Classifying Phenomena Part 1:
Dimensions†

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Abstract: This is the first part of a study on the classification of phenomena. It starts by addressing the status of classification schemes among knowledge organization systems (KOSs), as some features of them have been overlooked in recent reviews of KOS types. It then considers the different dimensions implied in a KOS, which include: the observed phenomena, the cultural and disciplinary perspective under which they are treated, the features of documents carrying such treatment, the collections of such documents as managed in libraries, archives or museums, the information needs prompting to search and use these collections and the people experiencing such different information needs. Until now, most library classification schemes have given priority to the perspective dimension as they first list disciplines. However, an increasing number of voices are now considering the possibility of classification schemes giving priority to phenomena as advocated in the León Manifesto. Although these schemes first list phenomena as their main classes, they can as well express perspective or the other relevant dimensions that occur in a classified item. The independence of a phenomenon-based classification from the institutional divisions into disciplines contributes to giving knowledge organization a more proactive and influential role.

1.0 The organization of recorded knowledge

The present study addresses some basic alternatives in the approach to classification, a special kind of knowledge organization system (KOS). As a brief introduction, the general role of KOSs in the dynamics of knowledge is considered. Knowledge organization systems provide a structured record of the concepts and of some relationships between them, which form the complex of human knowledge or of a special domain of knowledge.

Concepts are thus a basic unit in knowledge organization (Dahlberg 2014, 35). Although knowledge expressed in gesture and oral communication (Jousse 1969) should also be considered as a potential subject of study in our field, learned knowledge is most typically expressed and recorded in writing. Concepts are abstractions that in recorded knowledge usually correspond to some controlled terms, which in turn are originated from common-usage words. Written texts freely mix technical terminology with common words. The current paradigm of information retrieval through search engines and database queries rests upon written words as the basic units of knowledge, which obviously are only an indirect approximation of concepts.

Written words, together with images and other media, are continuously organized by people into "documents" of various complexity (Figure 1). The most basic degree of organization is broken into phrases and sentences that now have their formalized counterpart in linked data statements such as RDF triples. Linked data are but an extremely atomized form of document (Buckland 2014a), though po-

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tentially connected with large amounts of other data by their URIs. The next degree in the complexity of knowledge is occupied by such short documents as memorandum notes, SMSs or tweets. Further development of arguments can be implemented in documents of the size of a blog post or an academic paper. Knowledge as developed in such mid-size documents is reviewed and systematized from time to time into monographs. These in turn can be synthesized and systematized into encylopedias and dictionaries, both special and general. The networks of ideas explained in an encyclopedia can be visualized and formalized in a KOS, thus completing the circular structure of written knowledge.
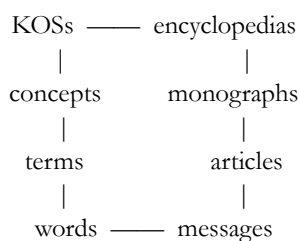
```
KOSs ——— encyclopedias
  |                  |
concepts       monographs
  |                  |
terms            articles
  |                  |
words ——— messages
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Fig. 1: The circle of recorded knowledge

KOSs also are the second in four layers (Figure 2) that can be identified in the field of knowledge organization (Golub 2015, 48-51); indeed, KOSs are based in more or less explicit ways on "theories" of knowledge organization (first layer); in turn, a KOS has to be "represented" in some format—a standard one if possible, and nowadays mostly a digital one (third layer); in such format, the KOS can be "applied" to particular information resources (fourth layer).

KO theory, e.g. systems theory, prototype theory
↕
KO systems, e.g. Universal Decimal Classification
↕
KO representation, e.g. UDC in SKOS
↕
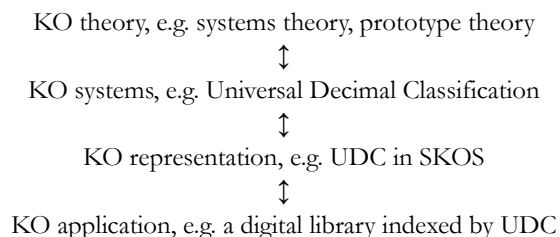KO application, e.g. a digital library indexed by UDC

Fig. 2: The layers of knowledge organization

2.0 Classification as a type of knowledge organization system

Several types of KOS exist, including keyword lists and folksonomies, subject heading lists, taxonomies, thesauri, classification schemes and ontologies. Their differences mostly concern the degree of detail in which knowledge is modelled, depending on the presence or absence of such devices as vocabulary control, synonyms, hierarchi-

cal relationships, associative relationships, alphabetical or systematic sorting, loose or formal definitions, logical restrictions, etc. As a KOS includes more of these features it becomes more powerful, but at the same time it becomes more demanding to be learned and applied.

