Letters to the Guest Editors

The Great Debate

In light of the recent and wonderful great debate on the continuing relevance of the thesaurus, I'd like to point out that the thesaurus—along with the underlying technology supporting thesaurus creation, maintenance, and implementation—has been evolving to stay relevant, keeping pace with new technical needs/challenges and, perhaps more importantly, the new possibilities/opportunities of connecting with the world of information. Some of the main gateways for such connections have been languages and format standards that allow data fields to be defined and included as integral parts of thesauri. These include developments of XML and its various forms, along with RDF and similar frameworks.

Any fully compliant ISO 25964-1 or ANSI/NISO Z39.19 thesaurus can be expressed in the OWL Full ontology format (https://www.w3org/TR/owl-ref/#Sub languages)—which is quite a flexible format indeed. Any such thesaurus is, therefore, "ontology-ready" except perhaps lacking directional indicators (or specified predicates, in triple stores) for related terms, which is not an impediment for OWL. Conversely, a strictly hierarchical view can express ontological "Is_a" or "Part_of" relationships as Broader-Narrower Term thesaurus-style relationships.

Data fields within thesauri originally served mainly to enable digital connections within the thesaurus. (Consider the standard schemas for non-preferred synonyms, definitions, associative relationships, and the like—properties that are recommended in national and international thesaurus and controlled vocabulary standards.) Later, data fields proved highly advantageous for mappings between thesauri and connections to enterprise databases by providing room to store internal- or external-facing links, joins, or other equivalences.

Over the past several years, the role of data fields (and the data itself, of course) in thesauri has been expanding to enable connections with the entire cyberuniverse. Thesaurus terms, and the information associated with those terms within individual thesauri, have been taking their place in the rapidly developing world of linked data. This is possible because thesauri now have the means to contain data that can be linked to from outside, which in turn allows users to follow unique identifiers to external data. Enriching a thesaurus via linked data URIs opens a whole new world of possibilities for capitalizing on the investment made to organize the knowledge domain a thesaurus covers.

Methods of embedding term-related data into thesauri will continue to evolve, I'm sure. And the possibilities for use of that data will continue to grow. I do think the interoperability of and extensions to the basic thesaurus architecture will continue to evolve, that standards will be updated to encompass the options now available, and that the thesaurus will stay highly relevant to our information universe.

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"A Point Along a Line:" Moving Knowledge Organization to the Next Level

> Our time is just a point along a line
> That runs forever with no end
> I never thought that we would come to find
> Ourselves upon these rocks again.
> —Al Stewart, *Lord Grenville*

When any technique or technology has been in use for some while, it tends to reach a plateau stage, after rapid growth, and questions are asked about where it goes next, and what comes after it. To my mind, the formal vocabularies (FVs) of knowledge organization (KO)—taxonomies and thesauri—are at this stage, but I fear that the questions being asked may not be the right ones. (I should immediately say that this is not a criticism of the papers in this issue, which I have not seen at the time of writing.)

A first set of questions, in the early days, were about what these FVs should be like; how should they be constructed and used. These questions were largely answered many years ago, and incorporated into textbooks and standards, although there is always room for new tweaks. A second set of questions were about how FVs related to other methods, such as categorization and free-term indexing. These questions were also answered satisfactorily decades ago, although oddly they seem to resurface regularly. A third set of questions relates to how FVs can be used in new digital environments, bearing in mind that their basic forms were devised in an age of print on paper. These questions also have been answered in a general

sense, although there is still work to do in the adaption of FVs to specific new formats, as they emerge.

It seems to me, again emphasizing that I am not criticizing the papers of this issue, that those of us interested in FVs, and with a belief in their continuing value, have a tendency to continue to ask the same questions as we have in the past, and, not surprisingly, to find the same answers. This may help ensure that we are using FVs to the best effect in the ways we are used to, but it does nothing to move us on from the plateau stage to a new phase of rapid growth in use in new ways and new environments. There will be a continuing need to ask such questions in particular contexts, as consultancy or short-term applied research, but there is also need to move on.

I see three ways in which we can, and should, be asking deeper questions.

First, although there is already a substantial body of theory underlying concepts and classification in particular - much of it, one suspects, little known to many of those who work with newer forms of KO - there is still a need for studies of the underlying theory. In particular, when we ask whether, and how, FVs can be used in newer environments, we need a better understanding of how much they embody deep principles, and how much they simply a pragmatic response to the contexts of their time.

Second, we need many more domain studies, of the kind consistently advocated by Birger Hjørland. These would encompass both the nature of information and knowledge in the domain, and the ways in which users of that domain make use of, and find, information. This moves the research focus away from the traditional KO concerns, and into epistemology on the one hand, and information behaviour on the other.

Third, there is a need for convincing studies of the value and impact of FVs, and of knowledge organization generally. For example, a question asked from the earliest days was whether FVs or free text were more effective for retrieval; indeed, studies of this question still emerge from time to time. The answer, known for a long while, is that the best solution is to have both available; but that this is more expensive, and potentially complex for users. The complexity issue may be addressed by the domain studies of point two. The economic issue requires studies using the best available methods for assessing the value and impact of information services generally; for example, contingent valuation, vignettes/personas and critical incidents. We may well find that, as in many other areas, standard products will be largely automated, while 'luxury goods' justify expert human intervention; but research is needed as to exactly what this means.

