Mapping of the Universe of Knowledge in Different Classification Schemes

M. P. Satija*, Daniel Martínez-Ávila**

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ABSTRACT

Given the variety of approaches to mapping the universe of knowledge that have been presented and discussed in the literature, the purpose of this paper is to systematize their main principles and their applications in the major general modern library classification schemes. We conducted an analysis of the literature on classification and the main classification systems, namely Dewey/Universal Decimal Classification, Cutter's Expansive Classification, Subject Classification of J.D. Brown, Colon Classification, Library of Congress Classification, Bibliographic Classification, Rider's International Classification, Bibliothecal Bibliographic Klassification (BBK), and Broad System of Ordering (BSO). We conclude that the arrangement of the main classes can be done following four principles that are not mutually exclusive: ideological principle, social purpose principle, scientific order, and division by discipline. The paper provides examples and analysis of each system. We also conclude that as knowledge is ever-changing, classifications also change and present a different structure of knowledge depending upon the society and time of their design.

1. Introduction

The concept of the "universe of knowledge" is a metaphor of great importance in library classification theory (Hjørland, 2006). Different authors in different moments of history have provided examples and models on this concept in relation to classification: tree, maps, atlas, and even constellations and multiverses (in the most physicist fashion, such as in Heuvel & Smiraglia, 2010; Smiraglia et al., 2011) are some of the examples that have been used in the literature. A common concern of all classificationists reflecting on the universe of knowledge is the necessity of mapping or translating knowledge "out there" into concrete and logically developed classes that compound the classification system. This is one of the core aspects of knowledge organization and development of knowledge

* Guru Nanak Dev University, Amritsar, India (satija_mp@yahoo.com)
** São Paulo State University (UNESP) Marilia, Brazil (dmartinezavila@marilia.unesp.br)
(corresponding author)

organization systems. The methodological approach to this mapping (e.g., top-down or bottom-up) has been also considered as an epistemological question (e.g., Hjørland, 1992). In other cases, the sole mention of universality in classification (as in universal representation) has been politically questioned from critical and poststructuralists stances (in opposition to the inclusion of the particular views of marginalized groups, as in for instance Olson, 2002; Martínez-Ávila & Guimarães, 2013; Sahadath, 2013; Martínez-Ávila et al., 2016). This position is summarized by Olson (1998, p. 217) as follows: "The rejection of universals or absolutes is central to postmodernism and poststructuralism. This rejection is accompanied by the suggestion that realities are constructed by discourses operating within societies. [...] The rejection of universals suggests a relativism that some critics find threatening, but does not require this frightening fragmentation of realities. Automatic acceptance of absolute individuality as concomitant to rejection of universality is a tacit acceptance of binary opposition, the intellectual division of concepts into dualities. Such binarism is a presumption that one conceptual framework is universally applicable." On a theoretical plane, and especially from a poststructiralist point of view, Smiraglia et al's discussions on multiverses might provide an exciting solution to this problem. However, in practice, common and implicit understandings of universe and universals among classificationists might be different. While Green et al. (2002) discussed universality in classification as "full equivalence across schemes for knowledge representation and knowledge organization," Szostak (2014) raised the question of the multiple meanings of universal in the classification fora, and also put the definition that it is understood and followed in this paper: a universal system that has a place for everything (and thus everything is potentially represented in the system). As not only the concept but also the practical mapping of the universe of knowledge has been approached differently by the different authors. In this paper, we aim to review and systematize the main principles for mapping the universe of knowledge and the examples of mappings in the different modern library classification schemes. While the methodology of the first part of the paper would ressemble those of the critical writings or essays, for the second part of the paper we have reviewed and systematized the way knowledge is mapped in the most common library classifications. The information about each system has been extracted from the literature and the systems themselves following a criteria of relevance for the purpose of this study.

2. On the concept of knowledge

Knowledge can be defined as the sum total of conserved ideas, facts, fiction, myths, experiences and expressed emotions conserved by the society. In simple words, what is known to the society and is held in its collective memory is knowledge. Knowledge is essentially public. Private knowledge is not knowledge *per see*. Tacit knowledge is formed with public knowledge. In other words the society is the conservator of knowledge. The knowledge is knower dependent. Humans are the creators and consumers of knowledge to solve problems facing society, or may be created for its own sake. Whatever be new knowledge invariably leads to new systems, products, services, values and ultimately the outlook to life and the universe. All assorted chunks of knowledge can be unified into a single big whole. There is unity in knowledge says Jesse. H.

Shera (1903-1981) (Shera, 1970). In other words, the entire body of knowledge is a system having its definite characteristics:

- Knowledge is not independent, it is dependent upon the knower, the man (Meadows, 1991, p. vii). Knowledge originates from the environment, both physical and social. Human being is the knower. The Nature, including society, is the ultimate source of knowledge. Our sense organs are raw tools to perceive data and convert these into knowledge.
- It is conserved and used by the human society. Thus it is social in character.
- Knowledge is never complete. It is fragmentary, dynamic, multidimensional and changing. It changes with time and society and with its own progress.
- Knowledge builds on knowledge, and is thus cumulative especially the empirical knowledge
- Thus it is inexhaustible, i.e., never ending. In other words it tends to be infinite
- Technology, social advancements and knowledge discovery are mutually dependent.

