Potential and Prospects of Taxonomies for Content Organization

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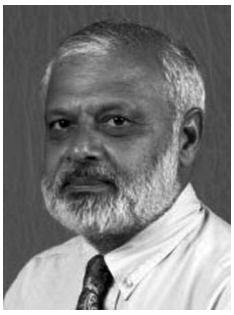

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ABSTRACT: While taxonomies are being increasingly discussed in published and grey literature, the term taxonomy still seems to be stated quite loosely and obscurely. This paper aims at explaining and clarifying the concept of taxonomy in the context of information organization. To this end, the salient features of taxonomies are identified and their scope, nature, and role are further elaborated based on an extensive literature review. In the meantime, the connection and distinctions between taxonomies and classification schemes and thesauri are also identified, and the rationale that taxonomies are chosen as a viable knowledge organization system used in organization-wide websites to support browsing and aid navigation is clarified.

1. Introduction

Taxonomies are increasingly being considered as a viable means to organize content on websites, intranet, or portals to facilitate browsing and discovery of information resources. They are becoming an essential component of information architecture that underlies these web initiatives. This enthusiasm seems to

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be driven by the fact that taxonomies make information discovery effective by categorizing resources, supporting browsing, and aiding navigation. However, despite an increasing interest in taxonomies, there appears to be lack of clarity about their scope, nature, and role. This obscurity can be partly attributed to the fact that taxonomy is a generic term that is rather loosely used referring to a type of hierarchical structure of concepts. The term taxonomy can cover a variety of meanings and applications, such as web directories, corporate taxonomies, searching filters, automatic classification and so forth. It may refer to different things in different context. Also further causing the obscurity is the fact that taxonomies look like classification schemes and thesauri to some degree. The classification scheme is a series of hierarchically-displayed subjects that is used to classify resources into these pre-defined subjects; while the thesaurus is a controlled indexing language that is composed of terms and term relationships. Taxonomy is often co-mentioned with them. Confusion abounds about the relations and differences between them. These impressions indicate that there is an obvious lack of an agreed understanding of the term taxonomy and this has lead to much confusion. This is a pressing issue that needs the attention of the information organization professionals.

In this paper we aim to explain and clarify the concept of taxonomy in the context of information organization. For this purpose, relevant literature has been reviewed and major papers written on conceptual framework for taxonomies have been synthesized. An effort has been made to distinguish taxonomies from other knowledge organization tools by highlighting their salient features, comparing and contrasting taxonomies with classification schemes and thesauri, and discussing their roles in facilitating browsing and aiding navigation. These important aspects of taxonomies are elaborated in the remainder of the paper in three sections, as follows. The second section describes salient features of taxonomies. The third section illuminates relations and differences between taxonomies and classification schemes and thesauri, and the rationale that taxonomies are chosen as organization-wide navigation systems is explored. Finally, the last section concludes the paper and states the limitations of the paper.

2. Features of Taxonomies

In this section we look into features of taxonomies in the context of information organization. Salient features of taxonomies are identified in terms of their scope, nature and roles. These features are accordingly organized into the following three subsections.

2.1 Scope: taxonomies are more organization-specific

A salient feature of taxonomies is that they are more organization-specific in the context of knowledge management. Taxonomies could be used in the organizational environment and serve knowledge workers in the organization. Chaudhry and Saeed (2001) particularly pointed out that one of distinguished characteristics of taxonomies is that they reflect specialized subject matter and organization-specific business process. The survey conducted by TFPL (Gilchrist & Kibby 2000) and later Ark Group (Wyllie 2005) reported that there is a tendency that more organizations choose taxonomies to organize and manage content. Gilchrist and Kibby (2000) emphasized the benefits of taxonomies. They analogized taxonomies to a knowledge map that could "facilitate navigation of, and access to, the intellectual capital of the enterprise" (p. 6). This organization-specific feature significantly distinguishes taxonomies from general knowledge organization tools that are utilized in a more general environment, libraries and information centers, and serve broader groups of users.

