

**Qualifying Examination
Part IV
Questions from Dr. F. Miksa**

Don Drumtra
University of Texas at Austin
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Dr. Fran Miksa, Chair
Dr. Randolph Bias
Dr. Larry Browning
Dr. Glynn Harmon

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Background

In some realms, the idea of a basic category or class is defined only loosely as the key categorical concept in some cluster or structure of related concepts, rather like a linchpin concept. Historically, however, the idea of a basic (i.e., fundamental, beginning point) class or category has been viewed as part of a more formalized hierarchical structure of such categories.

Three such realms of the idea of a basic class as key to a hierarchical structure of classes are: Library classification, Biological taxonomy, and Human mental categorization studies in anthropology and psychology. In library classification basic classes (called main classes) are found at the top end of a classificatory hierarchy with the lower reaches of the structure being open ended. In biological taxonomy basic classes (called species) are at the approximate bottom end of a classificatory hierarchy (with due allowance for subspecies/varieties) with the top end elements fixed. In human mental categorization, basic classes are found in a middling position in a hierarchy, with neither the upper or lower reaches of the structure fixed in their elements and with little impetus to identify such extended elements.

Questions

Describe these three approaches to basic/key classes as to what central concepts they involve, how they are determined, and their significance or basic importance for the field in question. Your descriptions should be based on sound references to key writers in the respective fields.

Critically evaluate each of the three approaches as to their strengths and weaknesses within the realms in which they are found. Here too, base your discussion on key critical writings in the relevant fields, although in this case you also have considerable latitude to insert your own critical observations as well.

Responses

In order to coherently describe the three approaches to basic classes a background of categorization or classification would be helpful and is provided as an introduction to the later more specific discussion.

Fundamentals of Categorization and Classification

“Categorization (i.e. classification) in its most fundamental sense means sorting or partitioning a set of objects into groups based on characteristics or attributes of the objects” (Miksa, 2000, p. 1). “Categorization activities may generally be divided into two basic kinds—sorting and identifying” (p. 2). Sorting involves dividing the set of objects to be categorized into separate categories, groups, or classes while identifying involves placing new objects into the established categories. Likewise categories can be organized into categories of categories ultimately creating a hierarchical arrangement of categories. In such a structure, subordinate categories are merged into superordinate categories with the former being said to be at a lower level than the latter. Similarly, categories at the same level may be arranged in a particular order, such as shirts of different sizes in a department store. Such organizations and arrangements are called classification or categorization schemes or systems.

Classification has deep roots. According to Mayr, Aristotle is considered “the father of the science of classification” (Mayr, 1982, p. 150). Aristotle discussed classification into hierarchical categories using the concept of the predicables (Aristotle, 1934, pp. 17-31). Jevons identifies them (from Prophyry) as: genus, species, difference, property, and accident (Jevons, 1958, p. 698).

S. R. Ranganathan provided probably the most rigorous definitions of library classification terminology (Ranganathan, 1967, p. 79):

Classification involves designing a *scheme for classification* that organizes and arranges the *classes* and provides guiding principles for adding new *classes*. Such schemes are designed by *Classificationists*.

Classifying involves assignment of new *entities*¹ within the *scheme for classification*. It also involves creation of new *classes* which may be added to the *scheme for classification* according to the rules and guiding principles. *Classifying* is done by *classifiers*.

In practice, however, the terminology is not used very rigorously and the two activities become mixed in practice. Miksa pointed out that

as one is partitioning a given group of objects and creating a set of categories for them, once a category is established (even if only tentatively), one will actually determine its appropriateness by identifying other objects with it. In short, one will switch to identifying in the middle of the activity of sorting. Likewise, the very act of identification may well lead one to revise a set of categories that already exist. Here, one switches to sorting in the middle of the activity of identifying. (Miksa, 2000, p. 2)

To make matters more interesting, terminology used classification in different disciplines is not the same. In the biological communities, *schemes for classification* are called *taxonomies* a term that is also becoming more widely used, even in the information science discipline. The universes of entities to be classified are becoming known as an *ontologies* (Taylor, 1999, p. 160) and *domain ontologies* (Fensel, 2000).

Basic Classes in Human Mental Categorization

With the above background, one can more easily understand basic or basic-level categories. George Lakoff related basic-level categories to others as follows:

The idea that categories are not merely organized in a hierarchy from the most general to the most specific but are also organized so that the categories that are cognitively basic are “in the middle” of a general-to-specific hierarchy. Generalization proceeds “upward” from the basic level and specialization proceeds “downward.”

