

Comparative modeling of Vickery's Faceted Classification and the oeuvre of S. R. Ranganathan

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Abstract

B.C. Vickery and S. R. Ranganathan both advanced methods of creating schemes for classification and facet analysis of documents. In his accessible and well-written 1960 text, Vickery acknowledges his debt, and indeed the debt owed by the CRG, to Ranganathan's work. Yet, because of the time of this writing, and its purpose, we see a very different view of the theory of faceted classification from Vickery, when compared to the overall *oeuvre* of S. R. Ranganathan (beyond the 1967 *Prolegomena*). And it is Vickery's 1960 and 1966 works, not Ranganathan's, that are often used as the introduction to (and often the end of the education in) faceted classification and facet analysis. The question surfaces, is there more than one conception of faceted analysis and faceted classification? We must take as an assumption that neither Vickery nor Ranganathan are wrong in their conception, but what if they differ? Others have examined the question of the definition of faceted classification, often with an eye to contemporary interpretations of facet analysis, not as an explicit comparison between these two bodies of thought (e.g., La Barre, 2004; see also *Axiomathes* 18(2)).

There are several commonalities that obtain between Vickery and Ranganathan which can be discerned by the informed reader. For instance, there are commonalities in how Vickery and Ranganathan talk about citation order. However, Vickery's discussion omits many details contained in Ranganathan's. This brings us to our question. What does Vickery's theory of faceted classification look like compared to Ranganathan's? Does Vickery create a different theory, and hence lineage, of faceted classification in the 1960s?

In an effort to make sense of both Ranganathan's work and Vickery's we modeled the process involved in classification using the IDEF0 (Integrated Definition for Function Modeling) formalism. This allows us to see five distinct parts of the classification process: actions, inputs, outputs, mechanisms, and constraints. When we model theories of classification this way we can then compare them by asking whether or not they contain the same actions, inputs, outputs, mechanisms, and constraints. This allows us to see how the conceptions held by Vickery and by Ranganathan are similar, and how they are different.

This work is ongoing, but preliminary analysis shows that while there is some cross-over, Vickery's exposition of faceted classification and facet analysis were more parsimonious than Ranganathan's. This leaves us with questions about decision-making when proceeding through the process of facet analysis and creating schemes for faceted classification.

Similarly, Ranganathan's work is left undone (primarily with rules for interpreting postulates and principles, but there are other places as well).

We will present the findings on the modeling of these two conceptions of faceted classification and facet analysis. We propose two ways to frame this discussion: by describing 1) what commitments we make when we assume a common model of facet analysis and classification, and 2) what we assume from identifying distinct theories of faceted classification and facet analysis. We will also identify gaps in our understanding of these two conceptions, as well as, strengths and weaknesses of the modeling technique.

Ranganathan's Theory and Faceted Classification

The first characteristic to note of Ranganathan's theory of classification is that it is always changing. From the time that he begins to reflect on his practice of classification in the late 1920s until his final publications in the 1960s, we see his thoughts evolve. This means when we consider what might Ranganathan's theory of classification might be, we must be explicit about which phase of his work we are discussing. I have elsewhere identified successive *waves* of classification theory that Ranganathan creates over the course of his career (Tennis, 2007, 2011).

The waves of Ranganathan's theory can be identified by the identification and definition of different components giving rise to differentiations between previous thought and subsequent thought on classification. Thus, each of the waves has a set of components. The sum of the components is a layer. Each wave subsequently adds, reorganizes, renames, or redefines these components. Very rarely are whole components taken away. Rather, we will see a renaming or a new definition of a component.

The waves can be schematized in the follow table. Following the table I discuss each of these components.

	Faceted (1924-1949)ⁱ	Analytico-Synthetic (1950-present)ⁱⁱ	Depth (1953-present)	Abstract (1965-present)
Facets	Unrounded and Unleveled and Unquasi-ed	PMEST, Rounded, Leveled, Emptied	PMEST, Rounded, Leveled, Emptied, (W) analysis, (QI) analysis, Zoned and Sectored	PMEST, Rounded, Leveled, Emptied, (W) analysis, (Q1) analysis, Zoned and Sectored, Grammatagraphal
Base	Robust	Thin	Brittle	Reinvested
Notation	'Meccano'	'Grammatical'	'Telescoping'	'Mnemonic'
Connecting Digits	1	Many	Many	Many and linked to linguistics research
Laws	6 ⁱⁱⁱ	8 (2 don't appear again) ^{iv}	7 (11) ^v	A source of more Laws
Canons	28	31	43	A source of more Canons