Information is generated when the knower interacts with the nature through the sense organs. Information thus gained is given context with the previously conserved knowledge for its use and validation. Thus knowledge is socio-biological in nature. Society is the producer and consumer of knowledge, while knowledge is the prime mover of society. Thus society and knowledge are inextricably locked in mutual influence on one another. It is not possible to isolate the one way influence. Knowledge grows as society grows; whereas society changes and develops progressively as new knowledge is generated. It is the society which decides which kind of knowledge it is going to have; in which direction and in how much quantity; and determines the value scales for the different categories of knowledge. Therefore thrust areas in research to develop new knowledge will depend on the values and priorities of society at a given time.

3. Importance of knowledge studies for librarians

Knowledge is both public and tacit, recorded and oral (tribal and illiterate societies orally preserve their knowledge). Librarians deal only with recorded knowledge i.e., documents. Knowledge is stock in trade of the librarians and information professionals. Therefore, quite obviously the study of the knowledge, its characteristics, and structure is important to we librarians. Study of the nature of knowledge is as important to the library and information professionals as is the study of anatomy to a surgeon, says Jesse Shera (1970). Hence as librarians we need to know the sources, nature and structure of knowledge. Only then we will be able to collect, organize, disseminate and preserve it effectively.

4. Modes of growth of knowledge

Knowledge has always grown incessantly, but now is growing so turbulently that it has been termed as information revolution. New subjects are emerging. S.R. Ranganathan (1892-1972) identified

many modes of growth of subjects of various kinds. These are:

A	**By Specialization**	
	A1	By Denudation (Vertical Division)
	A2	By Dissection (Horizontal Division.)
	A3	By Lamination (Specification)
B	**Interdisciplinary mode**	
	B1	By Loose assemblage (*Ad hoc* Combination)
	B2	By Fusion (Permanent Combination)
C	**Multidisciplinary**	
	C1	By Distillation (Indiscriminately fused)
	C2	By Agglomeration (Permanently federated)
	C3	By Subject bundles (Loosely gathered, *ad hoc*)

The modes of formation of subject cast a considerable influence on the structure of the subject. Explanation of these modes of formation of subjects is beyond the scope of this paper though the process has been extensively reviewed in Satija et al. (2014).

5. Mapping of the universe of knowledge

As said earlier, knowledge is ever growing, changing, and becoming ever new. New subjects constantly emerge, old subjects change their status, structure and boundaries. There is no universal pattern of all knowledge that could be all things to all users. Therefore individual subjects change their structure; and relationships between subjects can be seen in different ways. The prevailing philosophy, material culture, economic and technological needs, cosmic vision, sense of history and values held by the society influence the boundaries, status and structure of the stock of knowledge in its possession. Every age and society has a distinct view of the structure of knowledge and relative value of its different fields (McGarry, 1991, pp. 132-148). For example, in the Middle Ages theology was considered the queen of sciences and other subjects were valued according to their capacity to serve her. Natural sciences considered as an idle man's curiosity were not valued much then. Even during the times of Melvil Dewey (1851-1931) in the late 19th century, philosophy and theology occupied a very respectable position. It is evident from the fact that 1/5th of space in the Dewey's universe of knowledge was occupied jointly by these two classes. Today the scales are tilted towards the study of natural sciences and their economic and technical implications. Sciences rule the roost and have been given the de facto status of a national religion in some secular countries (In India the Parliament passed a science policy resolution making science the main "religion," Vasantha, 2000). Empirical and experimental modes of investigation are considered reliable methods to discover new knowledge and solve epistemological problems. These days authority, faith, speculation, and intuition as sources of knowledge are looked upon with suspicion by the scientific community. Thus the status a subject commands in a society is never constant. Some

subjects once important and at the center stage of knowledge are now relegated to a peripheral position. Once it was industrial production which was important. Today the environmental studies management, biotechnology and research on non-conventional sources of energy are gaining, importance. In the information society, subjects like resources management, human/animal rights, information technology, biotechnology, environment protection are pervasive.

5.1 Classifications are impermanent

As said earlier, with the emergence of new knowledge the status and position of existing subjects undergo a change. Inter- and intra-subject equations are always in a flux. For example, many subjects such as public health, international law, geopolitics, demography which had status of compound or complex subjects in the 6th edition (1960) of the Colon Classification gained the status of basic subjects in the 7th edition (1987) of the scheme. Many similar examples can be given from the DDC (see Miksa 1998 for a good recount of the DDC history in relation to the universe of knowledge). Thus knowledge structure is always perceived to be changing. An example of the scientific relevance of this matter is the recent special issue on "subject ontogeny and knowledge organization system change," published by the journal *Knowledge Organization* in 2016. Classification essentially represents knowledge, and is its map (Broughton, 2015, p. 94). It is a tool to analyze, organize and represent knowledge -thus a tool for knowledge management. Therefore, as the knowledge advances by filling gaps we need new classifications, or adjust and modify the earlier ones (Parrochia & Neuville, 2013, p. 18). We need new classifications from time to time as the new knowledge develops (Korford, 2017). We have not only to revise classifications, but have to invent new classificatory techniques to organize new knowledge. S.R. Ranganathan (1961) commended the DDC as the best classification for the 19th century literature. At the same time he thought it quite unsuitable to classify 20th century knowledge especially of the post-world wars period. Thus 20th century needed new classification system and techniques and the 21st century may well need new classification particularly for organizing the Internet. Regarding the structure of knowledge we need to limit ourselves to one epoch within one culture to find some firm basis for a unified knowledge.