This situation is often represented by a diagram from Zeng (2008, 161) or variations of it. In such diagrams, however, one important feature tends to be neglected; that is, the systematic arrangement of concepts, which is provided especially by classification schemes through their notation. As a result, classification schemes are ranked in a middle position, before thesauri and ontologies, although most of the latter do not provide for systematic arrangement. The widespread opinion that systematic sorting would not be needed anymore, since in digital environments we can rely on word search and retrieval facilities to locate information, is a sad misunderstanding; instead, systematic display continues to be an important cognitive aid when browsing lists of items, not just in library shelves but also in museum showcases, in website menus, in results retrieved from a database, etc.

Furthermore, while associative relationships are usually ascribed to thesauri and ontologies only, faceted classifications do provide for relationships other than hierarchical, and even connect them to standard fundamental categories (Broughton 2015). If systematic sorting was added to the parameters in the diagram, and relationships in faceted classifications were taken into account, classification schemes would be ranked in the highest positions. Hence classification schemes are still very much needed in the organization and use of knowledge.

Most existing general classification schemes are based on the "aspects" or "perspectives" by which knowledge can be viewed, as their classes represent academic disciplines each taking a particular approach to the study of the world (Svenonius 2000, 149-50; Broughton 2015, 19-20). These have originated in medieval academic specializations, which in turn can be referred to Martianus Capella's seven liberal arts and to Aristotle's distinction between theoretical, practical and poetical arts (Richardson 1901, 100-52). Thus their nature is that of a partition of the corpus of knowledge at the times they have started to develop.

Based on disciplines are such bibliographic classification systems, either enumerative or faceted, as the *Dewey Decimal Classification* (*DDC*), the Universal Decimal Classification (UDC), the Library of Congress *Classification*, the Bliss Bibliographic Classification and the *Colon Classification*. The author of the last one, S.R. Ranganathan, even claimed that an "isolate" such as "children" or "gold" or "year 1950" cannot stand alone in a subject; indeed, it has to be discussed in the context of some discipline, e.g. "psychology of children," "education of children," etc., since nobody can be knowledgeable on everything con-

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cerning children (Ranganathan 1967, section CR31). For this reason, it would not make sense to create a class for the phenomenon of children alone.

In recent years, however, many influential authors (e.g. Weinberg 1988; Jacob 1994; Begthol 1998a; Williamson 1998; Szostak 2007) have independently suggested that classification should transcend the limitations of disciplinarity in order to better organize any kind of subject. In scholarly research (Szostak, Gnoli and López-Huertas 2016), this would be a valuable aid for the sake of a greater interdisciplinarity. Classification principles should also cover non-academic subjects, such as services provided by local government to its citizens, products offered through vendor websites or information resources available for education or leisure, for which scholarly disciplines are often irrelevant.

Attempts at phenomenon-based classification within the field of knowledge organization already exist, including J.D. Brown's *Subject Classification* (Beghtol 2004), the Classification Research Group's general scheme drafted for NATO (Austin 1969; Classification Research Group 1969), Scheele's Universal Facet Classification (Scheele 1977) and Shpackov's Universal Classification (Shpackov 1992). A middle way is represented by the Information Coding Classification (Dahlberg 2008), which organizes fields of knowledge according to a combination of disciplinary perspectives ("form categories") and phenomena ("objects of being"), though its author does not believe that disciplines should be the main reference anymore: "Mit Disziplinen geht es nicht mehr" (Dahlberg 2014, 75). Two recent projects, the Integrative Levels Classification (ILC; see ISKO Italy 2004) and the Basic Concepts Classification (Szostak 2011), represent attempts to develop a fully phenomenon-based general scheme. Beghtol (2010, 1056) comments that "these investigations appear to be fruitful new directions in research on the structure(s) of knowledge organization classification," and Broughton (2015) mentions them as relevant work in classification research.

The research stream reported beginning with this paper deals with the development of classification schemes of phenomena as the main alternative to disciplinary classifications. The present part 1 is devoted to what will be described as the dimensions of classification, to which the dialectics between disciplines and phenomena belongs; planned subsequent parts will be devoted to types and levels, to facets, to modality and to applications. Though dealing with this subject in general terms, the papers will use classes of ILC, the experimental scheme developed by the present author together with several collaborators, as their examples.

A terminological clarification may be useful. In Dahlberg's classification of KO subjects, applied to the *KO Literature* bulletins and online database, hierarchical schemes of phenomena are labelled "taxonomies" and listed apart from "classification schemes and thesauri." They include such scientific taxonomies as those of chemical elements, of plants or of languages. In this respect, a hierarchical KOS of phenomena such as that described in the following pages could also be called a general taxonomy. However, we will still adopt the term "classification" for it, meaning a kind of system similar to the existing bibliographic classification schemes, in that it provides for systematic arrangement of concepts through a notation, a feature peculiar to classifications but not taxonomies. (On the other hand, this ordinality is not available for now in the Basic Concepts Classification (BCC), where notation is an abbreviation code for the class caption, e.g. A "art," E "economy," G "genetic predisposition," not controlling any systematic order.)

