Stevenson (2008); Tuohy (2005, 2007); and Stevenson, Tuohy, and Norrish (2008) have also mentioned using Topic Maps for this purpose.

Integration of library catalogs and records: Topic Maps is considered to be a model that can be used for mapping different metadata schemas at different levels. In this way, it facilitates the integration of different information systems, which allows users to perform federated searches or browse different and dis-
parate types of materials and vocabularies using a single system. Lourdi, Papatheodorou, and Nikolaidou (2007) used it in the Department of Greek Literature at the University of Athens in Greece, where each metadata element belonging to different schemas was converted into a topic, and associations were used to link the different elements between diverse schemas. Pharo (2008); Böckman (2006, 2007); Norrish and Stevenson (2008); Stevenson, Tuohy, and Norrish (2008); Laursen and Henriksen (2006); and Farquhar and Bandholdtz (2003) report on similar approaches.

Kivelä and Lyytinen (2007) have developed the possibility of doing mashups when integrating different sources, to combine information from different sources, including third party topic maps.

**Linguistic interoperability:** Lixin, Zhang, and Wang (2008) report on this capability of Topic Maps, which provides the mechanisms for creating a cross-language information retrieval model (Cross Language Information Retrieval -CLIR) for digital library systems. Schmitz-Esser and Sigel (2006) sketched the first ideas on how to represent ICLO (an Integrative Cross-Language Ontology) concepts and semantic relations with Topic Maps.

**Subject guides and pathways:** Tramullas and Garrido (2006) did a study of university libraries in Spain to develop an application for the creation of subject portals or pathways called Potnia which used Topic Maps together with RDF and Dublin Core. One particular library service based on library catalogs is the elaboration of subject guides. This has been considered by Iglesias and Stringer-Hye (2008) to be "the most visible and widespread evidence that topic maps are indeed making inroads into evolving library technologies" (17). Peng and Ke (2008) describe how Topic Maps was applied to build the Chung Hua University Library pathway (or subject guide), changing its previous simple HTML base to a topic map built with the TM4L tool.

**Other applications:** The capability of Topic Maps to provide contextual semantic information (Leunberger et al. 2006, 110) proved to be advantageous to new users in the Digital Humanities. Both Böckman (2007) and the Swinburne Project confirmed this in their applications of Topic Maps. In the Swinburne Project, their usability study showed that “for students, the additional contextual information provided by the glossary and encyclopedic reference features inherent in the Topic Maps metadata standard is critical for understanding obscure and unfamiliar references and allusions in literary texts” (Dalmau and Walsh 2007, 4). The needs of both expert and novice users in the context of the Humanities (and perhaps in other areas as well) opens up the potential role, noted by Michel and Dalmau in their Swinburne project, of Topic Maps as a teaching and research tool. Although this literature review doesn’t address that issue in particular, it does seem that there are more applications of Topic Maps to Education than to LIS. Topic Maps is also suitable for small scale online applications in MLA. Böckman (2007), for instance, suggested the use of Topic Maps to cover specific thematic areas such as exhibitions or educational projects. This has already been done in Hungary, where the National Library uses a topic map for an e-learning application on Hungarian literature for secondary school students. The LAM field could also take advantage of situations in which Topic Maps has been successfully implemented, such as the online delivery of newspaper archive content (Stevenson and Styron 2006), or the creation of temporary exhibition websites. An example of this is “The National Treasures,” an implementation of Topic Maps for a traveling exhibition of a collection of items from the Australian State and National libraries, which toured the country between 2006 and 2007. Both the publication of selected media documents produced during a computer fans event Kivelä and Lyytinen 2004) and the report on the use of Topic Maps for a digital collection on independently produced movies Ahmed 2007) give ideas for the potential application of Topic Maps in MLA. Finally, Sigel (2006a) suggested some of the Social Sciences as possible disciplines for the application of Topic Maps, and Howarth and Miller (2005) reported on the use of Topic Maps for visualizing searching results from digital libraries in cultural domains.

6.0 Discussion and further research

As it was concluded above, there are other models which in principle could serve for many of the same purposes mentioned for Topic Maps. RDF for instance is one of them. It has been widely accepted inside and outside the LIS community as the default model for the idea of a more semantic Web. Even though the comparison between RDF and Topic Maps was not a component of this study, it could be said that both are ontology models. In this case, the differences between the two must be found by looking at their potential ability as a model to represent ontologies and how expressively they are able to do
so. Three main issues that emphasize the existing differences between the two arise:

1) Until the appearance of the hash URIs and the 303 URIs (http code) solutions by the Semantic Web community, the main difference between Topic Maps and RDF was that Topic Maps had clearly developed an identity model (through the already explained direct and indirect identification). In RDF, there was a lack of clarity in this regard; the RDF community didn’t specify whether a URI such as "http://www.w3.org/Consortium" identified the W3C or a web page about the W3C. This was eventually referred to as the “identity crisis of the Web” (Pepper and Schwab 2003). The approach to the identification problem continues to be one of the main differences between Topic Maps and RDF/OWL (Semantic Web and Linked Data).

2) RDF/OWL is focused on machine-based inferencing, which implies the use of formal logic and formal ontologies. Topic Maps, on the contrary, uses a model that is closer to human reasoning and the ways to express knowledge used by KO (from the tradition of the back-of-book indexes). For some applications, this way of expressing knowledge is more suitable than RDF/OWL, as was seen in section 5.2 with various applications in the Humanities.