5.2 Principles for mapping the universe of knowledge

D.W. Langridge (1925-2001), a well-known English librarian, identifies four principles for mapping of the universe of knowledge (Langridge, 1976, pp. 1-7). These, however are not mutually exclusive.

5.2.1 Ideological Principle

These are based on some schools of thought, or some ideologically held principles. Earlier examples are Christian schemes of the middle ages. Latest example is the Russian classification system BBK which had made Marxism-Leninism as the center of the universe of knowledge. To some extent every scheme is based on some ideology. No classification scheme can be value free or independent of the time and culture of its origin (Judge, 1984). Every scheme by default is biased towards

the values and culture of the society of its origin. That is why the Dewey Decimal Classification has to be modified and adapted to classify African and Asian subjects (relevant discussions on this matter include the analyses of the religion class in Africa by Afolabi, 1992; in India Comaromi & Satija, 1985; and in Korea by Oh & Yeo, 2001).

5.2.2 Principle of Social Purpose

Vedic system (1500 BCE) of the division of knowledge into categories of *Dharma* (Normative principles), *Arth* (social sciences) *Kam* (Pure sciences and arts) and *Moksh* (spiritual knowledge) is an example of this principle. This is a broad classification which arranges knowledge in an order of decreasing current social utility and in the increasing potential for future use. *Dharma* is for formation of the society, *Artha* for its governing, *Kama* for its material progress and pleasure pursuits, while *Moksha* (salvation) is to prepare for the life after death. This is a theoretical classification which has never been the basis of a library classification or any detailed knowledge classification. Ranganathan was a bit influenced by it but he never used it as the basis of his Colon Classification.

5.2.3 Scientific Order

Based on some natural and logical order of subjects the principles of scientific order were first crystallized by E.C. Richardson (1860-1939) in his famous book, *Classification: Theoretical and Practical* (1901). C.A. Cutter (1837-1903) used the evolutionary order of main classes in his *Expansive Classification* (1893). Cutter was of the opinion that nature has an order which should be reflected in knowledge organization systems. His system is based upon the assumption, "order of sciences is the order of things, and order of things is the order of their complexity." This is obviously under the influence of the theory of origin of species as given by the Naturalist Charles Darwin (1809-1882). Entities in nature have evolved from atomic to molecular, and to molar forms. In the modern terms it is known as theory of integrative levels prorogated by J.E.L. Farradane, D.J. Foskett and others for using its principles for organizing our knowledge, which of course is in a visible state of constant evolution. These principles were used to some extent by J.D. Brown (1862-1914) in his Subject Classification (1906), and H.E. Bliss (1870-1955) in his Bibliographic Classification (1935). The arrangement of classes in the Library of Congress Classification is also based on this principle. The arrangement of classes in botany and zoology in the DDC and CC is predominantly taxonomic. But its full implications were explored by the Classification Research Group (CRG) London (established in 1955) when the Group attempted to solve the problems of general classification schemes and tiered to design a new system of library classification. The vague evolutionary order was more deeply explored and precisely defined in the theory of integrative levels by J.E.L. Farradane (1906-1989) and later propagated by D.J. Foskett (1918-2004). The objective of this theory was to "identify all the entities or objects of knowledge in existence, and to order them by means of a theory and thus provide a structure of knowledge." Obviously this theory applies mostly to natural objects which have physically evolved. It is also applicable to social entitles which obviously are always in a state of slow social evolution. Ranganathan (1967, p. 185) also prescribes the principle of evolutionary

sequence to arrange entities of an array in a helpful sequence.

5.2.4 Principle of Arrangement by Disciplines

A discipline is a major and cohesive chunk of knowledge formed by a single mode, or having the similar objects of study. Major contribution of Melvil Dewey (1851-1931) was to adopt the division of knowledge by discipline. The DDC (in its Glossary, vol. 1) defines a discipline as "an organized field of study or branch of learning dealing with specific kinds of subjects and/or subjects considered from specific points of view." Disciplines differentiate knowledge into number of logically distinct main classes characterized by the possession of cohesive types of concepts, structure and method of creation and verification of new knowledge. The division by discipline offers hope for a comparatively better, though by no means perfect, solution to the problems of information retrieval and to meet the needs of library users. First exposition of this method is from the *Advancement of Learning* (1605) by famous English philosopher, man of letters, and scientist Francis Bacon (1561-1626). He deeply examined the then prevailing state of knowledge and means of its production. He suggested (though erroneously) that there are three kinds (major disciplines) of knowledge based upon three faculties of mind, namely Memory, Imagination and Reason. This produces correspondingly three major disciplines: History, Arts, and Sciences. However, it is debatable whether these disciplines are autonomous, mutually exclusive, and fuse to make an integrated whole of knowledge. Anyhow, the present age is the age of division by discipline in unison with the trends pursued by scholars and reflected by the university academic organization.