At an organizational level, taxonomies would do more than the usual job, describing content. They would reflect objectives and business process, as well as people within the organization. Conway and Sligar (2002) claimed that taxonomy was a common semantic network composed of concepts and relationships between them. And this semantic network would be specific to business needs, content, and the way knowledge workers look for information. Corcoran (2002) indicated that taxonomy provided authoritative terms and definitions that an organization could use to classify its content. He further pointed out that at this particular level, taxonomy would accommodate the viewpoints and content sets of multiple populations within the organization. Gilchrist and Kibby (2000) deemed that taxonomies not only work at the level of information management by connecting people to documents and connecting documents to people, but also at the knowledge management level by connecting people to people. Hunter (2002) stated that taxonomies not only classify content within the organization, but also to its services, products and people. This particular property of taxonomies indicates taxonomies need to adopt slightly dif-

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ferent development strategies from that of general knowledge organization tools. Other aspects, such as organization operations and people, should be integrated into the development process of taxonomies.

2.2 Key Elements: hierarchical structure and labels

While taxonomies could take forms slightly different in width and depth, and perform variant functions, such as conveying searching context (Pahlevi & Kitagawa 2005), filtering search results (Cheung, Lee & Wang 2005), automatic classification, or more popularly, supporting browsing and aid navigation like Yahoo! Directory; they are essentially composed of two key elements of hierarchical structure and labels. The hierarchical structure is used to build a certain conceptual context; meanwhile, labels occurring in nodes at different levels in the context are used to name concepts. Figure 1 shows an example of taxonomy. The taxonomy is rendered by a one-dimensional hierarchical structure with four levels in depth. The basic elements of the hierarchical structure are labels. They are represented by terms, such as 'classification schemes,' 'metadata,' etc., to name corresponding concepts. These labels occur in nodes at certain levels based on their positions in the hierarchical context, as well as their hierarchical relationships with other concepts.

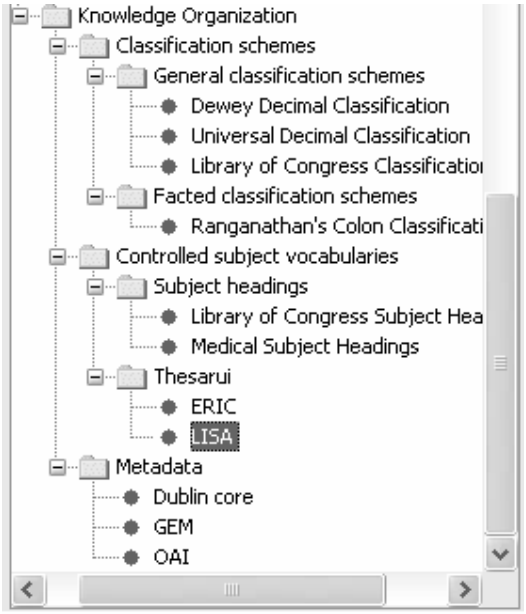

Figure 1. An Example of One-dimensional Taxonomy

The two key elements of taxonomies have been highlighted in the literature. Gilchrist (2001) acknowledged that structure (classification) and labeling (thesaurus) are contributory components of taxonomies. In the meantime, Chaudhry and Goh (2005) noted that the key feature of taxonomies is a structure made up of categories and relationships that connect them, which enables users to classify matters into a hierarchy. Clearly, hierarchical structure is the backbone for taxonomies, albeit, non-hierarchical facets can also be added to taxonomies to make them more dynamic and to use them to present information from different points of view; meanwhile, labels, represented by terms to name concepts contained in the information resources, are building blocks of taxonomies.