Basic-level primacy [is] the idea that basic-level categories are functionally and epistemologically primary with respect to the following factors: gestalt perception, image formation, motor movement, knowledge organization ease of cognitive processing (learning, recognition, memory, etc.), and ease of linguistic expression. (Lakoff, 1990, p. 13)

¹ Entities may be either the entities themselves or surrogates (representations) of the entities.

Roger Brown

George Lakoff and Arlene Taylor give Roger Brown credit for beginning the concept of basic-level categories in cognitive science. Brown “observed that of all the possible names for something in a category hierarchy, a particular name, at a particular level of categorization, “has a superior status”” (Lakoff, 1990, p. 31). That level was the level of flower or cat or dime. Brown considered there were more general class levels above the basic level, such as plant, animal, and money, and there were more specific levels below the basic level, such as rose, Angora cat, and Roosevelt dime. “Brown considered the child-level to be ‘natural’ while the specific and general levels were viewed as ‘achievements of the imagination’” (Taylor, 1999, p. 175). The properties of what Brown considered to be the first level included:

- It is the level of distinctive actions.
- It is the level which is learned earliest and at which things are first named.
- It is the level at which names are shortest and used most frequently.
- It is a natural level of categorization, as opposed to a level created by ‘achievements of the imagination.’” (Lakoff, 1990, p. 31)

Brent Berlin

Brent Berlin and his team of researchers conducted additional research and experiments in naming plants and animals and concluded that “there seems to be a universal level at which humans name things, and for plants and animals it is more likely to be at the genus level” (Taylor, 1999, p. 175). This would include cats and roses. Even more interesting, that level is not always the same for specific individuals. For example “someone with experience only in urban culture” or perhaps a child might use flower as the basic level rather than rose. And “someone whose training has led to a more precisely honed level” might use Eden Rose (Taylor, 1999, p.

175). (See also Lakoff, 1990, p. 37.) The properties of what Berlin considered to be the “folk-generic level” includes the following properties:

- People name things more readily at that level
- Languages have simpler names for things at that level.
- Categories at that level have greater cultural significance.
- Things are remembered more readily at that level.
- At that level things are perceived holistically, as a single gestalt, while for identification at a lower level, specific details (called *distinctive features*) have to be picked out to distinguish, for example, among the kinds of oak, (Lakoff, 1990, p. 33).

To these, research by Brian Stross suggests two more:

- Children learn the names for things at that level earlier.
- Folk categories correspond to scientific categories extremely accurately at this level, but not very accurately at other levels. (Lakoff, 1990, p. 34).

Eleanor Rosch

The next prominent researcher to deal with basic-level categories was Eleanor Rosch. “She developed what has become to be called ‘the theory of prototypes and basic-level categories,’ or ‘prototype theory.’” She “did more than any one to establish categorization as a subfield of cognitive psychology” (Lakoff, 1990, p. 39). Rosch’s research in basic-level classes generalized the specific findings of Brown, Berlin, and their colleagues and has added a horizontal component to the concepts of categorization. In the vertical structure, Rosch argues that “categories within taxonomies of concrete objects are structures such that there is generally one level of abstraction at which the most basic cuts can be made” (Rosch, 1978, p. 30). Rosch suggests that at the basic level:

- (1) In the perceived world, information-rich bundles of perceptual and functional attributes occur that form natural discontinuities, and (2) basic cuts in categorization are made at these discontinuities. Suppose that basic objects (e.g. chair, car) are at the most inclusive level at which there are attributes common to all or most members of the category. Then both total cue validities and category resemblance are maximized at that level of abstraction at which basic objects are categorized. That is categories one level more abstract will be superordinate categories (e.g. furniture, vehicle) whose members

share only a few attributes among each other. Categories below the basic level will be bundles of common and, thus, predictable attributes and functions but contain many attributes that overlap with other categories (for example, kitchen chair shares most of its attributes with other kinds of chairs). (Rosch, 1978, p. 31)

Thus according to Lakoff, “basic levels are basic in four respects:”

- Perception: Overall perceived shape; single mental image; fast identification.
- Function: General motor program.
- Communication: Shortest, most commonly used and contextually neutral words, first learned by children and first to enter the lexicon.
- Knowledge organization: Most attributes of category members are stored at this level. (Lakoff, 1990, p. 41)

Rosch’s horizontal dimension deals with the internal structure of categories. “Most, if not all, categories do not have clear cut boundaries” (Rosch, 1978, p. 35). Thus, boundaries between consecutive classes are not clear cut, but fuzzy. This gets into prototype theory—a topic for another paper.