6. Mapping the Universe of Knowledge in some General Library Classifications

In this section we will review how the universe of knowledge has been represented in some general library classification systems. Different classification schemes outline and represent the universe of knowledge in their own way observing some different principles.

6.1 In the DDC/UDC

Melvil Dewey based his classes on the inverted Baconian order formulated by his contemporary Hegelian philosopher W.T. Harris (1835-1909). Its first division is by discipline and it was the first library classification to do so. Division by discipline implies that one class can collocate all aspects of a subject. Subjects/topics are scattered by discipline. The three great divisions, produced by three faculties of the mind, are:

Main Classes	Disciplines	Faculty
100-600	Sciences	Reason
700-800	Arts & Literature	Imagination
900	History	Memory

In fact there are ten main classes 1-9 and the preceding Generalia Class 0. These ten main classes reflect the educational consensus of the late nineteenth century Western academic world. The DDC main classes are disciplines divided into sub disciplines which in turn are subdivided into subjects and their further aspects. A discipline provides a context for a subject.

6.1.1 Rigidity/Artificiality of the Decimal Notation

The DDC has been rightly criticized for its rigidity of division by ten at every step of its division. Major and convincing argument put forth by its critics is that knowledge does not proliferate into patterns of ten at every stage of its development. Indeed growth of knowledge is not conditioned by decimal or metric system. It is an artificial and rigid mold like the Procrustean bed. It happened because Dewey chose his notation first and classes were formulated later. Notation became the master to dictate its own convenience.

But the decimal fraction has a great advantage for hospitality in chain. Hierarchically the DDC subdivisions can be carried to any level by addition of a digit to the right. At each level the specificity/intension of the subject increases:

000/999	Universe of knowledge
300	Social Sciences
330	Economics
332	Financial economics
332.4	Money
332.42	Monetary standards
332.422	Monometallic
332.4222	Gold Coins
332.422209	Hallmark future-History

Visible hierarchy obtained as default by the use decimal notation is the hallmark feature of the DDC. However, the order in main class array is not without glaring faults: Religion (Theology), which is based upon faith rather than reason, has been included in the faculty of Reason.[1] Languages (400) has been separated from Literature (800). History (930/990) has been separated from social sciences. History and geography sharing the same main class is only due to paucity of space than any affinity between the two. Many more such irregularities can be mentioned at lower levels of divisions and sections. Dewey was of the opinion that the order of classes did not matter much as long as every class was given some place in the schedules. He provided a powerful and ingenious index for this purpose.

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1) This could be a lingering relic of the medieval ages when the Church held its clutching sway over life, thoughts, and the state.

The DDC, true to the times (19th century) and country of its origin (USA), is a practical scheme. To explore its theoretical or philosophical base is an unprofitable exercise, if not a futility. Dewey's concern was to devise a scheme which mechanizes a shelf order and provides an appropriate place for the incoming new subjects without disturbing the established order. Dewey's contribution lies only in solving a practical problem of hospitality. He neatly did that and successfully achieved that with his decimal fraction notation which is a major invention. Its seemingly lack of any theory is a later day invented criticism.

6.2 Cutter's Expansive classification

Expansive Classification (1891-1893) by C.A. Cutter (1831-1903) is important for arrangement of its pre-mediated order main classes. It was to be evolutionary order based upon the evolution of knowledge. He was of the opinion that book classification based on knowledge classification has a permanent value. Cutter used alphabets to denote classes to escape the rigidity of decimal notation. His broader classes are:

A	Generalia works
B/D	Philosophy and Religion
E/G	History and Geography
H/K	Social Sciences
L	Sciences and Arts
M/Q	Biosciences, Medicine
R/V	Useful arts, Technology, War, Athletics.
W	Fine Arts
X/Y	Language and Literature
Z	Book Art

Cutter himself explained: The Expansive classification follows the evolutionary order throughout. In natural history it puts the parts of each subject in the order which theory assigns to their appearance in creation. Its science proceeds from atomic to the molecular and then to the molar, from number to space, from matter and force, and then to matter and life. Its botany goes up from cryptograms to phenerograms. The book art follows the history of the book from its production, through its distribution, to its storage and use in libraries and ends with their description that is bibliography. Economics too has a natural order: population-production-distribution-property-consumption… (Maltby, 1975, p. 124). This arrangement has practical value since it bring together books which one may wish to use at the same time. Cutter's classification is dead now, but its influence has been considerable especially on the Library of Congress Classification. It was the first library classi- fication based on some definite and objectively expressed principles, and definitely the first classification which wanted a library classification to be more than just shelf arrangement.