Furthermore, a number of definitions of taxonomies primarily revolve around the two key elements of taxonomies. Wood (2004) remarked that a simple definition of taxonomies was that taxonomies were a hierarchical structure of categories used to classify documents and other information. Peters (2005) described taxonomies as "a way of consistently organizing and classifying large amounts of data through a controlled vocabulary of terms." Meanwhile, Corcoran (2002) defined taxonomies as a form of categorization that was hierarchically ordered, with a systematic list of the keywords or terms representing the subject matter of data, information, and knowledge. Ramos and Rasmus (2003, 1) described taxonomies as: "a hierarchically ordered, systematic and abstract structure for the classification of concepts or things." Taxonomy is considered to be composed of hierarchical structure and concepts. While these authors defined taxonomies somewhat differently, also they used different words to refer to the two key elements; they inevitably stressed the hierarchical structure and labels that exist in taxonomies.

2.3. Role: Taxonomies leverage on browsing and aiding site navigation

While taxonomies could be used in a variety of environments, and can perform multiple functions as mentioned in the previous subsection, they are closely associated with such words as *browsing*, *navigation*, *intranets* and *portals*. In fact, taxonomies primarily exhibit their effectiveness as navigation systems used in a variety of web initiatives. This significant role has been highlighted in the literature. While maintaining that taxonomy is a categorization scheme that covers a number of techniques and applications, Gilchrist (2003 and 2004) highlighted that front-end navigation tool was the most common application for

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taxonomies. Similarly, Corcoran (2002) pointed out that one of the ways for taxonomies to advance information search and retrieval is through providing powerful browsing capability. In the meantime, Knox and Logan (2003) pointed out that one of the objectives of taxonomies was to create reusable structures that link resources, while another was to enable users to navigate these structures to access a particular subject of interest. Peters (2005) maintained that the two elements of taxonomies could be leveraged to provide "a means for users to better browse and discover information." Graef (2001) described taxonomy in terms of the combination of its properties and applications. He highlighted that taxonomies consist of two parts: structures and applications. Structure consists of categories and relationships that link them together. Applications refer to navigation systems to facilitate browsing and discovery of information resources. Cisco and Jackson (2005) stated that taxonomy was a hierarchical classification system of topics or subject categories. They emphasized that taxonomies also provide "serendipitous guidance," while pointing out that taxonomies improve information retrieval through allowing users to select records from corresponding categories and enabling them to narrow search fields. These statements clearly demonstrate that taxonomies primarily show their potential through their browsing capability and roles as navigation systems.

3. Distinctions between taxonomies and classification schemes and thesauri

In this section we identify relations and differences between taxonomies and classification schemes and thesauri, and further discuss their respective suitability as organization-wide navigation systems. The connection between taxonomies and classification schemes and thesauri is established. And the differences between them, in terms of their scope, treated object, role, form, and focus, are identified. Based on their differences, the rationale that taxonomies are chosen as organization-wide navigation systems, in terms of coverage, hierarchical and terms, is clarified. These aspects are accordingly organized into the following three subsections.

3.1. Combining features of classification schemes and thesauri

As discussed in the previous section, the two key elements of taxonomies are hierarchical structure and labels. These two elements are also core features for classification schemes and thesauri, respectively. In other words, hierarchical structure is the foundation of classification schemes; while labels naming concepts and represented by terms are building blocks of thesauri. Thus, taxonomies can be considered as a combination of features of classification schemes and thesauri. Literature review indicates that the close relationship between taxonomies and classification schemes and thesauri can be established from the perspective of their contributory elements. Will (2004) maintains that taxonomies are built from the same components as that of classification schemes and thesauri and on fundamental principles that have been more fully developed in their application to classification schemes and thesauri. Bruno and Richmond (2003) agreed to this point of view. They stated that taxonomy essentially was a hierarchical classification of headings constructed using the principles of classification, and a thesaurus supplied the commentary and links to navigate the taxonomy. Chaudhry and Saeed (2001) indicated that taxonomies and other knowledge organization tools, like classification schemes and thesauri, comprised the same components, relationships and terms, albeit, they are differently rendered in different context for their respective applications. Also, this connection can be identified from a historical point of view. Taxonomies emerged and were used later than classification schemes and thesauri. Gilchrist and Kibby (2000) stated that it was a natural evolution that taxonomies inherited features of classification schemes and thesauri; and the development of taxonomies essentially is a creation of structure and labels. However, this connection of taxonomies with classification schemes and thesauri is limited. They differ in a number of aspects. The next two subsections, respectively, allow us to look closely into their differences in terms of scope, treated object, roles, and forms, and to discuss their roles in facilitating browsing and aiding navigation.