3.0 The dimensions of knowledge organization

One century ago Otlet (1990, 64) had already acknowledged that classifications should list both "objects" of knowledge and "points of view," according to the needs at hand. While his UDC, being derived from the disciplinary *DDC*, privileged the latter, the contemporary *Subject Classification* by J.D. Brown made the opposite choice. Ranganathan (1975, section AA23) applied the Indian belief that all entities have a ternary nature to books, when observing that any book is composed by an author's creative idea, that is its content (its *atma*, "soul"), a form (its *sukshma sarira*, "subtle body") and a material carrier (its *sthula sarira*, "heavy body"). These clearly are separate "dimensions" that are largely independent from one another; indeed, the same content could be dealt with in a different form, or the same text could be carried in a different medium, e.g. digital instead of printed or engraved.

Distinguishing between these dimensions does not mean that there is no influence among them, as emphasized by McLuhan's slogan "the medium is the message;" it is true that, for example, the availability of a certain space in an engraved or printed medium (Lamé et al. 2012), or the possibility of illustrations that are coloured or not, bidimensional or rotatable, etc. will affect the way content is understood. Still, claiming that the medium "is" the message clearly is a rhetorical exaggeration, as the same contents as a matter of fact are often translated into new languages, or reproduced using new media with only minor differences from the original version.

The term "dimension" appears to be a suitable way to express this articulation between object, intellectual form and medium of documents. Tennis (2002) adopted it to discuss a chronological dimension of KO, that is the change in the meaning of classes as a result of the change in human knowledge over time. Hjørland and Hartel

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(2003) identified an "ontological," an "epistemological" and a "sociological" dimension in knowledge domains, which refer respectively to the objects of knowledge, the theoretical ways they are approached, and the ways they are used by society. Dimensions of KO were prominently mentioned in the program of the 3rd Brazilian International Society for Knowledge Organization (ISKO) Conference, which included "epistemological," "applied," and "socio-cultural-political" dimensions in the names of sessions (Guimarães and Dodebei 2015).

Vickery (2008; see also Gnoli 2011) lists a series of steps "from the world to the classifier" including phenomena, disciplines or fields of activity, reports of activity, subjects of reports and classification of subjects. Starting from Vickery's list, I have proposed a list of dimensions of knowledge organization denoted by consecutive letters of the Greek alphabet (Gnoli 2010). After some refinement, the dimensions and corresponding fields listed in Table 1 can be identified.

α	reality in itself	mysticism
β	phenomena	ontology
γ	perspectives	epistemology
δ	documents	bibliograpy, epigraphy etc.
ε	collections	library, archive and museum science
ζ	information needs	cognitive and information science
η	people	sociology

Table 1. Dimensions of knowledge organization and corresponding fields

Dimensions β, γ and δ roughly correspond to those discussed by Ranganathan, probably being those most relevant for the heart of knowledge organization. However, the other listed dimensions may also be useful in order to connect studies in the library and information science (LIS) field and in other disciplines into a single framework.

The traditional activity of knowledge organization within the LIS field referred to dimensions δ and γ as an indexed item could be considered in such a manner as a "book of philosophy" or a "journal of botany." However, a broader approach not limited to the LIS field can make knowledge organization applicable to knowledge items at any dimension, including whole collections (as often happens with digital libraries, see Dunsire 2006), or categories of information needs or indeed phenomena. This is in agreement with Dahlberg's original view of knowledge organization, that she has contributed to establish as a research field, as being part of "science of

science," that is dealing with knowledge itself in a general way, rather than being just a part of LIS. LIS simply is one domain where the techniques of knowledge organization have been developed in most detail; but this does not prevent exporting them to other domains, nor from broadening their principles in view of more general application.

Dimension α in the table refers to reality "out there," prior to its knowledge by humans. As reality is experienced only indirectly through sense organs and central nervous systems, this dimension is inaccessible to knowledge organization in practice, and is listed here only to show its relationships with the next dimensions. Some believe that mysticism can be a way to attain a more direct experience of it; in any case, this does not seem to be part of the knowledge organization task.

One thing that can be said about dimension α is that reality in itself is often described in philosophy or religion as some undifferentiated whole, variously called the *ápeiron* (meaning "indefinite"), the *Tao*, the absolute, etc. It would only be when it is perceived as phenomena that this whole is analyzed into distinct elements by sense organs and brains. This is an inescapable character of human knowledge, which cannot encompass the whole of reality in a single act of perception, but needs to decompose reality into elements and relationships between them. In this sense, it is often said that "to think is to classify" (Perec 1986; Ridi 2006), as reality is spontaneously analyzed into classes of phenomena by our cognitive apparatus. Ranganathan himself (1967, 77) wrote that classification is perhaps "concomitant with the finiteness of the speed of neural impulses in the human body. When the speed is finite, structure emerges. Wherever there is structure, sequence emerges. When sequence is helpful to the purpose on hand, it is Classification."