6.3 Subject Classification of J.D. Brown

James Duff Brown (1862-1914) was a star librarian famous for introducing open access in libraries of England. His Subject Classification was first published in 1906 and revised posthumously in 1917 and 1939. Its main class order is interesting, as arrangement of subjects was different from that of the DDC and Expansive Classification. He claimed his main class order was in "Scientific progression". He was of the opinion that order of creation in nature is: Matter -> Force -> Life -> Mind -> Record. Accordingly the sequence of his main classes is:

Matter and force

	A	Generalia
	B-D	Physical Sciences

Life

	E-F	Biological Sciences
	G-H	Ethnology Medicine
	I	Economic biology

Mind

	J-K	Philosophy and religion
	L	Social and Political Science

Record

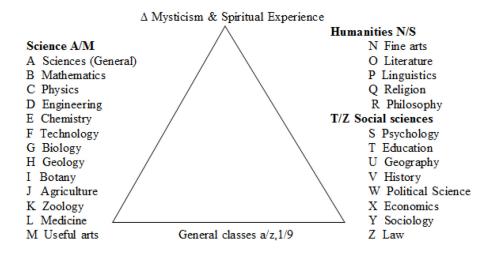|		
	M-N	Language and Literature
	O-W	History and Geography
	X	Bibliography

Brown is famous for his experimental "one-place theory", which is to collocate a subject and all its aspects at one place rather than to scatter them by discipline as done in the DDC and other systems. With the concrete subject as the basis its abstract aspects are placed around it. Let us take different aspects of the subject Copper: Metallurgy, Mineralogy, Chemistry, Conductivity, and Economics. The SC places all these aspects together with Copper, that is why it is called one-place theory. The concrete subject (Copper) is placed in a science to which it belongs most near. In this case it is mineralogy. Similarly, Apple is placed under Botany. Practice follows theory: Chemical technology is placed under Chemistry. But this one-place theory more often produces very funny and embarrassing results: Body exercises and body funeral come at one place in this system! Though the broader sequence of main classes is in perfect evolutionary order, but one place theory failed to give logical sequence to subjects. Nevertheless, it was a bold attempt to experiment with an alternative to division by discipline. The experiment failed. But the lessons from Brown survive.

6.4 Colon Classification

Colon Classification (1st ed. 1933) by S.R. Ranganathan (1892-1972) is a thoroughly faceted and theory based classification. Ranganathan was very particular about the order of main classes

and of facets in a class number. For him the order is the essence of classification. He formulated some postulates and principles for order of classes in arrays and chains, and facets in the facet formula. Contrary to expectation the order of main classes in the CC is not Vedic, though a weak influence of this system can be seen. His broader main class order is:

These can be represented by a triangle as given in the figure. Ranganathan was of the considered view that Sciences have evolved first followed by humanities; social sciences are the last to come into being. Keeping in view the social and academic trends, Ranganathan devoted half of the total notational space to main classes of science and technology. The other side of the triangle has been divided between humanities and social sciences. Sciences A to M are in the order of their increasing concreteness. B mathematics is most abstract of the sciences; C physics is more concrete than B mathematics and less concrete than D Engineering and so on. M useful arts having crafts and miscellaneous technologies such as Textile engineering Rope making, Carpentry, Smithy, Games, and Sports is the most concrete of the sciences. Within sciences Ranganathan follows the serial system i.e., principle of theory and practices alternating one another − as first given by August Comte (1798-1857). For example, B mathematics has many applications in C Physics which in turn Technology follows E Chemistry; and J Agriculture follows I Botany. In this way theory and its applications have been brought together, which have been separated in the DDC. But this order also separates Agriculture from Animal husbandry which are usually practiced together (Buchanan, 1979, p. 112). The Humanities N/S have been arranged in the order of their increasing richness of contents. Social sciences T/Z have been arranged in the order of their increasing artificiality: Z Law is the most artificial of all the social sciences. Main class △ delta Mysticism and Spiritual Experience at the vertex of the triangle has been given top position in his map of knowledge. It is at the cross roads of sciences and humanities. True to his bent of mind and orthodox religious beliefs Ranganathan was of the opinion that Mystic and Spiritual knowledge is the source of all kind of knowledge. It is sum and summary of the entire empirical knowledge. Spirituality in India is regarded as highest knowledge of God and self - *sarve vidya pratishtha*. Hence its highest position

(Satija, 2017). In addition to his well thought out main class order the sequence of PMEST categories is in the order of decreasing concreteness while their connecting symbols are given ordinal values in a way that order of subjects on the shelves is from abstract to concrete or general to specific. This is called the Principle of Inversion. Rounds and levels of facets in the facet formula are arranged by the picturesque Principles of Facet sequence such as Wall-Picture principles, Cow-Calf Principle etc. Ranganathan went beyond the systematic order of main classes by uniquely arranging his documents on the shelves in a single unbroken but recurring pedagogical order in the entire library. Termed as the APUPA pattern by this methods books with in a main are arranged in preliminary (mostly reference documents), core texts and advanced texts suitable for self-learning a subject. He achieved this by dividing his common forms divisions (common isolates) into two categories of anterior and posterior (Satija, 2001).