3) Topic Maps provides better mechanisms for expressing natural language. Firstly, through the use of scope, it is possible to express context. Secondly, through the use of non directional and n-ary associations, it is possible to expand the expressivity of relationships (also through the use of role types) and to represent more than just binary associations. Thirdly, through the use of variant names, it is possible to support different orthographic representations and synonyms. Reification represents the ability to view an event, situation, or relationship as a thing in itself; RDF/OWL is more limited in this respect. Sigel notes, “Topic Maps are more natural than RDF since the modelling takes part on a more useful level” (Sigel 2006b).

Today, the interoperability between Topic Maps and RDF is high, and “no-one has to fear not being in the right semantic web camp, just because most people use RDF, and topic mappers are only a few” (Sigel 2006b).

6.1 Limitations

Besides the previously noted limitation of this study (the lack of comparison with similar models), it has other shortcomings. For instance, it has been extensive, but not comprehensive or exhaustive (the resources selected for review were limited, and the selection of people for the interviews was not systematic). It has not focused on any specific feature of Topic Maps. Instead, it tried to give an overview of the model at a basic level, its applications and some conceptual relations to KO. Many of the documents found were not academic publications, thus the information was limited or only referential; some technical barrier problems were also present in analyzing the corpus. In addition, many of the mentioned applications are not available online or are still in their prototype stage, which made it impossible to review some of their specific features. The use of Grounded Theory as a data analysis tool proved to be useful for extracting the categories and starting the writing process through annotations, but the full potentials of the method were not used.

6.2 Future research.

Most agree that Topic Maps is an opportunity to implement the principles and expertise of KO and to interconnect Topic Maps with research directions in KO (Adams 2002; Pepper et al. 2000; Pharo 2008; Sigel 2003; Stringer-Hye 2005). Topic Maps seems to act as a kind of boundary object for the different communities and provides direction for further research. Yi (2008) already made an inventory of these directions; however, one way to conduct this research is to use theoretical frameworks to guide and also integrate the disparate research and working efforts on Topic Maps (and similar models) in KO. Joseph Tennis recently presented a classification of KO research to the KO community which was situated in a meta-theoretical framework (Tennis 2008). This framework would be suitable to provide directions for future research on Topic Maps and Semantic Web models and technologies.

Following, there is a list of some possible research topics on Topic Maps and KO within the framework designed by this author:
01 Epistemology
Topic Maps claims to be a model that better represents the way humans think (Pepper 2008b), as opposed to RDF/OWL, which is more machine oriented. The epistemological foundations of these two views and also the implications of the different models of representing knowledge (as in Svenonius 2004; Shirky 2003) need to be investigated. Along a similar line of thought, new direction for research could include the use of topics in a concept theory perspective, as well as the theoretical roots of Topic Maps and the assumptions that this model presents with respect to language and knowledge aggregation through merging.

02 Theory
As mentioned in 5.1.1, RDF is resource-centric (or document centric), whereas Topic Maps is more subject-centric, or “assertion-centric,” according to Sigel (Sigel 2006b). The implications of this have been called a “paradigm shift” by the Topic Maps communities. Limited research has been done on shift theories and “Document centric” vs. “subject centric.”

03 Methodology
From a methodological point of view, the most important area for research is the ontology design for KO with Topic Maps. At a lower level, the classification, indexing, and cataloging with Topic Maps (including the Knowledge Organization Processes) has not yet been fully explored.

04 Design
The application of Topic Maps to specific systems is the area that is most commonly covered in the existing literature. However, the representation of KOS with Topic Maps (the design patterns explored by Ahmed 2003) could be updated and extended. There is also a need for procedures which outline how to build KOS with Topic Maps. Although Sigel (2006c) has provided all the guidelines for implementation, there have not been any cases of implementation from which to gather information about building specific KOS with Topic Maps. Another area for research with respect to Topic Maps design is the ontology creation based on special KOS. For instance, Topic Maps could serve as a potential experiment in current research in KO on how to use the existing syntax of bibliographic languages to create facets from subject headings or UDC notations. The use of scope for multilingual applications, uses of merging for metadata and semantic interoperability (federated searches with topic maps, as studied by Kongsbakk 2004), and browsing and visualization of search results with topic maps are other topics that require further exploration.

05 Study
Research must be done in order to understand the specific problems which arise in topic maps design, as well as the applications to solve these problems (for example, how could authority control be solved from a Topic Maps perspective, also looking at how to integrate bottom-up and collaborative perspectives on it).

06 Critique
Critical research should also be done on the Topic Maps communities, their history, views, practices, and terminologies. The current research begs the question, why has RDF instead of Topic Maps been so widely accepted (including the LIS community)? There is a current lack of information regarding Topic Maps as an ISO standard, the politics of KO standards and their incorporation in KO discourses, theories and practices, not to mention, the implications of global identification made possible by semantic web technologies (Topic Maps among them).

7.0 Conclusions
Topic Maps is a development aligned within the principles of KO. The model created in approximately 1991 as a structure that overlaid documents to merge back-of-book indexes, was just the beginning. It provided the impetus and foundation for the development of a technologically independent ontology model, a “bibliographic” meta-language able to represent, extend, and integrate almost all KOS and bibliographic languages. Topic Maps provides a standardized model and interchange syntax—XML—to represent and exchange the products of KO in digital environments and the Web. Conceptually speaking, it falls within the boundaries of KO and Knowledge Representation, bringing to KO all the
mechanisms needed for taking existing KOS to the Web through the use of ontologies. Topic Maps questions some of the more traditional KO views (such as name-based vocabulary control), but the principles of semantic identification remain the same. Topic Maps provides the current mechanisms for semantic integration and identification of entities and concepts in a digital environment and on a global scale through the use of URIs. This implies a host of challenges for KO research, among them the difficulty of working methodologies with decentralized collaboration in building KOS. The advantage of Topic Maps over similar models (such as RDF), besides its identification mechanisms, is the capacity of the model itself to express assertions in a more natural way, which more closely resembles a humans’ ability to identify than that of a machine.