Table 1. Component Comparison of Ranganathan's Waves of Theory

The above table outlines 6 components that are useful in distinguishing Faceted Classification from three other waves of classification theory. These six form a common layer that spans FASDA (the categories listed in the table above). The components in this layer are 1) Facets, 2) Base, 3) Notation, 4) Connecting Digits, 5) Laws, and 6) Canons. To create a scheme for classifying subjects, Ranganathan felt all of these were important to reducing an N-dimensional universe to a single line – that is, taking the infinite universe of subjects with their myriad interrelationships and making systematic, comprehensible, and helpful the shelf of a library.

Faceted Classification, the first wave of Ranganathan's theory, is distinguished from the others in along the components: 1) the lack of fundamental categories or rounds and levels in the classification; 2) a base notation (mixed with letters and numbers) that is satisfactory to the purpose; 3) a rudimentary approach to hospitably expressive notation, with no *emptying digits* for interpolation or extrapolation in array; 4) fewer connecting digits which limited the extrapolation and interpolation in the chain and also rendered the notation by colon alone inelegant and non-parsimonious; 5) fewer laws, and canons. Faceted Classification is barebones. Its universe of application was restricted to subjects, but was not yet applied to schedules of classification of great extent, so seemed to fit the purpose. It is, in theory, flexible, but only to a point. It does not yet guide the design of schemes for classification that are infinitely hospitable and parsimoniously expressive. This is because we cannot interpolate or extrapolate in array, nor do we have notation that allows for the expression of that. That is, we could not add new facets in the proper place such that the

subjects would fall into a helpful sequence. A scheme for classification built according to Faceted Classification theory is *rigidly faceted* (Ranganathan, 1967, 107).

The second wave, Analytico-Synthetic Classification adds many characteristics to facets that aid Ranganathan's purpose. In Analytico-Synthetic Classification we add the fundamental categories of Personality, Matter, Energy, Space, and Time (PMEST), which were only intuitively present in the early classification schedules and theory. In this second wave, Ranganathan adds more digits to the classification notation. He adds connecting digits to express these fundamental categories and their citation order. This allowed him to express rounds and levels in his notation, making way for fully expressive notation in order to represent very complex subjects (i.e. subjects with many facets). Analytico-Synthetic Classification also allowed for notational expansion through *emptying digits*. This innovation allowed for interpolation and extrapolation in array. Analytico-Synthetic Classification was *guided by postulates and principles* (Ranganathan, 1967). It was also the zenith of applied classification theory for general collections.

The closely related third wave is Depth Classification. The novelty of Depth Classification lies in its *Whole and Part-Whole* (W) analysis, *Quasi-Isolate Analysis* (QI) and a focus on Zones and Sectors. With the desideratum of making very specific assertions about subjects in very particular domains, Ranganathan introduces a set of components that accommodate that desire. The design requirements of Depth Classification dictate that we must be able to add a large number of very specific facets while maintaining the semantics of the digits present. Furthermore we must be able to file those digits in the proper sequence – no matter how many there are, and no matter how precise they are. Interpolation and extrapolation are required, but semantically rich and systematically precise notation is jeopardized because of the limitation of notation as understood in earlier incarnations of the dynamic theory of classification. Ranganathan then adds analysis techniques to accommodate the constraints of using alpha-numeric symbols to represent the order and meaning of ideas. This analysis is the whole and whole-part analysis which results in different sectors and zones of notation. The complexities of this are worked out such that each array and chain has expressive notation regardless of how many ideas occupy a coordinate space in the classification schedule. That is, Depth Classification wants all characteristics and levels in the classification to be clearly and parsimoniously represented.

Finally, Abstract Classification is more about moving classification from trial-and-error empirical methods to postulational methods of thought, following the analogy of mathematics moving from applied mathematics to pure mathematics. That is, with enough data from the practice and reflection of classification, Abstract Classification can weigh the constraints and functional requirements, and then create more features of the classification system in the hypothetical, such that when applied to the work of classification, it maximizes the implementation of the desired results.

Besides being the reflective outcome of work on classification up to the 1960s, Abstract Classification focused on the power of notation to fulfill Ranganathan's desire for parsimonious and mnemonic representation. It was 'grammatographal' insofar as Abstract Classification, as outlined in his 1967 Prolegomena, hoped that innovation in notation would

aid the complex and growing requirements to faithfully represent the universe of subjects in a hierarchical, helpfully ordered, mutually exclusive, and jointly exhaustive scheme for classification.