6.5 The Library of Congress Classification (LCC)

Started in 1898 the first LCC schedule came out in 1902. Class Z Library science was chosen the first schedule to be developed. From the beginning, individual classes were developed by different groups of specialists under the direction of J.C.M. Hanson (1864-1943) and his assistant Charles Martel. There are 21 classes in 40+ schedules used by many US and foreign libraries. Cutter's Expansive Classification was the main guide to develop classes, with which it resembles in broad divisions. It is a classification by discipline. But is not universal being based on literary warrant. Schedules were developed from its vast collection. Its main classes were developed into sub classes denoted by two digits and are in a progressive order of general to specific. Tailored to local needs of world's biggest library the order of classes is even influenced by its building. Its success is a triumph of pragmatism over ideological embellishments.

A	General works
Social Sciences	
B	Philosophy, Psychology, Religion
C	History and Geography
H/L	Social Sciences
Humanities	
M/N	Music and Fine arts
P	Language and Literature
Science and Technology	
Q	Science
R	Medicine
S	Agriculture
T	Technology
U	Military Science
V	Navy
Z	Bibliography and Library Science

Yet some meaningful order of main classes can be perceived. General works lead the scheme which are followed by classes of philosophy and religions which set about theories on human beings in relations to God. C/G cover concepts such as human abode and their means of living, and transition of mind from primitive to advance culture. Related aspects H/L are social, economic, and political. M/P concern human aesthetics and intellectual development. Q/V are understanding nature and making material progress. I, O, W, X, and Y are kept vacant without any idea of their future inhabitants.

6.6 The Bibliographic Classification

Henry Evelyn Bliss (1870-1955) spent most part of his life in the study of the foundations of library classification. In Bibliographic Classification (BC, 1935, 1940-1953) the order of main classes is based on, what he calls, "Scientific and Educational Consensus." He was of the view that there is an order of main classes that exists in nature and it is nearer to the majority consensus. The order given by him is:

A	Philosophy
AM	Mathematics
B	Physics
C	Chemistry
D	Astronomy
E/G	Biology
H	Anthropology
I	Psychology
J	Education
K	Social Science
L/O	History
P	Religion (Alternative is Z)
Q	Social Welfare
R	Political Sciences
S	Law
T	Economics
U	Technology
V	Fine arts
W/Y	Language and Literature
Z	Religion(Alternative is P)

In addition he also used the principle of collocation and subordination to bring together closely allied subjects. For example, sciences and their applied aspects have been placed side by side. He also offered alternative locations for some subjects. For example, economic history could either be placed with economics or general history, and Religion either at P or Z. Such alternative locations

are numerous. On the other hand his theory of consensus has come under criticism. It is argued that there is no permanent order of main classes in nature, therefore it cannot be known, or no order is absolute. Moreover, this order is different from culture to culture. From time to time new subjects are formed and emergence of a new main class changes the status of other classes. Bliss' provision of alternative locations also goes against any absolute or permanent order of main classes in nature. Nevertheless, it is conceded that the order of main classes in the BC is logical and more stable, perhaps bit better than rival systems.

6.7 Rider's International Classification

Another general scheme "International Classification" is of Fremont A. Rider (1885-1962), an American librarian, famous for his advocacy of microforms in libraries. In 1961 he self-published his international classification "for arrangement of books on the shelves of general libraries." His scheme, a very broad one, has 26 main classes denoted by Roman capitals:

A	Generalia
B	Philosophy and Psychology
C/I	History and Geography
J/N	Social Sciences
O	Business & Industry
P	Military Science
Q/S	Physical sciences and Technology
T/V	Biology/Medicine/Agriculture
W	Fine arts / Music
X/Z	Language and Literature

The classes have been further divided alphabetically up to three letters, thus producing a total of (26x26x26) 17576 ultimate class numbers. Rider also announced that, being broader, his scheme will not be revised – indeed, broader a scheme less revision it needs. A broader KOS system is a self-perpetuating scheme which Ranganathan aspired for but never achieved (Ranganathan, 1949).

It can be described as a still born system, never used anywhere and even forgotten by the textbook writers. It did not sync with the times being primitively enumerative scheme born amidst faceted systems, and a broader one in times of turbulently growing knowledge needing depth classification. The broader arrangement is social sciences, science and technology, and humanities lastly. The author who described himself as 'master of none' did not seem to have cared for any order of classes.

6.8 The Bibliothecal Bibliographic Klassification (BBK)

The BBK, also abbreviated as LBC, was designed at and for the erstwhile Lenin State Library, Moscow. Published in 30 volumes between 1960-1968, its abridgments in 6 volumes (1970-75) and one volume (1976) are also available for medium and small libraries, respectively. Versions are also made out for types of documents such as printed books, electronic documents, or OPACs. Its 21 main classes are denoted by 28 capital Cyrillic alphabets. Since 1977 all versions provide alternative 1/9 decimal numbers. A brief outline of main classes looks like this:

1	General and interdisciplinary knowledge
2	Sciences (Physical and Bio)
3	Technology
4	Agriculture and Forestry
5	Public health and Medicine
6	Social sciences and Military art
7	Culture and Education
80/84	Language and Literature
85	Art
86	Religion and Atheism

Main tables are supplemented by two UDC-like tables of special and many common (including geographical) subdivisions. The system is hierarchical and faceted to some extent.