That such a programme of research is urgently needed is evident, from the growing importance of organized knowledge, in fields as disparate as molecular biology (Mayor and Robinson 2014) and communities of fans of films, television programmes, comics and the like (Price 2015). This latter kind of "public" application is likely to spread much more widely, as personal information management and "lifelogging" become established. Convincing such communities of the value of the principles underlying taxonomies and thesauri is likely to be a significant for the future as convincing more conventional information providers of their continuing pragmatics and economic benefits. Both are essential, and both should figure in a research programme to move to KO to the next level.

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Why Thesauri?

On February 19th 2015 I attended the extremely interesting debate organized in London by ISKO-UK. Stella Dextre Clarke invited me to write a letter to the editor in order to add my point of view. In the hope of adding some elements to the continuing debate in this special issue on the thesaurus, here I go. My contribution concerns something which I feel is important in the context of multilingual thesauri. Jorna and Davies (2001, 284) talk about thesauri as "tools for multilingual information retrieval and cross-cultural communication." In my view cross-cultural communication depends on two essential elements: semantic interoperability and cultural interoperability, as I defined in Mustafa El Hadi (2015). My focus is therefore on interoperability within knowledge organization systems (KOSs), since the concept of interoperability is an important issue for many organizations and discourse communities, and I believe that cultural interoperability, and therefore semantic interoperability should become a new epistemological perspective in knowledge organization (KO).

According to Winslow and Everts (2001), the first usage and definitions of "cultural interoperability" occurred in military and diplomatic contexts. Closer to our concerns are the definitions and scope of the term suggested by Fox and Marchionini (1998), who focused on interoperability in the context of digital libraries, identifying different layers; likewise Miller (2002) pointed out different "flavors" of "interoperability," as he noted the difficulty in defining the concept. Thus we can see that the term interoperability has many meanings, including the notions of communication, exchange, cooperation, and sharing of resources between systems. In fact, the essence of interoperability is that it is a relationship between systems, where each relationship is a manner of communication, exchange, cooperation and sharing (Carney et al. 2005).

The bulk of interoperability research has focused on technical and informational issues. Until recently, relatively little effort or expertise has been directed towards matters of semantic interoperability. Even less attention is directed to KOS cultural interoperability, apart from a few articles written by authors from the KO community (Miller 2002; Hudon 2005; Fox and Marchionini 1998; Favier and Mustafa El Hadi 2013; Mustafa El Hadi 2015). The issue is explored mainly in other discourse communities such as organizations (Bekker 2005; Kousouris et al. 2011), and military and diplomatic domains (Clément 2007; Wimmer 2008; Winslow and Everts 2001). However, there is a lack of a general theoretical framework for considering these developments.

Beghtol (2002a, 507) proposed "the concept of 'cultural hospitality,' which can act as a theoretical framework for the ethical warrant of knowledge representation and organization systems." She noted that ethical challenges arise in the electronic global information environment, and concluded (526) that cultural hospitality with user-choice mechanisms could provide a theoretical foundation for establishing methods of developing culture-neutral systems. But these proposals are so far untested, and further work is needed before we have a reliable framework. This idea was further developed in Beghtol (2002b, 47), who argued that "in order to develop KOSs for globalized information access and retrieval, we need a theoretical framework for KOSs that will privilege the needs of different cultures." Likewise pursuing the integration of knowledge across boundaries, Green (2002, 15) argued that "knowledge of conceptual universals should inform efforts at knowledge integration." She later found that sharing of truly universal concepts is more likely to occur at the basic level of KOSs, than at hierarchical levels above or below the basic level. "It may be that the best we can do in integrating two knowledge-based schemes is to construct such crosswalks as are truly appropriate and then rely on the individual structures of the schemes being 'integrated'" (Green 2002, 25).

The thesaurus is one of the specific KOSs which can be built on natural language, in different cultures and different organizations, usually within the same culture or language, but its importance in multilingual contexts cannot be overemphasized. Doerr (2001, 1) wrote:

> Thesauri are created in different languages, with different scope and points of view and at different levels of abstraction and detail, to accommodate access to a specific group of collections. In any wider search accessing distributed collections, the user would like to start with familiar terminology and let the system find out the correspondences to other terminologies in order to retrieve equivalent results from all addressed collections.

Why should we focus on thesauri? Unlike classification schemes and other KOSs using codes to represent concepts, multilingual thesauri display the semantic correspondences across languages in a much more visible way. The dilemma invoked by using terms to represent concepts was briefly discussed in Dextre Clarke and Zeng (2012). Smiraglia (2012) confirmed that the major challenge of multilingual thesauri is to allow controlled vocabularies to work across language boundaries. Increasingly they must accommodate complex cultural demands. Favier and Mustafa El Hadi (2013) believe that semantic interoperability is the most important layer because it has an important impact on cultural interoperability.