Summary and Evaluation

In summary, cognitive science research in basic-level categorization shows us that:

“categories are not organized just in terms of simple taxonomic hierarchies, Instead, categories ‘in the middle’ of a hierarchy are the most basic, relative to a variety of psychological criteria: gestalt perception, the ability to form a mental image, motor interactions, and ease of learning, remembering and use. Most knowledge is organized at this level. (Lakoff, 1990, p. 56)

On the surface the interpretation of the research that there is one basic-level categorization common to all people seems reasonable and supported by the research. But before we pass judgment, let us look at the application of basic classes in biological taxonomy.

Basic Classes in Biological Taxonomy

When I was in the 7th grade, our science class introduced us to the classification of plants and animals into taxonomic structures. The concept that one could not simply group plants and animals together into structures that went from a dog to animal and also that dogs could be systematically divided into types of dogs and then types of types. It did not seem significant to me that the names of the groups of organisms were the same as the levels. But later I would learn that biological taxonomies are unique in that regard. Miksa emphasizes that fact: “In biological taxonomy given levels of any given taxonomic hierarchy actually have specific names” (Miksa, 2000, p. 11). Examination of the history of biological taxonomic structures and the names of the mid-levels of the structure, genus and species can give us the understanding the concepts underlying the structure.

Foundations

These taxonomic structures have a long history dating back to the time of Aristotle’s classification principles. Philosophers and scientists have been using such structures to organize animals and plants as they have performed research. Although Aristotle used genus and species as we use superordinate class and subordinate class, the words were adopted by the biological community to signify the basic and the immediately higher level (or lower level) in biological taxonomies.

Mayr takes us through the history of biological classification introducing us to the works of Theophrastus, Discorides, Brunfels, Beck, Fuchs, etc., to the time of Carl Linnaeus in the mid 1700s. He notes that the interests of most of the early classifiers were “not at all in classification but in the properties of individual species.” Therefore, “the sequence seem[ed] to be quite arbitrary” and there appeared to be “the absence of any consistent system” (Mayr, 1982, p. 156)

Linnaeus

As Aristotle is the father of the science of classification, Mayr gives credit to Linnaeus as the “sometimes called ‘father of taxonomy’” ((Mayr, 1982, p. 171). Linnaeus was the first to provide a rigorous, logical structure to biological classification with particularly careful work at the genus level. “The genus represents his essentialist thinking par excellence, and all genera are separated by sharp discontinuities. . . . [Even today, biological taxonomists appear to agree that the Genus is] the lowest collective category, an aggregate of species sharing certain joint properties” (Mayr, 1982, p. 175).

Agassiz

Although there may be a clear understanding of the organization at the genus level, there was clear disagreement at the species level. Louis Agassiz, writing in the mid 1800s, provides four sets of criteria for biological organization: (Agassiz, 1962)

- “By relations toward the world” (p. 65).
- “By relations toward each other” (p. 72).
- “By metamorphosis” (p. 76).
- “By duration of life” (p. 89).

These sets of criteria produced different organizations at the species level. Scholars did not agree then on the predominance of any single principle and there is indication that they do not agree today.

Current trends

Current trends today still seem to leave confusion on what organisms are included in which class by what principles. If the species is considered the basic level then one might expect

a clear principle of organization to have emerged. However, Rebecca Bryant suggests that this is not so.

Three broad schools currently vie for supremacy—phenetics (also known as numerical taxonomy), evolutionary systematics, and phylogeny (or cladism)—and each generates a variety of different species concepts. . . . As a result, some philosophers have recently moved beyond the current impasse, arguing that no single unique form of classification can exist” (Bryant, 2000, p. 98).

Phenetics. Bryant summarized school of phenetics as follows:

“Phenetics (or numerical taxonomy) is a school of morphologically-based taxonomy which grew up in the 1960s and 1970s and is most commonly associated with Robert Sokal and Peter Sneath.

The basic notion behind phenetics is that biological organisms should be classified according to *overall similarity* (incorporating similarity of function, form, , and biological role), calculated using numerous characters. Each character is given equal weight—no character is preferred over any other. This work is mathematical—each character is first recorded in numerical form and overall similarity is then calculated by algorithmically manipulating the characteristics with the aid of a computer to produce a diagrammatic chart of the relationship between the entities to be classified, known as a phenogram. This diagram of phenetic distances is then converted in to a biological classification. The name “numerical taxonomy” reflects the pheneticists’ mathematical bias. Phenetics aims to produce uniform and object classifications, and adherents to this school believe that such classifications can be produced by explicitly formulated statistical methods. (Bryant, 2000, p. 99)

Sokal bases his firm belief in the mathematical approach as the result of the fundamental purposes of classification: “The paramount purpose of a classification is to describe the structure and relationship of the constituent objects to each other and do similar objects, and to simplify those relationships in such a way that general statements can be made about classes of objects” (Sokal, 1974, p. 1116). He adopted the position that “classification need not be hierarchic and the clusters may overlap (intersect)” (p. 1121).