This pre-classification of reality into manageable perceived data (called "Classification in Sense 2" by Ranganathan) is still different from the conscious intellectual processes of classification into explicit KOSs ("Classification in Sense 3"), of which it only forms the initial basis. Reality as perceived and pre-organized through human sense organs is what constitutes dimension β.

For dimension β, the word "phenomenon" is adopted mainly because it has been used consistently in previous KO literature, when considering classification of phenomena as opposed to classification of disciplines, e.g., by Mills and Broughton (1977, 37), Langridge (1992), Beghtol (1998a) and Szostak (2004, 30). An alternative is "object" (of knowledge), which means almost the same for our purposes, and is preferred by Dahlberg (personal communication, 2013) as she believes that "phenomenon" is strongly connoted by references to perception. We should make clear that the broad meaning of "phe-

nomenon" adopted here, and presumably also in the literature just cited, has no special reference to the philosophical school of phenomenology (although it can be interesting to explore what in this school is relevant to knowledge organization: see Smiraglia 2008); it seems to be closer to Kant's opposition between "noumenon" (our α) and "phenomenon" (β). Another reason to prefer "phenomenon" over "object" is that the former may better convey the idea of encompassing processes, properties and relationships together with entities as all these have to be dealt with in a KOS. It is exactly the broad meaning of the word that makes it suitable to represent a whole dimension of knowledge organization.

Knowledge of phenomena by an individual (Popper 1972) is the result of both her direct experience and pre-existing theories about the perceived world. Indeed, the very nature of knowledge is that of a cumulative corpus of concepts connected between them in complex ways, so that an individual does not discover the world every day from scratch again, but she continuously integrates her immediate experience with the theories forming her previous knowledge. This means that both individual and collective knowledge continually evolve, and that KOSs in turn have to evolve in order to stay updated with it.

From this, some (e.g., Gnoli et al. 2013) conclude that theories should be the prior unit of a KOS. However, this argument mixes things. Indeed, even the classification of theories in turn depends on some theory. For example, classifying approaches to knowledge organization into rationalist, historicist, empiricist and pragmaticist approaches (Hjørland 2003) is founded on one particular theory of theories, on which there is no final consensus (Dousa and Ibekwe SanJuan 2014). Therefore, starting from theories would only introduce one more factor of relativity. Also, classifying theories is admittedly difficult in some cases (Szostak 2003). It is usually easier to identify the phenomena dealt with in a document, say trade in developing countries, than the theory it applies to such phenomena, such as a particular school of economics or of human geography.

Theories applied in a document can still be expressed, where needed, as part of the next dimension, that of perspectives (γ). Szostak (2015) has sometimes listed the classification of perspectives as a task separate from the classification of theories, although he has later grouped disciplines, methods, theoretical orientation, ideological, epistemological, ethical and aesthetic outlook and rhetorical strategies under the broader term "authorial perspective." I have adopted a broad meaning of "perspective" to encompass all the components of a document subject pertaining to the ways the discussed phenomena are considered and looked at, including traditional disciplines, Szostak's "theories and methods," Hjørland and Albrechten's (1995) "domains," Svenonius' (2000) "aspect," Begh-

communicative function, e.g. report, operational instruction, advertisement
discipline, field of study, e.g. physics, engineering, architecure
domain of discourse, community, e.g. astronomers, sport fans
cultural context, viewpoint, e.g. modern Western, indigenous
activity field, e.g. cultivation, healing, education
theory, e.g. evolutionism, creationism
method, e.g. laboratory testing, interviews
locus of knowledge, e.g. China, Africa
epoch of knowledge, e.g. Medieval, contemporary

Table 2: Facets of perspective with examples.

tol's (1998b) "viewpoint" and Vickery's (2008) "activities." Perspective thus can be articulated into more specific facets, like those listed in Table 2.

Clearly, it is not always possible or relevant to determine which of these components are contained in the subject of a document. The instructions leaflet of a drug will not necessarily convey the perspective of any particular locus in the world, as it is meant to be used everywhere, and a collection of artistic landscape photographs will not usually be meant for any particular applied field of activity. Like any list of facets, Table 2 should be understood not as a grid where every box has to be filled mandatorily, but as a tool for analysis of the appropriate components of a subject when these can be identified. Only if this is the case should they be expressed in indexing.

Proposals have been made that some perspective facets, like theories (Szostak and Gnoli 2008) or methods (Kleineberg 2016), be in turn expressed as a combination of subfacets, although this would result in quite complex notation in practice.