Few worked in Abstract Classification besides Ranganathan, though it holds potential for a fruitful understanding of structure in relation to semantics of classification schemes as a particular kind of indexing language (c.f. Svenonius, 1979).

Modeling Ranganathan's theory in an IDEF0 formalism lends a focus on the actions. This formalism allows us a bird's-eye view of the actions, inputs, outputs, constraints, and mechanisms of complex processes. I have provided the diagrams that I generated in modeling FASDA in IDEF0 elsewhere (Tennis, 2011). And while the diagrams are too large and complex to present here, I will present some findings based on looking at them. Below is a table that outlines the differences and one commonality of the waves of classification theory developed by Ranganathan.

Postulational Work / Actions	Faceted (1924-1949)^{vi}	Analytico-Synthetic (1950-present)^{vii}	Depth (1953-present)	Abstract (1965-present)
Deciding facet sequence	Mechanical	Postulational	Postulational	Subject of research
Analysis into fundamental categories	Not present	In rounds and levels	In many rounds and levels	Subject of research
Analysis whole-part	Not present	Not present	Present	Subject of research
Analysis of documents	Not present	Not present	Not present	Not present
Separate universe of ideas into Sectors and Zones	Not present	Nascent	Fully present	Subject of research
Discern compound, complex, macro, micro, or spot subjects	Not present	Present	Necessary	Subject of research
Evaluate classification	Few laws	Many laws, postulates, and principles	Many laws, postulates, and principles	Generates criteria for classification, Looking outward to other philosophical grounding(s)

Table 2. Postulational work and actions

We can see from this table that Analytico-Synthetic and Depth Classification are more similar than either is to Faceted Classification. Yet, we can see how the actions required of the classifier-cum-classificationist increase in complexity as we move from left to right. Ranganathan's successive waves of classification theory required more and more of the classifier. Yet, we see very little attention being paid to what has dominated subsequent classification and indexing theory: the analysis of documents for their subjects. For Ranganathan, in each of his waves, the title was enough material to go off of, at least formally, to do the work required to place the document-in-hand into its most helpful place on the shelf. Here is one action, indexing, represented by a rich literature, that could be incorporated into this dynamic theory of classification.

Vickery

B.C. Vickery's work carries a very different tenor than Ranganathan's. The tone is one of advising the reader on the best way forward, and informative of the developments of the past. His definitions are casual and operational. Another characteristic of his work is that we perceive stability over the course of his career with regard to what a faceted classification scheme is and what facet analysis is. For example we can see the same kind of conceptual work at play in his 1966 work and in his 2008 article in *Axiomathes*. This may be due to the fact that much of Vickery's work built on the latter work of Ranganathan. Having said that, Vickery does advise different methods.

We can now look at how Ranganathan's theory and Vickery's theory compare. Below we see the table of Ranganathan's waves of classification theory and I have added Vickery's in one column to the right. I have also added characteristic titles that can be used to contrast Vickery from Ranganathan.

	Faceted (1924-1949) viii	Analytico-Synthetic (1950-present) ix	Depth (1953-present)	Abstract (1965-present)	Vickery (1966-2008)
Facets	<i>Common Across Schedules with Exceptions</i>				<i>Bespoke</i>
	Unrounded and Unleveled and Unquasi-ed	PMEST, Rounded, Leveled, Emptied	PMEST, Rounded, Leveled, Emptied, (W) analysis, (QI) analysis, Zoned and Sectored	PMEST, Rounded, Leveled, Emptied, (W) analysis, Zoned and Sectored, Grammatagraphal	Placed in Citation Chain, Admits of dependent facets, W Analysis is moved to Fundamental Categories
Base	Robust	Thin	Brittle	Reinvested	Not prescribed
Notation	<i>Fully Expressive</i>				<i>Optionally Expressive</i>
	"Meccano"	"Grammatical"	"Telescoping"	"Mnemonic"	Hierarchical, Ordinal, Simplified (NB no emptying notation discussed)
Connecting Digits	1	Many	Many	Many and linked to linguistics research	Optional
	<i>Legislated Behaviors</i>				<i>Advised Behaviors</i>
Laws	6x	8 (2 don't appear again)xi	7 (11)xii	A source of more Laws	Not formalized
Canons	28	31	43	A source of more Canons	Not formalized