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Oh, Sam G. (2008b). MARC, FRBR and RDA: The Topic Maps perspective. Presentation given at the
International Topic Maps Users Conference in Oslo.


The authors state that this book emerged from a proposal to do a second edition of *Explorations in Indexing and Abstracting* (O’Connor 1996); much of its content is the result of the authors’ reaction to the reviews of this first edition and their realization for “the necessity to address some more fundamental questions” (p. ix). The scope, goals, and objectives of this book are not stated as clearly, perhaps, as one would like: The authors discuss a number of points they wish to address, but what is lacking is a coherent statement of the purpose of this book. The final chapter of the book provides a clearer outline of this purpose, namely to present readers with new ways “to think about messages in all sorts of media and how they might be discovered, analyzed, synthesized, and generated” and to “[bring] together philosophical, scientific, and engineering notions into a fundamental model for just how we might understand doing this with information” (p. 225). Much of the preface is concerned with addressing reviewers’ comments of *Explorations in Indexing and Abstracting*; while the authors justify this approach by saying that it presents a snapshot of the thinking by the three authors during the early period of constructing this book, this approach does tend to muddy the clarity of the scope of the book. Readers must interpret the subtitle of this book with caution; as the authors state in the preface, this book is not specifically about indexing and abstracting, nor is it in any way a primer for these two activities. Once again, this caveat is made clear in the concluding chapter, rather than stated explicitly in the preface. The authors are influenced heavily by Patrick Wilson’s vision of interpreting and understanding information (Wilson 1977, 1983). We are told that when we design representation systems (e.g., indexing and abstracting), we need to “exhaust all possible representations of each document, considering relevance to the smallest granularities of both document meanings and structures” (p. xix). Until we have done this, we have not done our jobs as indexers, abstractors, or cataloguers, which the authors call surrogate engineers: An ambitious task indeed for any surrogate engineer.

The book is organized as follows:

Preface  
1. Background concepts and models  
2. Considerations of representation  
3. Representation, function, and utility  
4. Failures of representation: Indeterminacy and depth  
5. Aboutness and user-generated descriptors  
6. Responses to indeterminacy  
7. Doing things with word-based documents  
8. Functional application of information measurement  
9. Functional ontology construction  
10. Creek pebbles: A summary metaphor and touchstone for exploration

The first nine chapters of the book consist of discussions and analyses of different methods by which can be modelled the relationship amongst the user, the document, and the environment in which they exist. The user is presented as a person with a question. The authors prefer this phrase to the perhaps more common “information need.” The document is the potential source of information to address this question. The authors argue that document representation systems often fail to address the person’s questions because they do not adequately take into account the varying and individual nature of the relationship between a user and a document. These systems need to consider:

- How purpose influences mode of representation (e.g., the author’s stance on a topic),
- No representation without a common code (i.e., users often do not understand the language used
These three considerations are discussed throughout the first eight chapters. The authors do a good job of presenting interdisciplinary perspectives of these considerations, drawing from philosophy, engineering, information science, behaviourism, and so forth. The authors' focus on the centrality of the user in the design of document representation systems is not new. Calvin Mooers' (1950) Law that "an information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it," emphasized the need to design indexing terms that address the needs of users for the document. In her analysis of the two prevailing approaches to indexing, Fidel (1994) points to (a) the document-oriented approach (e.g., Borko and Bernier 1978; Rowley 1988), whereby indexing represents the content of a document in a prescribed indexing language, and (b) the user-oriented approach, whereby indexing reflects the requests and needs of the users for which the documents may be relevant (e.g., Lancaster 1991; Soergel 1995). The fact that indexing languages such as LCSH are not always readily understood by searchers has been a topic of discussion in LIS for some time (e.g., Carlyle 1989; Greenberg 2006; Yee 1991). While these two preceding points are understandably important to an understanding of the relationship between a user and a document and, by extension, the document's representation, the authors do not offer much that is new to this discussion. It is in their discussion of synchronic and diachronic attributes in indexing languages that the authors cover ground that is just emerging in LIS; for example, Tennis (2007) posits a model that focuses on largely diachronic attributes in indexing languages, although he does not make the same point as the authors about the unchanging attributes of these languages. The discussion pertaining to diachronic and synchronic attributes is an illustration of an aspect of the book that readers may find frustrating: The authors point to inherent problems or inadequacies with document representation systems, but little in the way of suggested solutions. Although the book does not purport to be an indexing manual, the discussion of at least some tangible solutions would certainly enhance the authors' arguments.

The authors' discussion of two specific problems with document representation systems, namely indeterminacy and depth, once again do not cover new ground. Indexers and cataloguers have been struggling for many years with maintaining an ideal balance between the recall (affected by the number of indexing terms assigned) and precision (affected by the specificity of the indexing terms assigned) of searches (e.g., Khosh-Khui 1987; Sparck Jones 1972; Svenonius 1971). The authors' suggestions for determining optimal level of indexing depth and specificity have guided indexers for several years, namely:

- extract whichever elements are useful to the patron
- extract however many elements that are necessary for the patron
- employ whatever form is consistent with patron abilities and requirements.

A noticeable omission in this book is the scant attention the authors pay to social tagging and folksonomies. User-generated descriptors are mentioned in Chapter 5, but are limited primarily to information retrieval systems, rather than to social tagging and bookmarking applications. Given that this book was written within the past two years, and the explosion of social tagging research within LIS, this omission seems especially surprising.