As clear, natural sciences and technology lead the list as could be expected from an atheist regime. These are followed by social sciences and humanities. Technology, agriculture, and medicine are aptly sandwiched between natural and social sciences. These are the bridge between science and societal needs. In between their further hierarchical subdivisions, an estimated total of 45,000 classes, are arranged in succession of their pedagogical order. As said earlier, their first place in every class is given to Marxism-Leninism. Broadly it can be seen that the disciplines are arranged in the decreasing order of their social utility as perceived in a socialist country. The sciences are from basic to applied; abstract to concrete; whereas social sciences move from quantity to quality. Fate of this system in a capitalist Russia is not known − though libraries always betray heavy inertia to replace a classification system once adopted.

6.9 Broad System of Ordering (BSO)

A general, faceted classification scheme for information exchange and switching is a unique system in the sense that it was not designed as a conventional classification for use in libraries or classifying knowledge *per se*. Commissioned by UNESCO in 1971 as a roof classification (an umbrella classification) for S & T, it was elaborated for the FID by Eric J. Coates, G. Lloyd and D. Simandi as a switching language to facilitate a broader level interoperability of various

indexing languages, library classifications, retrieval systems, information bodies and organizations. The aim was to make them mutually compatible on a very general level. As its another unique feature, it is the first originally designed post-1945 classification harnessing the modern developments in classification ushered in by S.R. Ranganathan and later by the Classification Research Group (CRG) and others.

Its first versions (1971) had only 4000 classes elaborated to 6800 in the 3rd and latest version (1994) available only in electronic form. It includes traditional disciplines, multidisciplinary and mission oriented subjects which can be expanded vertically and horizontally employing centesimal and millesimal fractions. Knowledge in BSO has been presented as a clockwise cyclic structure starting with application subjects such as 112 Logic, Mathematics Research methods, etc. starting at the left bottom of the circle going to 992 Esoteric practices at the right bottom. The 340 Life sciences, 480 Sports science on left side of the arc while 500 Humanities and social sciences, and 600 Technology on the right arc are high points on the circle.

112-188	Applied subjects, Logic, Math, Research Methodology
200-340	Physical & Bio sciences
359-420	Applications of life sciences
410-480	Agriculture, Environment, Medicine
445-480	Behaviour sciences, Education, Human Needs & Sports
500-588	Social studies
600-890	Technologies
910	Language & Literature
940	Arts
970	Religions
992	Esoteric practices

Compound subjects can be formed by facet synthesis with centesimal and millesimal notation introduced by a comma. The complex classes are formed with a hyphen, e.g., Information services in religion 970-140, Research in religion 970-182.

It is striking that application subjects precede the disciplines which have been arranged in the order: sciences, their applications Education, Human needs Social sciences proceed technology, art and religion as social sciences may determine directions for them. Esoteric practices which have least factual and verifiable knowledge have been placed at the end. It endows it with one of the most thoughtful order of knowledge in a documentary classification.

7. Summary and Conclusions

Table below summarizes the characteristics related to the mapping of knowledge of the analyzed systems.

System	Foundation	Major division	Notation main classes
Dewey Decimal Classification/Universal Decimal Classification	Baconian order of the three faculties of the mind (Reason, Imagination, Memory) as formulated by Hegelian philosopher W.T. Harris. Ideological Principle. Western-centric. Practicalism.	By discipline	Decimal
Cutter's Expansive Classification	Evolutiuonary and scientific order. Integrative Levels.	Not by discipline.	Alphabetical
Brown's Subject Classification	cosmic and social evolutionary order. Integrative Levels.	Not by discipline. One-place theory	Alphabetical
Ranganathan's Colon Classification	Evolutionary order for sequences. Weak Vedic influence. Spirituality in the highest position.	By discipline	Alphabetical
Library of Congress Classification	Practicalism. Literary warrant. Integrative Levels.	By discipline	Alphabetical
Bibliographic Classification	Scientific and Educational Consensus. Integrative Levels.	By discipline	Alphabetical
Rider's International Classification	Practicalism. General libraries.	By discipline	Alphabetical
Bibliothecal Bibliographic Klassification (BBK)	Ideological Principle. Marxism-Leninism.	By discipline	Alphabetical (Cyrillic) in origin, later versions numerical.
Broad System of Ordering (BSO)	Intended for information exchange and switching (umbrella classification)	By discipline	Numerical