3.2. Differing from classification schemes and thesauri

3.2.1. Scope, roles, and treated objects

The significant differences between taxonomies and classification schemes and thesauri in terms of their scope and roles can be attributed to the environment where they are created. Classification schemes were created in the library community and used to classify

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and allocate collections into pre-defined subjects. Meanwhile, thesauri are created in the online environment and used to index subject matters in documents. They also can be used to aid users' searching. Mai (2004, 93) pointed out that bibliographic classification schemes are "closely connected to the paper environment and to the scientific community and its discourse." Therefore, classification schemes and thesauri essentially are largely tied to the paper-based environment and more constrained within the academic community, albeit they now also are expanded into the web environment.

On the other hand, taxonomies are created in the web environment to deal with digital resources that have been investigated in the academic community for as much as 30 years to a new business context. Gilchrist (2003) pointed out that taxonomies reflect particular organizational languages that are missing in classification schemes and thesauri. Similarly, Corcoran (2002) deemed that taxonomies expand the traditional work of classifying to new content repositories and different groups users. Côté (2005) indicated that taxonomies cover different kinds of information formats and user groups from that of library-focused classification schemes. Thus, taxonomies and classification schemes and thesauri differ in scope, roles and treated objects. These differences are shown in Table 1.

Features		Classification schemes	Thesauri	Taxonomies
Scope		Library community Academic disciplines	Online environment Academic community	Web environment Organizational environment
Treated objects		Collections	Documents	Digital resources
Roles		Classifying Shelving	Indexing Searching	Categorizing Browsing and navigation
Forms	Hierarchical Structure	One-dimensional Use combination of notations	Networked term relationships	Dynamic structure
	Terms	Classes	Terms	Categories
Focus		More on content	More on content	More on users

Table 1. Differences between taxonomies and classification schemes & thesauri

are not limited within subjects. They are mostly used in organizational websites to categorize resources for browsing and navigation. These differences between them have been highlighted in the literature. Chaudhry and Saeed (2001), and Chaudhry and Goh (2005) pointed out the significant difference between taxonomies and other knowledge organization tools lie in their scope and applications. Taxonomies are more focused on the organizational environment and roles than on browsing and navigation. Gilchrist (2003) posited the same view. He highlighted that the organizational environment where taxonomies developed and their particular roles are quite different from that of classification schemes and thesauri. Gilchrist and Kibby (2000) indicated that one of new things about taxonomies is the context. They explained that taxonomies are applying techniques that

3.2.2. Forms and focus

Due to their respective particular roles, taxonomies and classification schemes and thesauri exhibit different forms. Classification schemes feature one-dimensional hierarchical structure, classes, and symbolic notations; while thesauri feature normalized terms and network relationships among terms, namely equivalent, hierarchical and associative term relationships. Will (2004) pointed out these typical features in them and discussed their underlying principles. On the other hand, taxonomies feature dynamic structure and intuitive labels (categories). Wyllie (2005) particularly pointed out that taxonomies can have more structure choices, such as multi-dimensional and faceted structures; they are not limited to one-dimensional hierarchical structure.