Chapter 9 presents the culmination of the authors' discussion in the presentation of their "Functional Ontology Construction" (FOC) model, which they suggest could be used to map the relationship between the user, the document, and the environment in which they exist. One would have hoped that Chapter 9 would enable the reader to "connect the dots" of the arguments and discussion of the preceding eight chapters; this is not the case, however. Most of Chapter 9 discusses the authors' rationale for basing their model on pragmatism and B.F. Skinner's Radical Behaviourism (1953); only the last three pages of the chapter focus specifically on the FOC model. Since Skinner has had a long foothold in LIS, particularly with respect to research in the area of relevance judgments (Saracevic 2006), perhaps less emphasis could have been placed on the rationale for the FOC, especially since Chapters 1-8 set the stage for this model. More time could have been spent on the model itself. Chapter 9 high-
lights a structural problem that occurs throughout most of the chapters: While the authors provide useful examples to highlight various concepts and theories, they often do so before, rather than after the concept is introduced. As a reader, I often had to read through a number of rather long examples before the actual concept under discussion was presented. I think it would be more helpful to first present the reader with a clear discussion of a concept and to then present the examples, especially as in many cases, more attention was paid to the examples than to the concepts.

This book provides a good overview of the relationship between the document and the user; in this regard, it reinforces the importance of the client-centred approach to the design of document representation systems. In the final chapter, the authors state: “We have offered examples of new ways to think about messages in all sorts of media and how they might be discovered, analyzed, synthesized, and generated. We brought together philosophical, scientific, and engineering notions into a fundamental model for just how we might understand doing this with information” (p. 225). The authors have certainly succeeded in highlighting the complex processes, nature, and implications of document representation systems, although, as has been seen, the novelty of some of their discussions and suggestions is sometimes limited. With further explanation, the FOC model may serve as a useful way to understand how to build document representation systems to better meet user needs.

References


Mooers, Calvin N. 1950. The theory of digital handling of non-numerical information and its implications to machine economics. *Proceedings of the Meeting of the Association for Computing Machinery*.


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8th Biennial Conference of the French Chapter of ISKO – Call for Papers

The French ISKO Chapter is conducting its 8th Biennial Conference in Lille France, 27-28 June 2011, University of Charles-De-Gaulle Lille 3. The theme of the conference is “Stability and Dynamism in Knowledge Organization.” Additional details can be found at: http://www.isko-france.asso.fr/ Proposals should be sent to: colloque.isko@univ-lille3.fr

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CALL FOR PAPERS: Classification & Ontology, The Hague 19-20 September 2011

Classification & Ontology – Formal Approaches and Access to Knowledge International UDC Seminar 2011

VENUE: The Hague, National Library of the Netherlands (Koninklijke Bibliotheek)
DATE: 19-20 September 2011
WEBSITE: http://seminar.udcc.org/2011/
CONTACT: seminar2011@udcc.org

The difference between bibliographic knowledge classifications and ontologies resides in their particular purpose/function, and levels of formality. However, they are both based on observation and reasoning (ontological analysis) and share some structural principles and elements. In principle, automatic processing of knowledge classifications is significant whenever there is a need to support intuitive services. For instance, ontology-like representations of classifications are recognized as potentially important facilitators in creating a web of linked data (the semantic web).

The objective of this conference is to promote collaboration and exchange of expertise between the bibliographic, the semantic web and the AI domains. We hope to learn more about methods in ontology modelling and whether these may be used to improve and formalise the data models of bibliographic classifications and enhance their value in information discovery.

Papers are now invited covering the following topics:

1. Modelling and representation of knowledge classifications
2. Standards and solutions for innovative and high-quality classification data processing
3. Applications and implementations of classification structures as ontologies
4. Theoretical considerations of the role of knowledge classifications

The proposals should be of interest to academic and research communities dealing with conceptual modelling, information systems design, knowledge organization, knowledge engineering, semantic interoperability & information integration, and natural-language processing. Read more and download the full text of the CFP at the conference website http://seminar.udcc.org/2011/.

Contributions may include conference papers and posters. Authors should submit a proposal in the form of an extended abstract (1000-1200 words including references, for papers, and 500-600 words for posters). To submit proposal online go to the conference website.

Conference proceedings will be published by Ergon Verlag and will be distributed at the conference.

IMPORTANT DATES:
28 Feb 2011 Paper proposal submission deadline
01 Apr 2011 Notification of acceptance
30 Jan 2011 Paper submission

ORGANIZER: Classification & Ontology is the third biennial conference in a series of UDC Seminars organized by the Universal Decimal Classification Consortium (UDC Consortium) and hosted by Koninklijke Bibliotheek (The National Library of
UDC is one of the most widely used knowledge organization systems in the bibliographic domain.

Aida Slavic
UDC Consortium
http://www.udcc.org

10th Conference of the ISKO Spanish Chapter, Ferrol, 30 June – 1 July, 2011

The 10th Congress ISKO-Spain will be devoted to the reflection on the twentieth anniversary of the initiative and creation of the ISKO Spanish Chapter, the scientific organization for knowledge organization in our country, which originates and emanates from the International Society for Knowledge Organization born in 1989 that stemmed from the International Classification Society created twenty years before.

This congress aims to tackle our most recent history of Knowledge Organization in Spain. Therefore, it is necessary to include a historical run through the landmarks that consolidate this discipline in the academic framework, as well as the analysis and reflection of this journey into the research and scientific production. Furthermore, it will acknowledge the observations on the scientific work, deepening into the epistemology and methodology of the Knowledge Organization, and conclude with the current difficulties and future challenges that this complex field must face.