The list includes the classical disciplines that form the basis of most modern general classification systems. Although a discipline often refers to a particular class of phenomena to be studied (botany is the study of plants), this does not exclude the possibility that the same phenomena can also be studied by different disciplines (plants are also studied in pharmacology or in landscape architecture). Some disciplines even lack a specific class of studied phenomena, being better characterized by their general approach to knowledge, as in the cases of philosophy, history, empirical science or the arts; it has been proposed (Mills and Broughton 1977, 37) that only these should be regarded as the true "disciplines," while those devoted to a specific class of phenomena would just be their "sub-disciplines." In sum, the definition of a

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discipline is often a mix of perspective facets and possibly of a class of studied phenomena, that has been determined by academic tradition.

The dimension of documents (δ) encompasses all the facets of the particular carriers by which knowledge is conveyed (indeed, I have previously labeled it as the "carrier" dimension). This can include their format, language, origin—e.g., for an evolution from, or a commentary to, previous documents—intended target, authors, publishers and producers, material, place and time of production.

It should be noticed that "document" is meant in a very broad sense, including not only books and articles but also anything (Buckland 2014b, 180) "to be held up as constituting evidence of some sort" such as letters or photographs kept in archives, films, paintings, museum items, websites, etc. Borderline cases, the inclusion of which is open to discussion, are monuments and places described by *in-situ* signs, like a living monumental tree (does the document include the tree, or just the sign?).

Dimension ε is that of collections, that is of the ways knowledge sources are gathered, kept and made available. There has been increasing awareness in recent years that libraries, archives and museums all share common purposes and problems, a trend that has generated the acronym *LAM* (libraries, archives and museums), or *GLAM* if galleries are included. Facets concerning storage, management, access to collections, etc., belong to this dimension. While LIS is the field concerned with much classical literature on knowledge organization, also archival science, museology, management of herbariums, botanical and zoological gardens, of galleries, and of expositions, etc., have to be included in the picture.

Collections provide additional context to knowledge stored in them, and such context may be worth being indexed. Melanie Feinberg has produced an interesting corpus of papers (e.g., Feinberg 2011) on how the way people gather and organize documents in a particular collection, especially a personal one, can be seen as a form of authorship expressing their own interests and orientations.

The final dimension in the scheme (η) is that of people, as each individual user will be interested in particular parts of a collection according to her own interests and condition. Knowledge users can be grouped in various ways by such sociological facets as education, gender, age, wealth, etc. Articulation between the dimensions of collections and of people is expressed in Ranganathan's classical laws, "every book its reader" and "every reader his book."

When presenting this list of dimensions at the 7th Italian ISKO Meeting held in Bologna, suggestions were given by Ridi (2016) about "the possibility of adding even a seventh 'dimension,' relating to the objectives, preferences, habits and constraints of individual users and to the characteristics of different and changing information needs and behaviours of each of them, studied by psychology and information science."

In particular, Alberto Cheti suggested considering information "needs" as a dimension. Needs are translated by users into questions to the information specialist or the computer; but it is well known in LIS literature that such questions are often formulated in inaccurate or vague ways, so that helping users to realize what they actually need, and how to search the available collections for it, is a task of the reference service. This dimension can then account for the behaviour of users who are searching for different kinds of information (Case 2002). Distinguishing it from the sociological dimension, which accounts for the people who use information, can be of some help in the debate on whether information needs and user behaviour should be considered from a cognitive or from a sociological approach (Hjørland 2007); indeed, both dimensions can be relevant, each one as for its own components, and dimensional analysis can make their relative role more clear.

Rather than being listed at the end of the series, the dimension of needs can be intercalated (ζ) between collections and people. Indeed, needs appear to be more directly connected to collections than people are, as people tend to address certain collections—e.g., an academic library as opposed to a public library—in the hope of fulfilling certain needs—e.g., to gather reference sources for their dissertation as opposed to finding a reading for their holiday. On the other hand, even the same user can search for different kinds of information in different moments of her life—e.g., for school, job, or leisure—or even cultivate different interests at the same time as an expression of different parts of her personality.

4.0 Priority among dimensions

As all the dimensions listed above are relevant to knowledge organization in some way, they should all be taken into account in a KOS. In practice, some are taken into account more often than others.

Beghtol (2010, 1049-52) reviews the main foundational principles that have been proposed for classifications, and identifies them in literary warrant, academic consensus, and phenomena themselves. Each of these three principles gives priority to a different dimension, that is respectively to documents, to perspectives and to phenomena, as discussed in the following paragraphs. (Further alternatives are also possible, though maybe less interesting on the theoretical plane: for example, founding a classification on the accidental physical features and

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size of buildings and shelves of a library or museum means to give priority to the collection dimension; the German "three-level libraries" organized in sections of increasing specialization (Emunds 1976) give priority to the needs dimension; and providing separate sections of a library or a catalogue devoted to children, young, or blind people gives priority to the people dimension.)