Evolutionary Systematics – Biological species.

The biological species concept—typically associated with the work of Ernest Mayr—defined species as, “Groups of actually or potentially interbreeding populations which are

reproductively isolate from other groups.” The basic principle notion here is that members of a species together constitute a reproductive community and so respond to one another as potential mates. . . . The biological species concept, then, (unlike phenetics) rests upon the presupposition of an inextricable link between taxonomy and evolution. (Bryant, 2000, p. 100).

In supporting the evolutionary systematics approach, Mayr wrote, “What needs to be emphasized once more is the fact that groups of organisms are the product of evolution and that no classification can hope to be satisfactory that does not take this fact fully into consideration” (Mayr, 1988, p. 283)

Phylogeny. The underlying principle for phylogeny and cladistics this kind of classification is that “classifications should reflect genealogy or evolutionary branching patterns. In order for a group of organisms to form a species, they must share some kind of common ancestry. Phylogeny posits a direct link between taxonomy and the history of evolution” (Bryant, 2000, p. 102).

Summary

With all the effort over the centuries in defining the principles of classifying biological organisms at the species level, consensus seems to be that the species level is the basic-level and the genus level is one level above—more general and less likely to be used by the average person for identification of an organism.

Evaluation of the Basic-Level Assumption

Perhaps the assignment has been too hasty. With the confusion of the three current schools of thought, one might wonder if the basic level in biological taxonomic structures truly is at the species level. The concentration of Linnaeus on the genus level of the biological taxonomy

has led scholars like Lakoff to question what the basic level in taxonomic structures really is. Referring back to the research results of Roger Brown (above) we see that the flower was the basic level. Referring to Berlin we see that Rose was the basic level. Lakoff notes that “the heart of the Linnaean system is the genus, not the species” (Lakoff, 1990, p. 34). Lakoff suggests that Linnaeus was right in establishing the basic level at the genus “as that level of biological discontinuity at which human beings most easily perceive, agree on, learn, remember, and name the discontinuities. The genus, as a scientific level of classification was set up because it was the most psychologically basic level for the purpose for the study of taxonomic biology by human beings” (Lakoff, 1990, p. 35). If Lakoff is correct, how do we determine the basic level in biological taxonomic structures? Is the basic level at the genus, species, or some other level?

The genus and species of biological taxonomic structures, like the central level of human mental categorization structures, clearly is where the basic-level must be. However, it is not clear whether it lies with the genus, species, or sub species. The answer is that it may be either of the three.

Berlin has suggested (personal communications) that a distinction be made between a general human capacity for basic-level categorization (due to general physiological and psychological factors) and functional basic-level categorization, which adds in factors having to do with culture and specialized training. Berlin suggests that a given culture may under-utilize certain human capacities used in basic-level categorization, for example, the capacity for gestalt perception. Thus, in urban cultures, people may treat the category *tree* as basic level. (Lakoff, 1990, p. 37)

So the apparently conflicting research results of Berlin and Roger Brown are consistent with this explanation.

Based on his research, Berlin seems to have revised his earlier suggestion that there is a single level in a hierarchal structure that is always the basis-level for everyone in all cultures. He now “hypothesizes two kinds of nonuniversality: (a) one kind due to cultural underutilization of

human capacities (e.g. dog) may be treated as basic, and (b) another kind due to special training, limited to subpopulations of experts who may treat a slightly more specific level as basic in some domains of expertise” (Lakoff, 1990, p. 37).

In my opinion, the actual case might be it might not be a case of “underutilized capacity” or “domains of expertise.” Lakoff wrote, “Basicness in categorization has to do with matters of human psychology: ease of perception, memory, learning, naming, and use. Basicness of level has no objective status external to human beings” (1990, p. 38). This makes sense to me. But he goes on, “It is constant only to the extent that the relevant human capacities are utilized in the same way. Basicness varies when those capacities either are under utilized in a culture or specially developed level of expertise” (p. 38). Although the implication might be technically true that all learning is “utilization of human capacity,” I would suggest that it is simply learning the level most useful to the environment and context within which one resides. In the artic, for example, one might consider the basic level of snow classification to be lower because of its importance in the culture, contrary to a resident in Florida. Does this mean that the latter is underutilizing their human capacity?

Basic Classes in Library Classification

Several authors have provided a description of “main classes” as used in library classification. Arlene Taylor wrote about the ten main classes of the Dewey Decimal system and the history that lead up to it.