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Additionally, taxonomies and classification schemes and thesauri have slightly differently-weighted focus. Classification schemes and thesauri focus more on content; while taxonomies focus more on users. Gilchrist and Kibby (2000) pointed out that traditional classification schemes and thesauri consider content before the people. Conversely, the first element for taxonomies is the user. Côté (2005) mentioned that taxonomies focus more on knowledge environment and targeted users. Thus, taxonomies and classification schemes and thesauri differ in form and focus. These differences are illustrated in Table 1.

A number of differences between taxonomies and classification schemes and thesauri have been identified in this subsection. These differences seem to indicate that taxonomies may be more suitable for use as navigation systems used in organization-wide websites. The next subsection will further uncover their differences in terms of their coverage and components, hierarchical structure and terms, and elaborate the rationale that taxonomies are chosen as organization-wide navigation systems.

3.3. Rationale of taxonomies as organization-wide navigation systems

3.3.1 Coverage

As previously indicated, classification schemes and thesauri are primarily used in the academic community and deal with scholarly documents. Thus, they primarily cover subjects. Koch et al. (1997) claimed that there are three types of classification schemes; namely, universal classification schemes and national general schemes, covering the entire universe of knowledge, that is, all subject fields; and subject specific schemes, focusing on a specific subject. On the other hand, thesauri are often to be subject-based. In other words, classification schemes and thesauri are more capable of treating information resources that are academic in nature. However, content on the organization-wide websites often shows complex characteristics in their coverage. For example, within the organizational environment, content can be organized by functions, products, departments, services, locations and people, as well as its subjects (Bruno & Richmond 2003); at the same time, the subjects may not always fit correctly. For example, in order for a construction company to perform its business processes, the company might need information from various subjects, such as, architecture design, real estate development, financial planning, etc. Hence, existing classification schemes and thesauri may not perform well in organizing content within the organizational environment in terms of coverage. In one aspect, they can not cover areas other than subjects. In another aspect, they sometimes seem to be a mile wider, such as the *Dewey Decimal Classification* (*DDC*), which can be in one place overly comprehensive, and some other times a bit narrow; similarly, thesauri may not be able to cover more than one subject.

In addition, classification schemes and thesauri seem to be slow at reacting to new areas of interest due to their formal updating processes; particularly for classification schemes, updating is also constrained by their notation-arranged rigid hierarchical structures (Koch et al. 1997). Koch et al. (1997) particularly pointed out that universal classification schemes are inefficient at handling new concepts and vocabularies. Vizine-Goetz (2002) further suggested that the captions of classification schemes should be updated and new terminology should be added if they were used to organize web resources. Thus, existing classification schemes and thesauri may not correspond well to the dynamic nature of the organizational environment or to web resources. Knowledge organization tools that were to be used for managing organization-specific resources need to be instantly maintained to keep them relevant and valuable.

However, taxonomies show strength in this regard. Taxonomies can be organization-specific and can focus on specific areas based on a given context. In other words, they could be home-grown based on a given context rather than following established subjects. Also, they are relatively more flexible and easier to modify. Taxonomies take digital format in the hyperlinked environment with dynamic structures and label-represented categories. Hudon (2003, 83) pointed out that they are not constrained by the "physical demands of shelf arrangement and proprietary collections." Taxonomies can quickly absorb new areas of interest and make changes based on needs. Côté (2005) particularly highlighted that the dynamic nature of taxonomies is very different from that of traditional classification schemes. Therefore, taxonomies are more suitable for organizing and managing content within organizational environments. The suitability of taxonomies and classification schemes and thesauri for organizing content within the organizational environment is shown in Table 2.