Interoperability is one of the challenges mentioned by Aitchison and Dextre Clarke (2004, 14) and I build my argument on their observations:

> Access to information proceeds through any number of different portals, gateways, and search engines, many geared to particular audiences and subject areas. There is no universal thesaurus, but a multitude of different vocabularies for different applications …. Confronting these challenges led to two major trends in thesaurus developments today. Firstly, the hunt is on for adaptations that will make a controlled vocabulary much quicker, easier, and more intuitive to use. Secondly, the drive for interoperability of systems means we must design our vocabularies for easy integration into downstream applications such as content management systems, indexing/meta-tagging interfaces, search engines, and portals. In some systems it is also necessary for two or more vocabularies to "interoperate," perhaps via mappings between corresponding terms.

As mentioned above, Jorna and Davies (2001) described thesauri "as tools for multilingual information retrieval

and cross-cultural communication" (284) and highlighted three essential aspects for "good modern thesauri" (285):

> Firstly, they should be multilingual to support access to information resources not published in one's native language, and in order to facilitate cross-cultural communication in an increasingly global information society. Secondly, they should be semantically structured rather than alphabetically. This is partly to allow equal representation of all languages (rather than using one language as filing language), and partly because semantic structures make the conceptual context of each term and its translations more explicit than randomly sorted lists. Thirdly, they should assist user comprehension and hence recall and precision in information retrieval by offering definitions, scope notes and even short encyclopedic articles.

The second argument put forward by Jorna and Davies (2001) is the requirement for rich semantic relations tools, which resonates with Birger Hjørland's criticism (2015, 75) when he mentioned the limitations of semantic relations in the "traditional thesaurus:"

> The set of relations used in thesauri have to my knowledge never been theoretically motivated! (They may be intuitively motivated by the need of searchers in online databases to increase "recall" and "precision" but this function has never been properly examined and for me it seems unlikely that a broader set of specified semantic relations should not provide better results). There is much more to say about controlled vocabularies in general and their challenge from Google-like systems that need to be explored by our community. But my attitude tends to support the claim "that the traditional thesaurus has no place in modern information retrieval."

Domain analysis is an important part of the design of a KOS, and in its broad scope can possibly have implications for cultural interpretability. In his paper on "Epistemology of Domain Analysis," in *Cultural Frames of Knowledge*, Smiraglia (2012, 111, 114) noted that:

> Domain analysis is at the heart of KO, for without it we would have no ontological matter to constitute our KOS. Essentially an empirical tactic, involving the analysis of a specific environment to ascertain its language, culture, and activities, domain analysis thus makes use of all epistemic stances in its interpretation and analysis of domain specific ontologies …. The domain is best understood as a unit of analysis for the construction of a KOS. That is, a domain is a group with an ontological base that reveals an underlying teleology, a set of common hypotheses, epistemological consensus on methodological approaches, and social semantics.

The concept of "domain" and the scope of domain analysis I am considering here is based on Hjørland and Albrechtsen (1995, 400) and Hjørland (2002; 2003; 2008).

In conclusion, semantic interoperability has a broad scope and we consider it as one of the core elements towards cultural interoperability. It should be noted however, that full semantic interoperability cannot operate in all contexts in spite of the efforts made in that direction and that there is even more to say about the difficulties ahead in trying to achieve cultural interoperability. What hinders semantic interoperability and consequently cultural interoperability is that the degree of success achievable, in the integration of multiple knowledge representation systems or knowledge organization schemes, is constrained by limitations on the universality of human conceptual systems. I believe that combining two types of KOSs (classifications and language-based KOSs such as multilingual thesauri and vocabularies) could bring progress towards full interoperability. Web ontology standards such as SKOS (Simple Knowledge Organization System) are designed specifically with the intention of providing a common data model for sharing and linking knowledge organization systems via the semantic web. Standards such as SKOS are also meant to be used as a vehicle for publishing and sharing knowledge organization systems that were not born digital. The considerations sketched above can open a path of research that until now has been largely focused on technical and semantic interoperability. However, a general theoretical framework for considering these developments is lacking. An analysis of the literature shows that in order to build a theoretical framework to support cultural interoperability in a KOS, some basic concepts, such as "universals in KO," "cultural warrant," "cultural hospitality" and "domain analysis" have to be used as a basis for considering both semantic and cultural interoperability. I therefore believe the thesaurus has a continuing place in information retrieval, in which it eases the path towards cultural interoperability.

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Scope

The more scientific data is generated in the impetuous present times, the more ordering energy needs to be expended to control these data in a retrievable fashion. With the abundance of knowledge now available the questions of new solutions to the ordering problem and thus of improved classification systems, methods and procedures have acquired unforeseen significance. For many years now they have been the focus of interest of information scientists the world over.

Until recently, the special literature relevant to classification was published in piecemeal fashion, scattered over the numerous technical journals serving the experts of the various fields such as:

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(1) clarifying the theoretical foundations (general ordering theory/ science, theoretical bases of classification, data analysis and reduction)
(2) describing practical operations connected with indexing/classification, as well as applications of classification systems and thesauri, manual and machine indexing
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