Main classes in library classification traditionally are at the top level of the organizational structure. This would be a position equal to the plant and animal division of the biological taxonomic structure discussed the previous section of this paper. Main classes thus divide the

universe into principle concepts or disciplines with like characteristics. Although some scholars have grouped disciplines into higher-level groups or agglomerates, most have agreed that the disciplines are the fundamental divisions and are thus at first or top level of the chain of subdivisions in the organization of knowledge. Ideally the selection of these divisions provides a stable order for thinking about and organizing the knowledge relating to the disciplines.

Scholars, such as Charles Cutter, Ernest C. Richardson, W. C. Berwick Sayers, Henry Bliss, and S. R. Ranganathan, have maintained that there is a natural order in nature that should be used to identify the disciplines and main classes of knowledge. And, as Arthur Maltby claims, “The search for an ‘enduring order of nature’ is one of perennial interest to classificationists” (Maltby, 1975, p. 57).

Henry Bliss

Bliss seems to have done the most work in determining what the main classes should be.

Building on the work of Richardson and Cutter, Bliss,

prefaced the construction of his BC [Bibliographic Classification] with a long and arduous study of the philosophic systems of the past, and the needs of libraries of the present. . . . He looked hard for signs of a majority viewpoint among experts, a “consensus of opinion,” which would act as a reliable and durable guideline for accepting groupings or collocations of subjects and the impressive architecture of his own completed system reflects his intensive efforts to find one.” (Maltby, 1975, pp. 57-58)

In the writings of Henry Bliss, main classes “comprise fundamental sciences or groups of sciences or studies” (1939, p. 75). In addition, “each would not only precede but would generalize subject-matter of the subordinate classes and thus would in a sense comprehend them” (p. 75). “Each *fundamental* science and each *major* study should have a main class as its particular domain, marked by its distinctive symbol” (pp. 76-77). These classes were intended to be relatively stable in the organization of knowledge. “In minor details they may change in a

decade, but in their main structures they seem likely to change little in a century” (Bliss, 1933a, p. 27)

In discussing his principles, Bliss was absolutely clear that an organization of library materials must follow the natural organization determined by consensus:

XIX. Organization of Knowledge in Libraries: in classification, in subject-catalogs and in other bibliothecal services, knowledge should be organized in consistency with the scientific and educational consensus, which is relatively stable and tends to become more so as theory and system become more definitely and permanently established in general and increasingly in detail. (Bliss, 1939, pp. 42-43)

Even though he had established this clear guideline, Bliss made the points that the main classes should “be adapted to certain purposive and practical considerations, and perhaps in places to the exigencies of notation” (1939, p. 75). As a consequence, he listed astronomy as a main class even though “it is not a fundamental science” (p. 77). History was separated into three main classes, because “the immense detail . . . exceeds the capacity of single main classes” (p. 77). And as Bliss divided the main classes into sections and subsections, he also allowed for apportionment of the division process based on the number of volumes to be placed in each class (pp. 78-79).²

Bliss seemed to have been troubled that a few of the disciplines could be placed logically in more than one place in the order of main classes. He resolved this problem by introducing alternate locations for these. “A library must select one of these—the one corresponding most closely to its needs—and leave the alternative(s) unused” (Maltby, 1975, p. 58). (See also Bliss, 1939, pp. 79-81 for a discussion of alternate locations.)

At the main class level, the system proposed by Bliss provides a fundamentally sound way of developing main classes more so than that of other classification schemes. Maltby

² Bliss wrote about the stages of systemizing a classification. The third stage includes a first expansion into sections and second expansion into sub-sections.

claimed and more than one scholar agreed; “it is concluded by many that, of the predominately enumerative classifications, it is BC which offers the most helpful order at the main class level” (Maltby, 1975, p. 58).

Bliss’s hierarchy consisted of: “*main divisions* (for groups of sciences, etc.), *main classes* (for principal sciences or studies), *sub-classes* (for sub-sciences, etc.), *sections*, and *sub-sections*” (1939, p. 27). In this one exception, the main class is not at the top of the organizational hierarchy—the top consists of main classes and main divisions with subordinate main classes.