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Features	Classification Schemes	Thesauri	Taxonomies
Coverage	Disciplines-based Regular update	Discipline-specific Regular update	Context-based Easier to modify
Structure	Hierarchical Subject-based Use of combination of notations Tend to be deep Rigid	Hierarchical with BT, NT, RT Shallower	Manageable size hierarchical or faceted Context-based Dynamic
Terms	Classes (Subject-based)	Terms (Content-oriented)	Categories represented by (user-focused) labels

Table 2. Suitability of taxonomies, classification schemes and thesauri

3.3.2. Hierarchical structure

Classification schemes prefer to adopt pre-existing standards to create their hierarchical structures. Mai (2004) claimed that classification schemes are based on widely accepted scientific classifications and favorably adopt existing orders in sciences or subjects. Will (2004) pointed out that many classification schemes are found to prefer to group topics or documents by subjects or area of study. This type of hierarchical structure is undoubtedly powerful for effectively classifying scholarly documents. However, they may not be useful for end-user navigation. Hunter (2000) pointed out that the divisions used in navigation systems should be consistent with users' expectations to facilitate intuitive navigation. Classification schemes seem to be a bit distant from common users. As an example, for the subject of computer science, *DDC* organizes it into systems, data processing, computer programming, and special computer methods. This kind of division is meaningful for a subject specialist but might not be suitable for end-users. Users might prefer divisions such as hardware, software, multimedia, and networks. Thus, hierarchical structures in existing classification schemes may not be appropriate for supporting browsing and aiding end-user's navigation.

However, taxonomies show potential in this regard. They create their hierarchical structures based on a given context and intended users. Côté (2005) said they do not necessarily adopt pre-existing standards. She further clarified that the hierarchical structures in taxonomies are often based on a synthesis derived from user's needs and language. Gilchrist and Kibby (2000) pointed out that structure in taxonomies should reflect needs of organizations. Successful taxonomies would know their users well. Hence, such hierarchical structures that keep context and users in mind would be more useful for supporting browsing and aiding end-user navigation.

Notations are an essential part of hierarchical structure for classification schemes. These notations are necessary to determine shelf locations of collections, as well as symbolically denote hierarchical positions of classes. However, notations appear to be superfluous for navigation. In one aspect, the access mechanisms in navigation systems are different from that of classification schemes. Mai (2004) pointed out that the resources in navigation systems have been part of the same systems. In another aspect, these notations would be a distraction for user's navigation, particularly in the environment of hypertext. Koch et al. (1997) suggested that notations do not need to be displayed on the screen when structures of classification schemes are used for navigation. On the other hand, taxonomies choose intuitive labels instead of imposed notations as navigation layers. They are more easily understood by users and allow more flexible arrangement of categories. Categories can be alphabetically or systematically arranged. This flexible arrangement would facilitate easy location and navigation of resources, as well as easy maintenance of hierarchical structures.

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To exhaustively represent subject matters contained in collections, classification schemes have a tendency to be constructed with complex structures. Vizine-Goetz (2002) highlighted that the depth of DDC stretches to thirteen levels including its expanded classes. However, this kind of exhaustive hierarchical structure seems to be overly complicated for navigation. The investigation conducted by Vizine-Goetz (2002), which compared the subject trees of Internet Directory with the hierarchical structure of DDC with respect to characteristics of browsing, revealed that the majority of relevant resources are located in the upper third of the DDC's hierarchical structure. That indicates that hierarchical structures in general classification schemes like DDC have to be adapted when they are used to organize web resources and support browsing and aid navigation. As described by Dodd (1996, 278), general knowledge organization tools like DDC, seem to be "an inch deep" for browsing and navigation on the web. Another serious weakness of classification schemes for browsing is that they have to take a one-dimensional hierarchical structure in order to build one-to-one correspondence between collections and notations. This one-dimensioned hierarchical structure imposes a pre-defined viewpoint on users, which facilitates neither navigation nor resource discovery.