Literary warrant, as formulated by E.W. Hulme, is a classical principle of general classification, claiming that classes in classification systems should be created on the basis of actually existing documents dealing with each topic (Hulme 1911; Svenonius 2000, 135). Classificationists should reserve an appropriate provision of classes only for topics that are treated in literature widely enough, while they should not create classes for topics not yet treated in literature, even if logic would suggest that they could be. This principle gives priority to dimension δ; indeed, classifications are assumed to start from the material documents and the practical need of organizing them in a collection. In this approach, both perspectives and phenomena are only considered inasmuch as they are the subject content of some document. The "universe" to be classified is thus divided primarily into documents of type x, documents of type y, and so on. In such classifications as the *DDC*, this is reflected in some classes for dictionaries, for journals or for bibliographies, which have the same status as those for religion books or for literature books. What first matters is the document, while its subject is only an attribute of it.

Academic consensus was taken as another foundational principle by H.E. Bliss (1933), to state that disciplines listed in a classification should be identified and ordered according to the agreed opinion of a majority of scholars. As with literary warrant, this principle also delegates the decision on the arrangement of classes to a reference outside the creators of the classification. It moves priority, however, from dimension δ to dimension γ: indeed, the items to be classified are not the documents anymore, which are now considered just as material carriers, but the disciplines. Bliss' Bibliographic Classification, like most classifications adopted in libraries, is structured basically as a list of disciplines, which are only later divided into subclasses or analyzed into facets. When a given phenomenon is listed in their schedules, say "bats," this is always meant in the context of some disciplinary main class, e.g., "zoology," so that the actual meaning of the subclass should be formulated more precisely as "systematic zoology of bats;" bats as symbols in folklore would be classified in a completely different class.

The emphasis on domain analysis in knowledge organization research (e.g., Hjørland and Albrechtsen 1995) also reflects this approach. Indeed, domains are also part of dimension γ, the difference with disciplines being that

domains are identified on a more social basis, in terms of communities of discourse which provide a relevant corpus of concepts and related terminology, rather than as traditional divisions in academic teaching. Thus some domains overlap largely with a discipline while others do not.

What all approaches giving priority to dimension γ have in common is that they tend to make the borders between specialists of different perspectives even stronger than they are at present. Indeed, as the existing differences in terminology, methods, and viewpoints are accounted for in a perspective-based KOS, users will be encouraged to think in terms of those differences in order to get familiar with the KOS and to navigate it, thus reinforcing the separation between the corresponding classes. The classifier only has a passive, bureaucratic role; her task as an information professional simply consists in recording the existing divisions in the production and use of knowledge with due accuracy and ensuring that they are respected in present and future usage.

On the contrary, Lambe (2015) has emphatically encouraged knowledge organizers to abandon the passivity of such a role, and to become aware that different KOSs can lead to different consequences in society, sometimes even to the point that a human being can die or not depending on different KOS applications. After all, knowledge organization can be more ambitious than it often is, by advocating a more active and propositive role to itself. This is possible if KOSs are constructed not just on the basis of external forces, but according to their own autonomous principles.

One important function that can be promoted by a more active approach to knowledge organization is interdisciplinarity. Many authors have complained about the intellectual grids that force researchers to stay confined within their discipline of provenance, preventing them from exploiting relevant knowledge on related topics that is available in other disciplines and combining it into new, fruitful developments (see Szostak, Gnoli and López-Huertas (2016) for an analysis of the problem in relation to knowledge organization).

The whole eighth conference of the Spanish chapter of ISKO, held in León, was devoted to the theme of interdisciplinarity and transdisciplinarity (Rodríguez Bravo and Alvite Díez 2007). In his presentation, Rick Szostak (2007) launched the idea of a manifesto for interdisciplinary KOSs, and the idea was approved by several people in attendance including the present author, Mela Bosch, María J. López-Huertas, and the conference organizers. Thus we actually formulated what became known as the León Manifesto and published it, for practical reasons, on the website of the Italian Chapter of ISKO; some weeks later it also appeared in this journal (León Manifesto 2007).

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The Manifesto is structured in five points:

- the current trend towards an increasing interdisciplinarity of knowledge calls for essentially new KOSs, based on a substantive revision of the principles underlying the traditional discipline-based KOSs;
- this innovation is not only desirable, but also feasible, and should be implemented by actually developing some new KOS;
- instead of disciplines, the basic units of the new KOS should be phenomena of the real world as it is represented in human knowledge;
- the new KOS should allow users to shift from one perspective or viewpoint to another, thus reflecting the multidimensional nature of complex thought. In particular, it should allow them to search independently for particular phenomena, for particular theories about phenomena (and about relations between phenomena), and for particular methods of investigation; and,
- the connections between phenomena, those between phenomena and the theories studying them and those between phenomena and the methods to investigate them can be expressed and managed by analytico-synthetic techniques already developed in faceted classification.

The points especially relevant to the purposes of this paper concern 1) the introduction of theories and methods as relevant components of a classification system, as a result of Szostak's previous work (in my scheme above, both theories and methods are facets of dimension γ); and, 2) taking phenomena over disciplines or other components as the prior dimension on which a classification system favouring interdisciplinary research should be built.