Table 3. Comparison of Ranganathan and Vickery's Classification Theory

Postulational Work / Actions	Faceted (1924-1949) ^{xiii}	Analytico-Synthetic (1950-present) ^{xiv}	Depth (1953-present)	Abstract (1965-present)	Vickery (1966-2008)
Deciding Facet Sequence	Mechanical	Postulational	Postulational	Subject of Research	Decided for each schedule and each part of each schedule
Analysis into Fundamental Categories	Not present	In rounds and levels	In many rounds and levels	Subject of Research	Into a <i>citation chain</i>
Analysis Whole-Part	Not present	Not present	Present	Subject of Research	Not present
Analysis of Documents	Not present	Not present	Not present	Not present	More of a concern, but not a preoccupation
Separate Universe of Ideas into Sectors and Zones	Not present	Nascent	Fully present	Subject of Research	Not required because of citation chain
Discern Compound, Complex, Macro, Micro, or Spot Subjects	Not present	Present	Necessary	Subject of Research	Not present
Evaluate Classification	Few Laws	Many Laws, Postulates, and Principles	Many Laws, Postulates, and Principles	Generates criteria for classification, Looking outward to other philosophical grounding(s)	General ideas, drawing on IR conceptions set out in Cranfield and the like

Table 4. Work and Actions in Ranganathan's and Vickery's work

From these tables we can discuss the points of comparison. As noted by Vickery (1966), he takes a different approach to fundamental categories, erring on the side of being more explicit than Ranganathan on what the basic parts of a subject string in a particular discipline should be. So we get Vickery's example of:

[Things] [Parts] [Materials] [Properties] [Operations] [Operating Agents]

which is a distillation of 36 fundamental categories identified by the Classification Research Group (CRG) for a special classification on aircraft (Vickery, 1966, 48-49). We can see here that the first two, Things and Parts, present a different approach compared to

Ranganathan's work. Ranganathan introduces whole and whole-part analysis in his later waves, and these allow the classificationist to see which facets should come first in citation order. The work is slightly different from what Vickery advocates. Vickery proposes separating wholes and parts at the fundamental category level, and naming each of these. Because of the nature of Vickery's *advised behaviours*, where we do not have general laws or canons governing the classificationist and the classifier, we do not need to appeal to a generalizable rule. Ranganathan does want that to happen. So his

[Personality] [Matter] [Energy] [Space] [Time]

will repeat as needed (using rounds and levels), but will also be separated into wholes and parts. So that the first part of a Personality facet will be the whole, while the following facets will represent parts of the Personality.

For example in the context of history we might want to show *community* first, then *parts of that community* second. In this case, *community* is the first level of Personality [P] and *part of community* is the second level of personality [P2]. The effect of this on the work and actions of classification are important to consider. Ranganathan's concern for this whole-part analysis is linked to his concern with fully expressive notation. Without this constraint we would not have whole-part analysis. Thus there is a contingency linkage between expressive notation and whole-part analysis in the latter waves of Ranganathan's theory of classification.

With Vickery we are presented with a different method. Because notation is not required to be expressive we can rely on interpolation and extrapolation to be unexpressed in notation. This requires the classificationist to understand the role of fundamental categories in relation to hierarchy. Likewise the bespoke nature of Vickery's theory requires the classificationist to make explicit his assumptions about dependent facets and their ranking in the hierarchy. Are we adding a new level or 'focusing' a facet? There is little talk of focus in Vickery's theory, and again this might be due to his relationship to notation. Whereas Ranganathan never waived from his design requirement that notation be expressive of what classification is doing (setting up classes into mutually exclusive, jointly exhaustive, hierarchical and systematically ordered sets), we see with Vickery's classification theory that we have options. And even if those options do not violate hierarchical order per se, we see no expression of it in notation, and we are suspicious of the relationship between systematic order in array given the concept of subfacets or dependent facets and hierarchy. It is clear we have the capacity for mutual exclusivity and we likely have joint exhaustivity in a Vickery-informed scheme for classification, but we sacrifice other aspects of the ideal type of classification.