The goal is to celebrate a congress about the Knowledge Organization, but even more to recall how this discipline was shaped, point out the covered path, and discern where the gaze lies ahead.

Call for papers

ISKO Spanish Chapter invites to submit papers for the “10th Conference of the ISKO Spanish Chapter” that will be held in Ferrol (A Coruña), Spain, June 30th – July 1st, 2011, at the University of A Coruña, Faculty of Humanidades – Ferrol Campus.

Within the general subject “20 Years of the ISKO Spanish Chapter”, the topics to be dealt with are the following ones:

– Epistemology of Knowledge Organization.
– History of Knowledge Organization in Spain.
– Analysis of Knowledge Organization Scientific Productivity in Spain.
– Present and future challenges in a complex discipline field.

Proposals for Contributions

1. Types of contribution accepted

The Conference will accept: scientific papers, posters, and proposals for workshops.

All authors interested in submitting an abstract for contribution to the 10th Conference of the ISKO Spanish Chapter should send it to the below e-mail address. These abstracts will be revised by the Conference Scientific Committee.

2. Admission of contributions

The Scientific Committee of the ISKO Spanish Chapter Conference will select the contributions through their revision and evaluation. The criteria to be applied to decide the admission will be related to originality, relevance, clarity, and connection to the topics proposed. Authors should clearly highlight the approach, goals, description and methodology of the work together with their results.

Important dates

Abstract submission deadline: until December 20, 2010 to the following e-mail: carmen.perez.pais@udc.es

Notification of provisional acceptance and full text request: January 30, 2011.

Full text submission deadline: until March 30, 2011. This first version will be submitted for approval.

Notification of acceptance, and last version request: until March 10 April, 2011.

3. Submission guidelines

The languages of the Conference will be Spanish, Galician, English, and Portuguese, and abstracts must be between 500 and 1000 words.

The front page should include the following information: – 10th ISKO Spanish Chapter Conference – Ferrol, 30 June-1 July 2011 – Names of Au-
The abstract should be included in the next page with no mentioning of the authors’ names or any other kind of identification.

The submission of the proposal should be made by e-mail to the following address: carmen.perez.pais@udc.es (Please, fill in “ISKO” in the field “Matter”). The document format should be Word of RTF; font: Times New Roman; size: 12 pt.; and interlineal spacing: 1.5.

The rules for presentation of the contributions accepted will be published shortly.

Website: http://humanidades.udc.es/index.php/gl/novas/140-congreso-isco

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Brief Communication:

How to Improve ISKO’s Standing: Ten Desiderata for Knowledge Organization*

Ingetraut Dahlberg

Am Hirtenberg 13, 64732 Bad König, Germany, <IDahlberg@t-online.de>

Ingetraut Dahlberg started work on thesauri and classification in the early sixties. She developed her concept theory in 1972 together with her work on the establishment of a universal classification system of knowledge fields, the Information Coding Classification, published in 1982. In 1974 she founded the journal International Classification, now known as Knowledge Organization, and was its editor for 23 years. She founded also the German Society for Classification in 1977 and chaired it until 1986. In 1989 the International Society for Knowledge Organization was founded with her as president until 1996. In 1980 she founded the INDEKS Verlag, which was taken over by Ergon Verlag in 1997.


ABSTRACT: In 2009 ISKO had its 20th anniversary, a time for review and reflection on what might be envisaged to further Knowledge Organization in the forthcoming years. In addition to some proposals set forth at the end of this contribution, ten desiderata appear urgent. A preliminary condition to any other consideration is the recognition of the fundamental difference in the organization of knowledge between the concept (i.e., the unit of knowledge)—the conceptual level—and the word, term or code—the verbal level—and the need for implementing this distinction in theory and practice (Desideratum 1). On this basis, some further proposals are enunciated. The 2nd proposition concerns the surveying of extant classification systems, thesauri, and other means of organizing, ordering, and indexing knowledge; the 3rd proposition envisages the improvement of expert training in Knowledge Organization (KO), also with regard to curricula and professional acknowledgment. Nr.4) refers to the professionalization of the hitherto rather neglected national ISKO secretariats, as well as the international ISKO secretariat. Nr.5) urges a systematic survey of KO-relevant concepts to serve as a model or standard for other subject fields, Nr.6) claims the establishment of KO Institutes, Nr.7) views consultancy to the effect that anybody interested in KO may approach ISKO for help, Nr 8) urges ISKO’s promotion of membership and chapters in as many countries as possible, Nr.9) presses for intensification of ISKO’s publication activities, and Nr.10) pleads for KO as a scientific discipline on its own.

* Slightly revised translation into English of a contribution given at the 11th German ISKO Conference, Bonn, 19-21 Oct. 2009

0.0 Introductory remarks

On July 22, 2009, ISKO had its 20th anniversary. Much, very much has been achieved during these 20 years by its members. A detailed testimony of this is given in a long article on ISKO, published in the Encyclopedia of Library and Information Sciences, Vol. 3 (Dahlberg 2010). Knowledge Organization (KO) has developed during these 20 years into a full-fledged science as appears from the excellent collection of contributions in the ISKO journal Knowledge Organization 35 No.2/3 (2008) on the topic: “What is Knowledge Organization?” Profs. Ia McIlwaine, London, and Joan Mitchell, Dublin, Ohio, acting as guest editors (McIlwaine and Mitchell 2008). This achievement is also evident from the wide range of research work published in Knowledge Organization, as well as in the proceedings volumes of the international and national ISKO Conferences. But there is still room for development.
We wish to take the opportunity of reconsidering ISKO's evolution thus far and look for areas of improvements. Some of what had been aimed at in the beginning is still waiting to be recognized and pursued accordingly. Other aspects, not having as yet been considered, would seem to be rewarding in order to improve the present performance. The following 10 desiderata are offered for reflection. We plead that they may not be discarded on the ground of being "too far from reality", but that they may be found worthwhile and subsequently acted upon.