Dimension β of phenomena is indeed the other big alternative considered by Beghtol (2010, 1051-2). Despite the prevalence of disciplinary classifications, this alternative, as mentioned above, has already been explored partially in Brown's *Subject Classification*, has been drafted in more explicit ways in the CRG NATO system and in some other systems of the subsequent decades and is currently being developed in the ILC (inspired by the CRG drafts) and in the BCC.

Although we still lack enough data to evaluate the effectiveness of phenomenon-based vs. discipline-based classifications on a quantitative basis, as rightly suggested by H.-Peter Ohly during discussion at the German ISKO Conference in 2008, it is now quite clear that the alternative is a real one, and that it is worth being explored. The purpose of the present series of papers is indeed to introduce the structural features of a phenomenon-based classification system in more detail.

One important advantage of a system giving priority to dimension β is that emphasized in the León Manifesto; documents dealing with the same phenomena from different disciplines can be connected much more easily as they will either belong to the same main class or will both include the notation for the phenomenon as some part of their classmarks so that it will be possible to retrieve both in the same search. This will promote interdisciplinarity.

However, interdisciplinarity is not the only purpose of such a system. More generally, a classification of phenomena is a sounder, more general reference to which all concepts can be referred. In a discipline-based classification, a certain phenomenon, say a plant species, is listed in several disciplinary classes (biochemistry, botany, pharmacology, landscape architecture, etc.) without any explicit relationship between them, apart from an alphabetical index where available. The representation of that plant is scattered across the system. In a phenomenon-based classification, the plant itself becomes a reference concept expressed by a stable notation—what Farradane called its "place of unique definition" (Classification Research Group 1969). All documents dealing with it as their main theme will thus be gathered under the corresponding class; other documents dealing with the plant as only a particular theme will still be scattered in various points of the scheme, but will be retrievable in an easy and consistent way through its stable notation.

Even among discipline-based systems, both Coates's *Broad System of Ordering* (Mills 2004; Kawamura 2007) and Bliss Bibliographic Classification 2nd edition (Gnoli 2005) provide some room for phenomenon classes. The UDC is gradually evolving towards a freer combination of concepts, some of which are defined in auxiliary tables independently from disciplines, which presupposes the idea of a place of unique definition (Gnoli 2007); the whole scheme has been interpreted in phenomenon terms for application in school libraries (Cousson 2009). Even the editors of *DDC* are "moving towards a topic-based *DDC*" (Green 2015), where "topics" are meant to be the concepts listed in captions and the alphabetical relative index, which can be disciplines but are often phenomena. This trend is probably stimulated implicitly by the fact that phenomena offer a more general reference ground for defining the relationships between concepts and the disciplines themselves.

Indeed, disciplines, domains, theories and other perspective facets can still be dealt with in a phenomenon-based system. They can be defined in terms of phenomena (e.g., botany will be defined as the scientific study of plants), and such a definition can be formally recorded in schedules in various ways, thus allowing for later retrieval of the related classes. The same can be said of docu-

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ments (handbooks can be defined as a class of phenomena belonging to artifacts, and can be used in turn as a document facet, as it will be explained), as well as of collections, of needs and of people.

Therefore, taking phenomena as the prior reference does not prevent the other dimensions from being accounted for in a scheme and being searched for through it. The next section discusses in more detail how relationships between dimensions can be managed in such a kind of classification system.

5.0 Articulation between dimensions

The schedules of a phenomenon-based classification scheme will thus list phenomena, rather than disciplines, domains or other entities, as its main classes. Everything will be considered as a phenomenon, including the disciplines, documents, collections, needs and people, which ultimately are but special kinds of phenomena. More precisely, the whole scheme will consist of one single schedule, subsuming all kinds of classes. Classes for the phenomenon of disciplines will be listed at one particular place in the schedule. For example, in ILC disciplines are listed under class "y knowledge":

y	knowledge
ys	sciences
ysd	physics
ysq	linguistics
ysx	ethnography

In order to implement the recommendations of the León Manifesto, the other dimensions also have to be expressed in classmarks where appropriate, by means of some analytico-synthetic device.

As phenomena are the primary reference, a classmark will usually begin by notation expressing some phenomenon β (say, *mqvtofbg* "tigers"). To this, notation for other dimensions can be appended (tigers, in the perspective of ethnography, documented in video, collected in a museum hall). (Notice that the frequent use of animals or plants as examples does not depend on any bias of this approach towards the natural sciences; it is only a way to make subtle ideas more immediate to grasp by referring to mesoscopic phenomena, that are closer to everyday experience as compared to microscopic or macroscopic ones. Still it would be equally possible to take quarks or economic systems as examples without altering the logic of the argumentation.)

In phenomenon-based classification, the default standard citation order of dimensions in a classmark will be β, γ, δ, ε …. However, alternative orders are clearly possible (see below), and are implemented routinely in discipline-based classifications ("ethnography, studying tigers, …").