Knowledge is sum total of what the mankind knows and is stored up in its collective memory devices. Knowledge is dynamic, changing, ever incomplete and infinite. Knowledge depends upon the knower, the man. It is social in character, so its structure changes from society to society and from age to age. Study of its nature, structure and characteristics is as important to library and information professionals as is the study of anatomy to a surgeon. Classifications represent knowledge and indicate position and status of its various branches. Since knowledge is changing so classification also change and present a different structure of knowledge depending upon the society and time of their designing. No classification is neutral and permanent. All classifications present an inherently biased or value loaded structure of knowledge visible in their main classes

order. The arrangement of main classes can be done in four ways: ideological principle, social purpose principle, scientific order, and division by discipline. These principles are not mutually exclusive. Knowledge has been mapped differently in different classification systems as perceived by their designers living in different societies and times. Dewey followed the inverted Baconian order of the main classes produced by the three faculties of the mind, namely Memory, Imagination and Reason. Major division is by discipline. It is a nineteenth century system which is further molded by the decimal notation. Division by ten at every step is artificial and rigid. Natural growth of knowledge knows no such constraints. Though the hierarchy depicts only one dimension of a class, but provides virtually infinite hospitality. Hierarchy has been adopted by all the later day classifications whether decimal or not. C.A. Cutter followed evolutionary and scientific order in main classes in his Expansive. Classification (1891-1893). Its science proceed from molecular to molar and mathematics from number to space. Subject Classification (1906) by James Duff Brown has a very interesting order of matter, force, life, mind, and record. The main classes are arranged in the cosmic and social evolutionary order. By way of experiment, Brown discarded the traditional approach of division by discipline. He applied one-place theory which chose a concrete subject, say, Iron or Apple and brought together all its abstract aspects at one place. For example chemistry, mineralogy, alloys, technology, archaeology, folklore of iron will be brought together at one place in the schedules. Other systems such as the DDC, LCC, BC and the CC scatter such aspects by discipline. But this one place theory did not yield good results to serve users needs. S.R. Ranganathan in his Colon Classification (1933-1987) uses alphabets to denote major main classes and made fool proof provisions for insertion of new main classes at proper places. In the 7th edition (1987) the number of basic subjects has grown to more than 750. The CC devotes half the place A/M to sciences which are arranged in the order of increasing concreteness. Humanities N/S are arranged in the order of increasing richness of contents; while social sciences T/Z are arranged in the order of increasing artificiality. $\triangle$ (Delta) Mysticism and spiritual experience is at the apex symbolizing the conflux of two streams and fountain head of all knowledge. He also used crystallized Principles of Helpful sequence for further arrangement within a main classes and for an overall shelf order what he calls APUPA pattern. H.E. Bliss in his Bibliographic Classification (1940-1953) based main classes on, what he called, Scientific and Educational Consensus. He also gave the option of alternative locations for some of the classes. His order of main classes is considered more durable. However, some philosophers rightly argue that there is no permanently consensual order of classes in nature. Whatever be, the order of main classes in BC has many merits. The BBK is inevitably biased towards the heavily loaded theories of Marxism-Leninism. The BSO delineates the best and thoughtful order, yet ironically it is not used for this purpose. In nutshell there can be no universally acceptable map of knowledge. Best of such order can be easily faulted. Indeed there is no perfect classification as found out by the Classification Research Group (Foskett, 1962). Such maps are only perceived, but there is no immaculate perception (McGarry, 1991, p. 134). These are convenient, inherently biased and change with time and place. Librarians must be aware of the characteristics and epistemology of the system they are using (and of the alternatives), so they know the bias and consequences of their system. Librarians need to know the sources, nature and structure of knowledge. Knowledge changes, so does its map and mapping. Nobody has said it in a better

way than Kevin McGarry (1991, p. 148):

Whatever views we have of human knowledge, the classification we use are, at best, temporary structures only. They act as maps to impose order on the unknown and we adjust them in the light of further discoveries. Those of us who guard the hoarded thought of humanity should bear in mind T.S. Eliot's observation on the ever changing nature of what we know:

> There is it seems to us
> At best, only a limited value
> In the knowledge derived from experience
> The knowledge imposes a pattern, and falsifies
> For the pattern is new in every moment
> And every moment is a new and shocking
> Valuation of all we have been.

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[About the authors]

M. P. Satija is Scholar in Residence, Satija Research Foundation in Library & Info Science, Delhi, and a visitng scientist at the Documentation Research and Training Centre, Bengalurue. He is retired as professor of library science and head and then UGC emeritus fellow from the Guru Nanak Dev University, Amritsar, India. In his long career he has written about twenty-five books and about one hundred papers in refereed journals on knowledge organization and Ranganthan. In his professional life he has collaborated with Ingetraut Dahlberg, founder and editor of Knowledge Organisation, John Comaromi, editor of the Dewey Decimal Classification (DDC) from 1979-1991 and Joan Mitchell, editor of the DDC from 1993-2012. He also served as Visiting Professor at the Marshall McLuhan Institute, Maastricht, Netherlands.

Daniel Martínez-Ávila, PhD, is Assistant Professor at the Department of Information Science, São Paulo State University (UNESP), Marília, Brazil. His area of specialization is knowledge organization. He is a member of the ISKO Scientific Advisory Council. He also collaborates with the Satija Research Foundation for Library and Information Science (SRFLIS), India, and the Institute for Gender Studies (IEG) at University Carlos III of Madrid, Spain.