1.0 The science-theoretical foundation of knowledge organization

In the learned contribution of J. T. Tennis (Tennis 2008) we find the following statement: “In Knowledge Organization we are concerned with assumptions about language and how we can work with it in harmony with our conceptions of reality, how we know it and what it means”. By this statement, Mr. Tennis bases KO essentially on language, resp. its units, words. B. Hjørland argued similarly in his long article on Concept Theory (Hjørland 2009), following many others, by regarding the concept, in the linguistic sense, as “the meaning of a word”. Against this view I must underline that KO deals with language only incidentally as it primarily deals with concepts representing Knowledge Units. I have always defined such units in the following way:

A Knowledge Unit (concept) is the synthesis of the essential characteristics of a referent to be represented by designations (terms, names, codes).

It might be considered necessary to add to this definition also those for concepts of characteristics (i.e., knowledge elements), “category” or “concept relationships,” etc., as I had pointed out in my paper on “Concepts and Terms” (Dahlberg 2009) and in many other contributions (Dahlberg 1974, 1978, 1981, 1987). A concept definition is hence the shortest possible form of summing up “essential characteristics”. In as far as we are concerned with concepts as defined above, we stand already with one foot in the so-called Theory of Science, which is still a sub-discipline of Philosophy in our universities.

In order to clarify our concepts, we must, in each case, analyse carefully the referent in question to include its essential characteristics as these take care of the relationships between concepts, also indicating the next higher level and thus assist in ranking them within their pertaining hierarchy. Obviously, if two different concepts share the same or similar essential characteristics, this indicates a relationship between them.

Desideratum No. 1: Recognize the units in an order system (classification system, thesaurus, ontology, etc.) as concepts/knowledge units, analyse their essential characteristics, and use these characteristics when creating a Knowledge Order System.

2.0 Need for surveys

In vol. 1 of the International Classification and Indexing Bibliography (ICIB 1), all universal and special classification systems and thesauri were listed for the years 1952-1982. A continuation of this huge collection can be found in the section Classification/Knowledge Organization Literature of ISKO's quarterly, Knowledge Organization. It cannot be guaranteed, however, that all relevant systems could be listed. It seems therefore highly advisable for each country to probe for an updated survey for the 30 years which have lapsed since; a summary of the results of these surveys could become a project of ISKO. For this, one would need to contact libraries, documentation and information centers, archives, museums, terminology centers, editorial offices of certain publishers, television companies, and the like. Thereby it will also be possible to get into contact with the persons in charge of these systems.

Desideratum No. 2: Establishment of country surveys of order systems to identify their main respective scope, as well as their preferred kind. Also, summaries of the results of these surveys by ISKO.

3.0 Educational questions in knowledge organization

Training in classification, thesauri and ontologies in Europe is mainly dispensed at Polytechnical Schools under Library and Information Science. An ISKO group or an ISKO Project Manager might take care of collecting their curricula, compare them with regard to KO and survey the findings for different countries, in order to reach conclusions on training curricula and expert level of awardees. On the basis of those results, it may be possible, on the one hand, to formulate proposals for improvement, and, on the other, to evaluate chances to recruit for KO future
experts among these awardees. An ISKO Committee for Training should elaborate a schedule of qualifications and awards for KO expertise.

**Desiratum No. 3 covers two proposals:** 1) An ISKO group should elaborate a curriculum for the various KO activities to be published after approval by the ISKO Executive Board (EB). Together with this, the qualifying titles of different professionals (teacher, professor, system designer etc.) should also be discussed by the ISKO EB, adopted and proposed for acknowledgement by official institutions; and, 2) It may be possible for ISKO to establish its own Academy and also take care of teaching with the elaborated curricula.

4.0 Establishment of national secretariats, as well as the international secretariat

Each country with an ISKO Chapter organizing national conferences biannually should have—in addition to the elected chairperson—a paid expert for all organizational matters in relation to the proposals made here. The ISKO Secretary General also needs additional experts in order to coordinate all activities more effectively. Financial help for this could be applied for in Europe with the European Union; other countries would have to turn to their governmental agencies or research institutions. The results of Desiderata 2 and 3 may evidence abundance or missing uniformity of data, precluding intelligent communication among colleagues and hence the need for further work on clarification and updating. Variation may be a positive factor, however, if it occurs only for lack of knowing better, it will turn out wasteful and irrational.

**Desideratum No. 4:** Every national ISKO Chapter and the General Secretariat should make efforts to employ a paid expert for the necessary secretarial work, and seek financial support therefore from national or international organizations, in order to become more professionalised.

5.0 Establishing knowledge order systems

Once Desideratum No.1 is recognized as the fundamental difference to the existing language orientation, it should be understood by ISKO’s KO experts and by the creators of order systems, to base any work on analyzed and defined concepts and their acknowledged terms. There are many concepts which possess a multitude of terms, which means their terms are synonyms of a concept with the same definition. They should all be listed. However, if two equally sounding terms have different definitions—the case of homonymity—different concepts are at stake which need suitable verbal distinctions. In each scientific domain, indeed in each subject field, its representatives and professionals who should know its concepts, should be able to recognize on the basis of respective definitions and the necessary analytical identification of concept characteristics, the systematic relationships by comparison of characteristics and should also be able to demonstrate this accordingly. In the paper mentioned (Dahlberg 2008), I outlined and proposed this necessary work for the scientific discipline of KO itself as a task for ISKO. If this work can be accomplished, the result could serve as a model for other sciences and subject fields.