There are those who have criticized the necessity of a classification system based at all on the organization of science. They say that it is not practical. Rather, they would advocate a practical, standard system designed primarily to retrieve known items. To know the item, the user should use a subject classification system and relative index. Bliss resoundingly rejected such arguments:

This “subject-index illusion” would be true only where subjects are unrelated to other subjects. . . . Practical classification implies logical subordination and collocation for ready convenience of readers and librarians. It is not practical in the better sense to be illogical and in disorder. (Bliss, 1933b, p. 36)

An index is an obvious necessity of any elaborate scheme of subjects and captions and any index that is not relative, is—well, simply irrelevant. Good classification avails; poor classification fails, and no index can make it good for this broad use. Where classification is a misfit to a body of science, it throws a multiplicity of subjects into disarray, and the now indispensable index shows us only how many steps we have to take to gather together the scattered materials of our study. (Bliss, 1912, p. 661)

Bliss often counseled against adopting a standard system and schedule just because it was standard. He wrote, “the gain from following a standard system may largely be offset by the faults of the system and by its complexity and inadaptability. . . . It is more effectual to have your classification for your collection than to have it conform to some standard” (1931, p. 438).

Of Bliss’ principles, Maltby affirmed, “Bliss indeed occupies a transitional place in the development of the principles of library classification. Some of his ideas are rooted in the past,

but he has also offered us some suggestions which harmonize well with the findings of Ranganathan and his British disciples” (Maltby, 1975, p. 58)

W. C. Berwick Sayers

Sayers wrote that main classes “must be comprehensive, that is to say cover all things in a class, and all the terms of the classes added together must be equal to the whole field to be covered” (Sayers, 1938, p. 14) He did not dwell on natural order. Rather he stated that “we can choose any reasonable method or arrangement so long as it is the most useful for the users of the things we are to arrange. . . . *the characteristics chosen as the basis of arrangement must be essential to the purpose of the classification*” (Sayers, 1938, pp. 12-13).

The hierarchy Sayers described consists first of main classes, followed by divisions, subdivisions, sections, and sub-sections (Sayers, 1938, p. 15).

Library of Congress

The library of congress system has been said to be a “flat” system for subdividing books. Chan simply stated that, “LCC is not hierarchical.” (Chan, 1990, p. 62) She, nevertheless, asserted that there are main and subordinate classes. “Main classes are denoted by single capital letters. Double or triple letters represent subclasses. . . . Within each main class or subclass, the integers 1-999 are used for subdivisions.” (Chan, 1990, p. 21) According to this assertion, the hierarchy of the LCC system (without hierarchy) is main-class to subclass to subdivision.

However, later in her book, Chan seemed to redefine the hierarchy, “Depending on the context, a single letter may stand for a main class or for its first subclass. . . . Under each subclass, divisions and subdivisions are denoted by integral numbers in ordinal sequence ranging from 1 to 9999, each of which may be extended decimally” (Chan, 1990, p. 54). This statement

seemed to imply, at least from LCC notation, that the LCC system hierarchy is, in some instances, main class, subclass, division, and subdivision. Regardless, upon examination of the LCC structure, it is difficult to see what subjects are classified at what level.

Shiyali Ramamrita Ranganathan

Ranganathan provides, in my opinion, the most logical discussion related to main classes as used in library classification. It includes discussion of main classis, main subjects, main class numbers, and main foci depending on context of usage. Main subjects are the foci when one is discussing ideas and main class numbers are the foci when one is discussion classification notation (Ranganathan, 1964, p. 279).

Ranganathan's Concept of Basic Class starts with the Principle of Canonical Sequence in his *Prolegomena*:

If the subjects in an array of subjects or the isolates in an array of isolates are traditionally referred to in a specific sequence, although no underlying principle is discovered, it will be convenient to conform to this traditional sequence.

It may even happen that no specific characteristic can be isolated as forming the basis of the derivation of the classes, except that they are simply those into which their immediate universes had been traditionally divided. In CC such classes are known as **Canonical Classes** (Ranganathan, 1967, p. 194)

Now, taking from Chapter 05, Focus and Facet, (Ranganathan, 1960, p. 1.20) we find the following (abbreviations have been spelled out):

501. Some of the **Main Classes** (MC) —viz. B Mathematics, C Physics, H Geology, M Useful Arts, N Fine Arts, and R Philosophy—are divided in the first instance as **Canonical Classes** (CC).

502. In certain subjects the canonical mode of division may be repeated more than once. For example in B23 Algebraic Equations, it is done twice.

Thus Ranganathan tells us that he has divided main classes into sub-classes (not facets) for as many as two subordinate levels.

503. A **Main Class** *or* a **Canonical Class** is said to be a **Basic Class** (BC) [emphasis added].

504. The term **Basic Focus** or **Basic Facet** (BF) is applicable equally in the plane of (1) Idea, (2) Language, and (3) Notation.