However, taxonomies exhibit several strengths in this regard. In one aspect, taxonomies are controlled in a manageable size. Rosenfeld and Morville (2002) highlighted that the breadth and depth of the taxonomy should be controlled and balanced within users' abilities and cognitive limits. A number of researchers (Rosenfeld & Morville 2002; Bruno & Richmond 2003; Delphi Group 2004) recommended that number of top categories is seven plus or minus two, and that the depth is within four levels. Bruno and Richmond (2003) particularly highlighted that the taxonomies beyond four levels in depth would inhibit users' ability to navigate easily within the structure. This guideline seems to be widely accepted in the taxonomy community. In another aspect, as previously mentioned, taxonomies can take more flexible structure forms. They are not limited within one-dimensional structure. This flexibility, especially their faceted structures, harvest more benefits. Peters (2005) mentioned that multiple attributes can be represented in faceted structures, and users can have more choices to navigate. Côté (2005) pointed out that this faceted choice not only facilitates reflecting connections and processes in a semantic structure, but also leaves room for growth and maintenance. It is clear that this kind of dynamic structure in taxonomies is more suitable for supporting browsing and aid navigation. It not only allows for efficiently reflecting a variety of attributes contained in the content, but also facilitates navigation by enabling users to arrive at the destination through exploring multiple pathways, as well as the maintenance and growth of taxonomies without much disruption to the entire hierarchical structures.

Thesauri show more than one kind of term relationship including hierarchical, equivalent and associative relationships. These delicate term relationships are used to help users to select appropriate search terms to enhance search performance. They focus more on searching rather than browsing. Will (2004, 127) pointed out that hierarchical relationships in thesauri are used to support "query expansion." Aitchison and Clarke (2004) pointed out that the hierarchical relationships in taxonomies are more loosely applied and have another kind of function. Furthermore, hierarchical relationships in thesauri are often at two levels. They are shallower for browsing. Thus, the hierarchical relationships in thesauri are not suitable to be used to support browsing and aid navigation.

These differences discussed above demonstrate the potential of taxonomies as navigation systems, with respect to the divisions and notations used in hierarchical structure, and the size of the hierarchical structure. The suitability of taxonomies and classification schemes and thesauri in terms of hierarchical structure is shown in Table 2.

3.3.3. Terms

There are delicate differences between taxonomies and classification schemes and thesauri in the use of terms. Classification schemes choose classes for the purpose of classifying documents. The granularities of certain classes depend on the size of the relevant subject and its distribution in the scheme. However, classes in the classification schemes appear to be generic and may not be suitable for being used as navigation labels. On the other hand, as previously pointed out, classification schemes and thesauri give more weight on content even though they also take users into consideration. They are essentially developed with an assumption that they are first used by experts for indexing, then by end-users for searching. Molholt (1995) indicated that classification

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schemes were designed and used for librarians, not for end-users. Similarly, Rosenfeld and Morville (2002) pointed out that traditional thesauri were created in the academic communities and designed primarily for experts. Thus, classification schemes and thesauri choose terms based on literary warrant more than on user warrant. However, for navigation systems, since labels are considered as a layer between users and the content, they prefer terms that are friendly to users. Rosenfeld and Morville (2002) suggested using terms that are attuned to the tone of the users. Hence, terms in classification schemes and thesauri need to be carefully checked if being chosen as navigation labels. The slight differences between taxonomies and classification schemes and thesauri in terms of terms are shown in Table 2.

4. Conclusion

We have explained the concept of taxonomy in the context of information organization. Salient features of taxonomies were identified, and their scope, nature, and role were elaborated based on an extensive literature review. Meanwhile, the relations and differences between taxonomies and classification schemes and thesauri were identified. Further, the rationale that taxonomies are chosen as organization-wide navigation systems was clarified. We focused on distinguishing taxonomies from more look alike knowledge organization tools, such as classification schemes and thesauri. We did not cover other tools, such as subject headings, ontologies, and topic maps. Our emphasis is on the conceptual framework of taxonomies, rather than their construction or application.

The rationale that taxonomies are chosen as organization-wide navigation systems has been clarified. In table 2, the comparison of taxonomies to classification schemes and thesauri aims at illustrating the features and potential of taxonomies. In fact, their differences are more in terms of their deployment and not in terms of their foundation. They each have their respective unique features and roles. They are fundamentally complementary to one another. They do coexist in this fancy information era.

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