**Desideratum No. 5:** The ISKO Executive Board should decide to elaborate and publish an order system of all KO-relevant concepts to serve as a model and perhaps sometimes as a standard for similar work in other scientific disciplines and knowledge fields.

6.0 Establishment of knowledge organization institutes

The activities mentioned under Desideratum 5, which could serve as a model for other sciences and knowledge fields need an institutional framework. The ideal would be the establishment of autonomous Knowledge Organization Institutes. It was proposed that KO scientists should collaborate with subject experts from other fields and also with terminologists in elaborating, analyzing, and defining—according to Desideratum 1—the specific concepts of each discipline and subject field, including also the identification of obsolete terms. This will finally result in a new general Knowledge Order System. Such a general classification of concepts is missing so far—not only in Germany but also in Europe and world-wide—the result of such a collaboration would serve everybody and could become an essential help for all those who are teaching (in schools, universities, etc.), who are working in the area of disciplinary or interdisciplinary communication (media), in translation, etc. Obviously, much work has been done in this respect at documentation centers and in translation departments (e.g., the EU), as well as by Infoterm in Vienna which can be relied on. Such work may also be performed at the proposed Academy as mentioned under Desi-
Desideratum 3. Results of this work could also serve KO experts in their possible research work.

Desideratum No. 6: Establishment of national Knowledge Organization Institutes should be scheduled by national chapters, planned energetically and submitted to corresponding administrative authorities for support. They could be attached to research institutions, e.g., the Max-Planck or Fraunhofer Institutes in Germany or to universities. Their scope and research areas relate to the elaboration of knowledge systems of subject related concepts, according to Desideratum 1, and may be connected to training activities and KO-subject-related research work.

7.0 Process- and product-orientation in knowledge organization

Special expert knowledge in KO has hitherto been too much ignored by technology, especially computer technology with the result that we have been confronted already for many years with the fact that computer scientists have discovered KO-knowledge, which they propagate under their own terms. Against this development, KO-experts should demonstrate their own expert knowledge and rub it in. Consultancy should be made available—on the one hand—at the national secretariats, according to Desideratum 4, and—on the other—at the KO Institutes. The elaborated standard knowledge systems (Desideratum 5) could serve therefore, as well as a reconsideration of “KO Recommendations” to be elaborated by ISKO Committees. Further publications of relevant textbooks in KO could also serve this purpose; thus far, only two have appeared (Fugmann 1993 and Iyer 1995).

Desideratum No. 7: ISKO experts should not accept to be impressed by Internet and Computer Science, but should demonstrate their expertise more actively on the public plane. They should tend to take a leading part in the ISKO Secretariats and the KO Institutes, and act as consultants and informants, as well as editors of statistics and other publications.

8.0 ISKO and global expansion

Although ISKO had started 1989 in Europe, its second international conference in 1992 took place in India. It was considered from the very beginning to implicate in the Society colleagues from as many countries as possible. Of course, the expenses for printing the ISKO journal, which had to be financed by membership fees, had to be taken into account. Up to the present time, ISKO still suffers from a shrinking membership since 1997, considering that members from countries with a low rate of exchange cannot be expected to pay the full fee. In the years before, they were allowed a much lesser fee, although it is to be mentioned as praise-worthy that in 2008 the membership for such countries was reduced by the ISKO EB, yet this has so far not raised the number of members in these countries, so that—to my knowledge—except for India, no other chapters have been reestablished. Also in ISKO News—a feature of our journal which had been given up for some time—nothing is being reported on developments in the KO-world. ISKO’s website in all honour—but it is fleeting, the journal keeps instead the information on the Society and one has always access to it.

Desideratum No. 8: All colleagues trained in the field of classification/indexing and thesauri construction and active in different countries should be identified and approached for membership in ISKO. This would have to be accomplished by the General Secretariat with the collaboration of the experts in the different secretariats of the countries, as soon as they start to work. The more members ISKO will have, the greater will be its reputation and influence. But it will also prove its professionalism by the quality of its products, especially its innovating conceptual order systems to come.

9.0 ISKO’s publication agenda

Three ISKO publications are available, namely 1) the ISKO quarterly, 2) the proceedings volumes of the international conferences (every even year), entitled Advances in Knowledge Organization, and 3) the biannual proceedings volumes of the national ISKO conferences, (appearing in odd years), so far in Germany, France, and Spain. Another kind of publication is the ISKO Website. The series of textbooks, mentioned above, could be taken up again, as well as the series of Recommendations in KO in English or in the languages of the national chapters. A further possibility of cumulated information on existing KO literature would be the printing of vols. 4 and 5 of the International Classification and Indexing Bibliography (ICIB) mentioned already, as well as additional volumes on extant order systems and relevant KO-litterature after 1982. This is easily feasible since fortunately the bibliographical data of the section Class-
sification/Knowledge Organization Literature in the ISKO journal is electronically available up to the latest issue of 2008. It has been continued since then and is now available for ISKO members on the ISKO Website.

Desideratum No. 9: ISKO should—especially in view of global expansion—intensify the promotion of knowledge about its own subject area through the publications mentioned here and in further publications as deemed necessary. It should be made clear that, especially in ISKO’s own publications, professional subject indexes are a sine qua non.

