

**A KALEIDOSCOPE PERSPECTIVE: CHANGE IN THE SEMANTICS AND  
STRUCTURE OF FACETS AND ISOLATES IN ANALYTICO-SYNTHETIC  
CLASSIFICATION**

*Joseph T. Tennis*<sup>1</sup>

Examines the limitations of the *dynamic theory of classification* in accommodating the changes and rapid growth of new topics in the universe of knowledge. Change in an analytico-synthetic scheme for classification is much more a web of connections and mapping these changes is a complex process. Suggests that there is need for exploration of this complexity for both improving systems, and revisiting our theory

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Shiyali Ramamrita Ranganathan, often considered the founder of library science in India, is known for many innovations with regard to conceptualizing library services and systems. Not the least of his contributions is the commitment to developing a *dynamic theory of classification* [4]. This theory surfaces in the early twentieth century due to that fact that libraries and documentation centers were trying to accommodate the increased production of publications on established as well as new topics.

Accommodating the rapid increase in the number of new topics gives rise to new conceptual tools that classificationists now draw on. Facets are the most commonly known tool constructed by Ranganathan, but there are others – and there is a large and rich body of literature that describes these tools dating from 1927 to the posthumously published texts in the 1980s.

In this paper we outline the purpose, design requirements, and assumptions of these conceptual tools, but then highlight how dynamic theory of classification is a partial solution to the issue of the changing universe of knowledge. The main lacuna in the dynamic theory of classification is changing denotation of facets and isolates – that is the effect of time on the semantics of facets.

For example the facet ELECTRICAL ENGINEERING appeared in the 1930s in the Colon Classification. We cannot expect the meaning to have persisted unchanged from then to today. Given this we would also expect to find a different body of literature collocated under this facet in 1930 compared with today. This is further complicated by the addition of facets to the scheme, which may or may not have been considered part of the meaning of a previously used facet. The intention of facet analysis and schemes for classification that are fully analytico-synthetic is that the classificationist is only adding new facets and isolates. However the reality of this is only borne out if we fully apprehend the extant semantics in the scheme. Further, we can only verify our understanding of facet semantics when we look at the collection of texts fixed under that

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<sup>1</sup> Information School, University of Washington, Seattle, USA, E-mail: jtennis@u.washington.edu

facet-cum-class. Given this we have a number of relationships to consider when we consider change in schemes for classification built on a dynamic theory of classification. This paper lays out some of those considerations and constructs a kaleidoscope perspective on facets over time in analytico-synthetic schemes.

## **1 KINDS OF CHANGE IN CLASSIFICATION SCHEMES IN GENERAL**

Change is inevitable for classification schemes. And the particular characteristics of classification schemes means we have to account for change in particular ways. For our purposes in this paper, classification schemes are a general class of knowledge organization system that is a mutually exclusive, jointly exhaustive listing of classes arranged in a hierarchical and systemic order, where the further down the hierarchy we find classes that are of greater intension and lesser extension than those above, and where in each rank in the hierarchy classes are listed in a meaningful and systematic order of first-in-the-rank, second-in-the-rank, third, and so on – all at the same level of intension and extension. This is a formal definition, and is not always adhered to in practice, but it will serve as our starting point when discussing what changes in classification schemes. That is, we have to assume this structure when we consider the ramifications of change on semantics in classification schemes.

There are three major kinds of change that surface when we examine revisions to classification schemes. These types are (1) structural change, (2) word-use change, and (3) textual change. We can use EUGENICS as an example since it has undergone much change in the Dewey Decimal Classification system, first surfacing in 1911 as a biological science and now no longer placed there, but rather in a range of disciplines. Historically, EUGENICS is the betterment of the human race through scientific and policy-based practices like measurement, purification, and sterilization. And because of the nature of this concept and the literatures associated with it, it serves as a good example for discussing scheme change – semantics and structure.

Structural change affects the relationships represented in the classification scheme. It also affects how users navigate in the scheme. Structural change can happen in at least five ways. We can (a) add a new facet, (b) change synonym structure (e.g., use EUGENICS to lead to both GENETICS and PSYCHOLOGY), (c) change equivalence structures (e.g., USE and/or USED FOR), (d) assign a facet to another part of the scheme or hierarchy, and (e) add or delete an associative relationship (viz. RT).

Word-use change does not affect how users navigate in the scheme. Word-use change is adding or replacing words linked to a digit in a scheme. For example the classificationist might (a) use a new word with a digit, (b) add a synonym (e.g., replace GENETICS with EUGENICS), (c) formally change a definition of a facet or isolate.