The concepts apply in all three planes but the terms are different in each plane. Here is what the terms are:

505. In the Plane of Idea, **Basic Class** is the equivalent of Basic Focus.

506. In the Plane of Language, **Basic Subject** is equivalent of Basic Focus.

507. In the Plane of Notation, **Basic Class Number** is the equivalent of Basic Focus.

If we look, for example, at the schedule for mathematics (Ranganathan, 1960, p. 2.31), we will find that the Main Class is divided into 9 sub-classes called “**Canonical divisions**,” at the beginning of the table. Then each of the 9 divisions are further divided and/or faceted depending on the particular division. Note that the facet sequence may also vary depending on the sub class.

This must have caused confusion in the users of the table, so the writers of the 7th edition created a table of basic subjects (Ranganathan, 1987, pp. 56-57) (which is not in the 6th edition). The first level of Canonical Divisions is pretty much the same between 6th and 7th edition. But the lower levels have been moved to the personality facet in the 7th edition. One may see this by comparing the math schedules in the 6th and 7th editions (Ranganathan, 1960, p. 2.31; 1987, p. 137).

As a final note, there were 42 main classes in the 6th edition (including Library Science) and every canonical class was a division of a main class. In the 7th edition, there were 26 main subjects and several canonical subjects that stood alone without an associated main subject. Neither the term main class nor basic class is used in the 7th edition. Also, in the discussion of work in the idea plane, where the basic class and main class previously resided, the terminology now refers to common and special isolates and subjects.

Considerations of Main Class and Basic Class in Library Classification

With the wide variation in what is considered a main class it appears to me that the division of the universe of subjects is somewhat arbitrary. Dewey's chose ten main classes because there were ten digits in his numbering system. Other classificationists did not limit themselves to ten by selecting numbering schemes consisting of letters or combinations of letters and numbers. The specific subjects residing at the top level also seem arbitrary. Bliss suggests that we could have organizational elements above main classes called main divisions (Bliss, 1939, p. 27). In this scheme, main classes would be the principle sciences, such as chemistry, which would be encompassed by main divisions, such as natural sciences, above the main classes. Ranganathan provides isolates for both at the top level. He allocates numeric codes for each of the general subjects such as natural science and then allocates letters at the same level for each of the sciences (Ranganathan, 1987, pp. 113, 185). Conceivably, like the biological taxonomic structure, there could be two main classes at the top level: scientific subjects and other subjects with subordinate topics being established in a narrower hierarchy than we see today in library classification.

Considering that the main class in library classification is at the top of the hierarchal structure, I suggest that it is not the same concept as the basic class used in cognitive categorization or biological taxonomies. I suggest that the main class in library classification is not a basic class but that it lies above the basic class just as animals and plants lie above the genus and species in the taxonomic structure.

Synthesis

If the main class of library classification is not the basic class that what is?

Insight may be gained from the research conducted by Robert Lloyd, Davis Patton, and Rex Cammack (1996). The research dealt with understanding the nature of special knowledge in the use of cartographic material. In discussing the hierarchy of cartographic material, the authors provide us with the traditional organizational structure of Country-Region-State-City-Neighborhood. The actual structure consists of a hierarchy of specific entities. Alabama and Georgia would be subordinate to the Southeast Region and Montgomery and Atlanta subordinate to Alabama and Georgia. In this structure, Alabama and Georgia would be coordinate at one level and Montgomery and Atlanta would be coordinate at the next lower level. The top level in this structure might be considered the World. The authors claim that there is no basic level in such a structure.

Lloyd, Patton, and Cammack have developed an alternate structural concept consisting of a hierarchy of a class called place at the top, classes of country, region, state, city and neighborhood coordinate at the next level and the entities coordinate at the next. In this structure Alabama and Georgia would be coordinate below states and Montgomery and Atlanta coordinate below the class cities. Significantly, all four entities Alabama, Georgia, Montgomery and Atlanta are at the same level. The researchers claim that the classes at the State and city level are the main classes.

Lloyd, Patton, and Cammack tested their hypotheses using techniques similar to Rosch but the results showed some basic-class effect but were inconclusive overall perhaps due to experimental design. Further research was advised.

Regardless of the inconclusiveness of this studies results, I believe the alternative organization concept is very important to library classification structures and perhaps to the design of topic maps which are fundamentally classes that sit on top of various entities.

Let us now consider the basic objects classified in libraries in terms of the basic-level criteria suggested by Lakoff (listed in pages 5 and 6 above) in light of Lloyd, Patton, and Cammack's concepts. Using Lakoff's criteria, one might come to the conclusion that there are two basic-level objects in library classification: books and magazines. Although research would have to prove it, these are perhaps the two things that the majority of library users think about when asked what the library has. But when one talks to another, we say, "I have just read a book" or "I found such and such in a magazine." And we also say, "I just read a mystery novel" or "I found the recipe in my cookbook," or perhaps we name the magazine, "I read it in *Atlantic Monthly*." Considering Lloyd, Patton, and Cammack's cartographic structure, we could say that book and cookbook coordinate classes at the basic level. Below this level is the book or magazine with its subject, title, and the author.