10.0 Cooperation in knowledge organization

As it happened to “philosophy” of ancient times, many subject fields developed out of it in the course of centuries to the effect that “philosophy” finally became a scientific discipline of its own in early nineteenth century; it happened similarly in the thirties of the last century that documentation and information science developed out of library science and became disciplines on their own. And out of these three, “classification science” developed with the foundation of classification societies in England and Germany. However, in England classification science had its origin in mathematics, whereas in the German classification society, mathematics played only a minor part, which was to grow steadily during the years 1977-1989 so that in the end, half of the 200 members came from mathematics, the other half from library and information science. This was the moment when ISKO was founded as the international offspring of the latter half of the membership and as a continuation of the concept-oriented classification science, which then preferred the term “knowledge organization” in its name. Thus, we had first the founding of the international society and, later, the emergence of national chapters. Shortly after and in an analogous way to what happened to information science and information management, industry developed “knowledge management” for its own purposes. Unfortunately, this latter designation is now often mixed up with KO. And, finally, in the past years, yet another grouping appeared and assembled quickly a great number of adepts via the Internet under the name of “information architects”. All those new groupings share an interest in structuring knowledge. But we should not forget the efforts made already in the 18th century by Buffon and Linné et al. to establish taxonomies for plants and animals, which are, however, purely object classification systems just as, in the years after the Second World War (WW2), classification systems for patents and products were conceived, as well as for war materials, product statistics, and even statistics for university subjects. Since the early thirties, a further area of interest arose which also needed classification and which, however, was concept-oriented (and hence analytical) from the very beginning: it was in the field of terminology, initiated by the Austrian Eugen Wüster with his famous book (Wüster 1931, 2.1966), followed by the first DIN Standards on Terminology, drawn up mainly by him. His school of thought established Terminology Science in Vienna and, under his followers, Infoterm (mentioned already) was founded. In all these areas, as well as, of course, on the Internet, concept-oriented order systems are necessary, which can be established, according to the principles outlined already by the Indian S. R. Ranganathan in his Colon Classification (Ranganathan 1933, 6th ed. 1964) and in his textbook Prolegomena to Library Classification (Ranganathan 1936, 3rd ed. repr. 1967). His way of thought and the development of his faceted classification system did not only show his mathematical background as a combination of structures, but also his pragmatism as he built into his order system psychologically important mnemotechnical features. After WW2, it was on his ideas that the British authors D. C. Foskett, B. Vickery and D. Langridge based their faceted classification systems and described them in their books on special subject areas (Foskett 1953, Vickery 1958, Langridge 1976). This faceted approach has also been my own since 1970 which was published in Grundlagen universaler Wissensordnung (Foundations of a universal order of knowledge, Dahlberg 1974), more precisely worked out in later contributions. It was on this basis that the Information Coding Classification (ICC) was developed in 1977 (Dahlberg 1982) as a universal system of knowledge fields with its mnemotechnical “Systematifier,” which among other things, takes care of system positions indicating interdisciplinary and transdisciplinary relationships between different knowledge fields.

Desideratum No. 10 covers again two proposals: 1) Knowledge Organization, having arisen from librarianship and documentation, the contents of which has many points of contact with numerous application fields, should—although still linked up with its areas of descent—be recognized in the long run as an independent autonomous discipline to be located under
the science of science, since only thereby can it fully play its role as an equal partner in all application fields; and, 2) An “at-a-first-glance knowledge order” could be implemented through the Information Coding Classification (ICC), as this system is based on an entirely new approach, namely based on general object areas, thus deviating from discipline-oriented main classes of the current main universal classification systems. It can therefore recoup by simple display on screen the hitherto lost overview of all knowledge areas and fields. On “one look”, one perceives 9 object areas subdivided into 9 aspects which break down into 81 subject areas with their 729 subject fields, including further special fields. The synthesis and place of order of all knowledge becomes thus evident at a glance to everybody. Nobody would any longer be irritated by the abundance of singular apparently unrelated knowledge fields or become hesitant in his/her understanding of the world.

11.0 Final remarks

By no means do these 10 Desiderata provide for all that could be wished ISKO for the future. In any case, it should be possible to enlarge the membership month by month. The acknowledgment of Unesco should also be sought and all members should receive leaflets about ISKO, as this was the case in ISKO’s first years, so that members will have something at hand for distribution to colleagues, thus promoting ISKO. The special ISKO Committees which had been established at ISKO’s beginning, could also be taken up again. Their members would not need to meet personally but could discuss problems via the Internet.

Now, what may be the eventual outcome of these 10 Desiderata? Many of the term-oriented people will presumably say, “This is really not necessary; we have the Internet, where we can find what we are looking for.” Well, this is about the same as if one looked into a traditional encyclopedia, one will always only find the single object or item, not the item in its context with all its relations, its natural environment. And what will happen if the Internet collapses, and the satellites don’t work any longer? Others might argue: “Well, this is all very nice, but where to find the money to implement these wonderful ideas?” All right. But if we envisage the probable results of these efforts (i.e., the representation of human knowledge by optimal, easily understandable concepts in their natural environment, namely in their relevant relationships based on their characteristics and presenting to everybody a clear and significant order), it appears that the necessary costs are well spent in comparison with many other expenses for culture and research, for this investment will also serve the mutual understanding of people of different countries. To achieve this, it will, of course, be necessary for our KO-experts to get going and make themselves perceptible. The money will become available if concrete, well-founded projects for the tasks outlined are submitted to national or international funding agencies. To adopt these proposals supposes surely hard work and a lot of courage, but it will enhance ISKO’s future. I am sure that we will get what we want, if we are determined and do our best: all that matters is our good will!

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