The final form of change in classification schemes is textual change. These are changes in the relationships, over time, between the facets or isolates in the scheme and the texts described by those facets and isolates. There are two primary forms of textual changes. The first is textual warrant change and the second is document-set change. The former, textual warrant change is the change of the texts used to create the facet or isolate and its relationships to other facets and in my

isolates in the scheme. The second change is document-set change. This is the change alluded to ELECTRICAL ENGINEERING example above. The meaning of this facet can be interpreted through which texts are referenced by it. We can assume that those texts have changed over time.

We can see effects of this on classifying documents in recent studies of the DDC [8]. What we do not know is how this might affect faceted and analytico-synthetic schemes in ways that are different from enumerative schemes.

## **2 KINDS OF CHANGE IN SCHEMES FOR CLASSIFICATION THAT ARE FULLY ANALYTICO-SYNTHETIC**

Elsewhere I have discussed some of the problems with change in an analytico-synthetic scheme for classification [7]. Here I will do it in the context of the conceptual tools used in the most refined theory for dynamic classification.

Ranganathan's thoughts on how best to design a scheme for classification that could accommodate change evolved over time. At the end of his career he calls his theory and the schemes for classification built from it, analytico-synthetic. Facets are part of this theory, but they are not the only part. If we can accommodate new subjects in what Ranganathan calls a filiation sequence by breaking apart subjects we have to have a meaningful way of recombining those pieces. This is where the postulates and principles come into play in faceted classification that makes it analytico-synthetic. This latter kind of classification is guided by a set of principles on how facets should be sequenced and therefore how to accommodate new subjects as the universe of knowledge grows.

The interesting research question that surfaces here lies at the intersection of the principles and the structure of the facets and isolates. As mentioned above, the semantics of a single facet are assumed at a particular time. So that ELECTRICAL ENGINEERING and EUGENICS carry with them particular meaning in the 1920s and that is different from the meaning in the 2010s. Thus the interesting research question that surfaces in the context of analytico-synthetic classification is what is the same with regard to scheme change as outlined above and what is particular to this kind of classification?

For the enumerative scheme it seems that we have an unwritten assumption about the relationship between the old edition and the new edition of the scheme. If a library adopts a new edition of the scheme it can decide to re-class books based on the new coherent scheme. The fact that purely enumerative schemes allow you to re-class more simply means this is sometimes and option. It is more complicated for analytico-synthetic schemes however. While it is true in this latter case we can conceptualize a new editions as coherent, we are constructing classes, not simply assigning them to documents. Parts of the class number in an analytico-synthetic scheme will be revised and some will not. Some will look the same as those already on the shelf, but will have drifted in meaning because of the change in semantics over time. We thus have a kaleidoscope view of semantics because of the fragmented structure of the evolving analytico-synthetic classification and its semantic echoes found in the collection already classed. The

semantics of facets and isolates are also considered in relation to each other in the scheme for classification. They have an *ecological* relationship.

This kaleidoscopic view and ecology perspective of change in analytico-synthetic classification lays bare the differences between enumerative scheme change and analytico-synthetic scheme change. We can see this with examples from the Colon Classification.

When we examine facets and isolates in the various editions of the Colon Classification we can see the effects of both ecological change and word-use change. Starting from the third edition [2] when postulates and principles were mature in Ranganathan's thought, we followed GENETICS, ALTERNATION OF GENERATION, and ONTOGENY. We can see the lexical change reflected in the headings that go with the isolate numbers. With Genetics we see an erasure of a refined meaning because the editors drop Phylogeny as a qualifying term. See Table 1.

**Table 1: Biology Isolate Numbers in a Sample of Editions of the Colon Classification**

Date and Edition Number	Isolate Number	Isolate Heading
1950 3 <sup>rd</sup> Edition [1]	6	Genetics, phylogeny
1952 4 <sup>th</sup> Edition [2]	6	Genetic, phylogeny
1960 (1969) 6 <sup>th</sup> Edition [3]	6	Genetics (phylogeny)
1987 (1989) 7 <sup>th</sup> Edition [5]	6	Genetics

We can infer that phylogeny is not, according to the editors, the only way to conceptualization and describe genetics by 1987. And this tracks the change in the science. So we see how the line breaks here. This is word-use change.

Table 2 shows the ecological change in the same area of the Colon schedules.