The syntax of ILC expresses relationships of the basic class with other dimensional components of the subject by treating them as a series of facets introduced by some *0*s. These are usually cited after the ordinary facets *1* to *9* used to specify attributes of the phenomenon (as in "tigers, female, in Asia").

In particular, dimension γ of perspectives is indicated by facets starting with *0-* (*mqvtofbg07sx* "tigers, studied by ethnography"); dimension δ of documents is indicated by facets starting with *00-* (*mqvtofbg00m* "tigers, documented in video"); and so on. To schematize it,

β	phenomenon
β0γ	phenomenon, in perspective *γ*
β00δ	phenomenon, in document *δ*

These can be combined according to the standard citation order:

β0γ00δ phenomenon, in perspective *γ*, in document *δ*.

A two-dimensional classmark of the form *β0γ* will thus look like this:

mqvtofbg07sx "tigers, studied by ethnography."

In case *β* has its own facets (e.g., "in Asia"), these will precede the dimensional facet *γ* in the citation order:

mqvtofbg2k07sx "tigers, in Asia, studied by ethnography."

Indeed, Asia is here part of the studied phenomenon, rather than being part of the perspective. Only in the latter case (tigers of unspecified place in the world studied in Asian ethnography) would a facet for Asia be appended after the discipline facet.

More perspective facets can be introduced by further *0-* indicators, in order to specify other perspectives from Table 2, like cultural context or theory or method. These are listed in Gnoli (2010) and exemplified in more detail in Szostak and Gnoli (2008).

As a third component, we can append a facet expressing dimension δ of documents (e.g., "documented in video") at the right end of the classmark, to express the subject of a video showing tigers in some context of ethnographic interest:

mqvtofbg07sx00m "tigers, studied by ethnograhy, documented in video."

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We are not going further into the details of ILC notation and syntax here, as our purpose was only to show how components belonging to different dimensions can all be expressed and combined in a standard citation order.

The order β, γ, δ, ε ... presented above does not prevent expressing a priority of perspective or of another dimension where appropriate. Indeed, this can be needed even in phenomenon-based classification to express cases where a dimension other than phenomena is prior in the knowledge item itself. A book discussing ethnography itself as a discipline should be indexed with ethnography as the main theme expressed at the beginning of the classmark, possibly followed by phenomena that are discussed as case studies ("ethnography, studying tigers"). Notation for the phenomenon will then follow notation for the discipline, and will be connected to it by an inverted dimensional facet (notational devices for inverted facets are available in ILC).

In principle, this would also allow a phenomenon-based classification to mimic the logic of classmarks in a common disciplinary classification. This possibility demonstrates that phenomenon-based classifications have more representational power than discipline-based classifications. Although giving priority to phenomena or to disciplines is a matter of choice also depending on local purposes, the former have the advantage that they are able to encompass the latter as the basis of a general reference system, while the reverse is not the case; while disciplines can be treated as a special class of phenomena, phenomena can hardly be a special class of disciplines.

6.0 Discussion

This part of the present study has concerned the analysis of dimensions in knowledge and knowledge organization. While some dimensions have already been identified and discussed in existing literature on classification, a more systematic framework has been provided here, consisting of a list of dimensions identified by labels and Greek letters (adopted to avoid confusion with the Latin letters and digits used in classmarks).

It has been shown how our approach supports a broader view of knowledge organization than that developed in the (still valuable) tradition of general classification. In our view, knowledge organization should not limit itself to representing the order of concepts as they are presented in existing disciplines, documents or institutions. Instead, knowledge organization can aim at a more active role by representing knowledge units and their relationships with its own independent methods, thus enabling researchers to creatively explore inter-disciplinary and cross-medium connections. An ethnographic video on superstitions about tigers can be relevant for the PhD thesis of an ecologist investigating factors that affect changes in tiger populations.

Knowledge organization has the potential to provide general, comprehensive tools for organizing books in libraries, items in archives, specimens in museums and gardens and artworks in galleries, rather than forcing them into separate indexing systems. While some initial considerations have been put forward about e.g., the application of thesauri developed by the LIS community to museums (Will 1993), much more experimentation and theoretical work have yet to be done concerning cross-medium application of KOSs and of knowledge organization principles.

This will be possible if the focus of knowledge organization will be moved from documents and their material and content features to other component dimensions of knowledge. Dimensional analysis suggests that, as reality in itself is unattainable by direct knowledge, the most general dimension to which the other ones can be referred is that of phenomena. Accordingly, a KOS aiming to work as a very general reference for any kind of knowledge should be based on phenomena, and should treat the other dimensions as for their relationship to phenomena.

Once the prior role of phenomena and their relationships with the other dimensions have been made clear, we have to move towards the examination of how phenomena can actually be classified. Which classification principles are available, and how should they be applied in order to produce good phenomenon-based KOSs? These questions have to be addressed in the next parts of the present study.

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