Tying this to taxonomic structure, I suggest that classes books, magazines, and genre are at the genus level, the entities—the books and magazines themselves—are at the species level, and the title author and subject, are at the subspecies level.

Let us consider subjects in more detail. Library classification schemes are organizations of subjects. What is the basic level of subjects? Consider what we say in normal conversation. I just read a book on tigers. I have a new cookbook for making cakes. My daughter just got her mathematics text book for school. In each of these cases the subject is subordinate to the entity itself—the book. In short, I am convinced that there is no basic-level class in library subject classification that is equivalent to that addressed by basic-level cognitive theory.

Nevertheless, the concept of basic-level remains important as a concepts to help us understand how humans think about entities in cognitive categorizations, taxonomic structures and library classification.

References

- Agassiz, L. (1962). *Essay on Classification*. (Original 1859). In E. Lurie (Ed.), *Louis Agassiz: A life in science ??* Cambridge, MA: Belcamp / Harvard University Press.
- Aristotle. (1934). *Catagories* (H. P. Cook, Trans.). In *Aristotle, the categories, on interpretation, prior analytics* (pp. 12-109). Cambridge, MA: Harvard University Press.
- Bliss, H. E. (1912). Conservation in library classification. *Library Journal*, 37(12), 659-668.
- Bliss, H. E. (1931). Billionaire bibliography. *Library Journal*, 56, 435-439.
- Bliss, H. E. (1933a). *The organization of knowledge in libraries*. New York: H. W. Wilson.
- Bliss, H. E. (1933b). What do you mean by practical classification. *Special libraries.*, 24(2), 35-37.
- Bliss, H. E. (1939). *The organization of knowledge in libraries* (2nd ed.). New York: H. W. Wilson.
- Bryant, R. (2000). *Discovery and decision: Exploring the metaphysics and epistemology of scientific classification*. Madison, NJ: Fairleigh Dickenson University Press.
- Chan, L. M. (1990). *Immroth's Guide to the Library of Congress classification* (4th ed.). Englewood Cliffs, NJ: Libraries Unlimited.
- Fensel, D. (2000). *Ontologies: A silver bullet for knowledge management and electronic commerce*. Berlin: Springer-Verlag.
- Jevons, W. S. (1958). *Principles of science: Treatise on logic and scientific method* (2nd ed.). New York: Dover Publications.
- Lakoff, G. (1990). *Women, fire, and dangerous things: What categories reveal about the mind* (Paperback Edition ed.). Chicago: University of Chicago Press.
- Lloyd, R., Patton, D., & Cammack, R. (1996). Basic-level geographic categories. *The Professional Geographer*, 48(2), 181-194.
- Maltby, A. (1975). *Sayer's manual of classification for libraries* (5th ed.). London: André Deutsch / A Grafton Book.
- Mayr, E. (1982). *The growth of biological thought: Diversity evolution, and inheritance*. Cambridge, MA: Belcamp / Harvard University Press.

- Mayr, E. (1988). *Toward a new philosophy of biology*. Cambridge, MA: Belknap / Harvard University Press.
- Miksa, F. L. (2000). *Categorization and information organization*. Unpublished manuscript, Austin, TX.
- Ranganathan, S. R. (1960). *Colon Classification* (6th ed.). Bombay: Asia Publishing House.
- Ranganathan, S. R. (1964). *Classified catalog code* (5th ed.). Bangalore, India: Sarada Ranganathan Endowment for Library Science.
- Ranganathan, S. R. (1967). *Prolegomena to library classification* (3rd ed.). Bombay: Asia Publishing House.
- Ranganathan, S. R. (1987). *Colon Classification* (7th (Basic and Depth Version) ed. Vol. 1 - Schedule and Depth Version). Bangalore, India: Sarada Ranganathan Endowment for Library Science.
- Rosch, E. (1978). Principles of categorization. In E. Rosch, B. B. Lloyd & S. S. R. Council (Eds.), *Cognition and Categorization* (pp. 27-48). Hillsdale, NJ: Lawrence Erlbaum.
- Sayers, W. C. B. (1938). *An introduction to library classification, theoretical, historical and practical, with readings, exercises and examination papers* (5th, revised ed.). London: Grafton & Co.,
- Sokal, R. (1974). Classification: Purposes, principles, progress, prospects. *Science*, 185(4157), 1115-1123.
- Taylor, A. G. (1999). *The organization of information*. Englewood, CO: Libraries Unlimited.