**Table 2: Sample Isolate Notation in Four Editions of Colon Classification**

Notation	1950 3rd Edition	1952 4th Edition	1960 (1969) 6 <sup>th</sup> Ed.	1987 (1989) 7th Ed.
7	Ontogeny	Ontogeny	Development (ontogeny)	Development (Ontogenesis)
71	Fertilisation	Fertilisation		
715	Artificial fertilisation	Artificial fertilisation		
7192	Twins	Twin		
72	Germination	Germination		
73	Embryology	Embryology		
75	Growth after birth	Growth after birth		
751	New born	New born		
752	Toddler	Toddler		
755	Infant	Infant		
76	Pre-adolescent	Pre-adolescent		
77	Adolescent	Adolescent		
78	Old age	Old age		
791	Death	Death		

The 7<sup>th</sup> Edition has this note: “Divisions as for "7 Development" in the Schedule of (1MP1) isolates for "L Medicine" in Chap EL. Schedule of (1MMt1) Substance isolates. Divisions as in the schedule of (1P1) isolates "E1 General Chemistry" Chap EE. Schedule (1E) Action isolates (For use also in (1E) of GT, GV, I, and K” [5]. This directs the classifier to another part of the schedule.

Table 2 is a clear example of ecological change. We removed isolate numbers from this subject, removing the expressivity. From this we can see how the line is broken from one edition to another.

The final example from this part of the Colon Classification ALTERNATION OF GENERATION, has a single change in the 7<sup>th</sup> Edition. We add a synonym. It then reads, ALTERNATION OF GENERATION (METAGENSIS). It is not clear what effect this has on the semantics. It could be either a lexical or ecological change if METAGENSIS was defined or used elsewhere.

### **3 FACETS AND ISOLATES AND THE KALEIDOSCOPE PERSPECTIVE**

Typical to his holistic style of thinking, Ranganathan considered facets as part of an ecology of tools useful to dynamic classification. Inspired by toy sets that had combinable pieces, Ranganathan, used that metaphor to describe subjects and parts of subjects. This is a fine starting point for accommodating a wide range of new subjects made of parts of extant subjects or new parts. However, this is only one view of time and meaning. It is a distinctly *rationalist*.

I have argued elsewhere that Ranganathan was a *postulational rationalist* [6]. Whereas rationalism posits eternal and fixed concepts that transcend time and space, I suggest that Ranganathan’s fundamental categories of Property, Matter, Energy, Space, and Time were postulated and are available for revision should the scheme need it. However, I have a harder time seeing that perspective in this ecology of structure and semantics. From this investigation it seems that even with quite a bit of word-use change in the Colon Classification there is an assumption that words and meanings are fixed.

The only amelioration here is to resituate classification in its context of joint exhaustivity – where all that needs to be said about subjects is provided in the scheme for classification. For us to guarantee this means that designers would need a method for defining each facet and isolate in relation to the interrelationships in the scheme, with the literary warrant, and with the text collection described by the scheme. Further we would have to say that any change in this context would trigger a reevaluation of the whole context, or a turning of the cylinder of the kaleidoscope to see a new configuration of facets and relationships. We must document the current classification and context to manage changes to them both.

### **4 CONCLUSION**

We are able to show at this point that there are three levels of analysis of change in an analytico-synthetic scheme for classification. We must (1) document change of facets in relation to each other and (2) change in potential subjects constructed from combining facets. Finally, (3)

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we must document change in the explicit relationship structure over time in the Colon Classification, our example.

In the case of our biological examples above we can see deletion of facets and pointing to other areas in the schedule for classification. This is the first level of analysis. The change in the potential subjects that can be represented seems straightforward. By 1960 we cannot use G7192 for twin ontogeny. We have to start with G7 (ontogeny/development), and then add a connecting digit without direction. In 1987 we have guidance on this. So there are at least three potential notations for the ontogeny of twins in the life of the Colon Classification. This is the second level of analysis. The third level requires us to link these three notations. This third level is ongoing research and will be reported elsewhere.

Change in an analytico-synthetic scheme for classification is much more a web of connections, and the complexity of mapping these changes is quite large. However, there is value in the exploration of this complexity for our understanding of both improving systems, and revisiting our theory of meaning in knowledge organization. We are forced to consider which contexts matter and which do not in our pragmatic systems design mentality.

S.R. Ranganathan worked tirelessly to improve this theory of dynamic classification; I hope that thinking about change in this way allows us more insight into his contributions and the remaining research questions in this space. He was the father of library science in India, and his work still resonates and makes curious the rest of the world.

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