It must be said that notation for the purpose of filing order is not the same as expressive notation. Vickery (1966, 59) shows us this example:

No.	Hierarchical	Subject	Ordinal
(1)	A	Library Types	A
(2)	A2	.. Public	A22
(3)	A3	.. Non-public	A3
(4)	A32 Academic	A4
(5)	A321 School	A5
(6)	A322 College	A6
(7)	A329 University	A65

Table 5. Two types of notation

Here we can see two forms of notation. On the left we can see an expressive hierarchical notation. We know where we are in the hierarchy from the notation, and we can see where we are in the array (though depending on context, it might be argued that this example is not very good at showing the filiation between subjects 6 and 7). On the right hand side we see ordinal notation, notation where within the same facet (in this case all numbers with notation A, 'Library Types'), facets are arranged, not in a hierarchical arrangement, but in a way that shows their order in a line – fixing a particular place on the shelf – such that it does not matter that Academic and School are related hierarchically. We lose, in this notation, the expression of hierarchy. Likewise we see a contradiction, perhaps, in the expression of a relationship between College and University. The notation A6 and A65 connotes a hierarchical relationship, yet given Vickery's theory, we know that in fact that is not the relationship that we are conveying in the notation. We can see from the non-notation display (the middle column not counting the example numbers) that facets, according to Vickery can be represented in a multitude of ways and that we must read the classificationist and their work before we open the text to know whether we will be working with expressive notation or not.

Lineage

What remains is a discussion of whether or not there are multiple lineages of faceted classification. As documented by La Barre (2000), we do not need to believe that Ranganathan is the founder of facets. However, we would be irresponsible to think that his conception of faceted classification was identical to all others. As we have demonstrated in our tables above, there are novelties in how Ranganathan perceived his work and made sense of others'. He also presented a distinct *theory* of classification that is not the same as the *theory* of Vickery. When we lay the two side by side we see clearly that there are different design requirements established by Ranganathan and by Vickery. The work is similar but distinct.

How then does a lineage inspired by Ranganathan's work differ from that of Vickery's? The former spends time on the Laws and Canons, uses them to evaluate the work done, and works within a constraint of expressive notation. The problem here for Ranganathan is the wily life of words and their defiance against fixity and transparency. For a Vickery-inspired classificationist we see nothing but *carte blanche*. The work is ready for your decisions and the order established is cogent and coherent with only the introduction needed as explanatory. That is, they both do work, but they approach facets from two different methodologies.

Conclusion

Modeling Vickery's work and Ranganathan's work has led to a deep understanding of what exactly each thinker considers faceted classification to be. The challenge in this work comes from the relationship between entities and action in designing and updating a faceted classification. However, and because of this work, the insight into the nature of faceted classification is invaluable. We can better understand what is involved in a faceted classification, and begin to document intentional differences among designers of classification schemes in LIS. That is, we can take a page from Max Mueller's concepts of language, and say, to know one kind of faceted classification is to know none.

References

- Gnoli, C. (2008). *Axiomathes*. 18(2), 127-271.
- La Barre, K. (2004). Adventures in faceted classification: A brave new world or a world of confusion? In Ia C. McIlwaine (Ed.) *Advances in Knowledge Organization and the Global Information Society*. 9, 79-84. Würzburg: Ergon Verlag.
- Ranganathan, S. R. (1967). *Prolegomena to library classification*. 3rd ed. Bombay: Asia Publishing House.
- Tennis, J. T. (2007). Modeling Ranganathanian Classification Theory: Toward Formalisms for the Theoretical Design and Evaluation of Subject Classification Systems. In *36th Annual Meeting of the Canadian Association for Information Science/L'Association canadienne des sciences de l'information*. June 2008. Vancouver, British Columbia.
- Tennis, J. T. (2011a). Ranganathan's Layers of Classification Theory and the FASDA Model of Classification. In *Proceedings of NASKO 2011*. June 2011. Toronto, Ontario.
- Tennis, J. T. (2011b). *IDEFO Models of Ranganathan's work*. Retrieved from <http://faculty.washington.edu/jtennis>
- Vickery, B.C. (1960). *Faceted classification: a guide to construction and use of special schemes*. London: Aslib.
- Vickery, B.C. (1966). *Faceted classification schemes*. New Jersey: Rutgers University Press.

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Footnotes

- i) Facet Analysis began in 1924 (Ranganathan 1967, 566), whereas Faceted Classification surfaces in 1933 with the first edition of the Colon Classification. This is a distinction (not consistently held) that we can do analysis without notation, but once we do analysis and add notation we are doing classification.
- ii)
- iii) Round and Level Analysis started in 1950, whereas Analytico-Synthetic Classification guided by Postulates and Principles begins in 1957 (Ranganathan, 1967, 566).
- iv)
- v) One of these Laws later becomes a Canon
- vi)
- vii) The two that do not appear again are the Law of Large Numbers and the Law of Probability
- viii)
- ix) There are seven laws if you count all of the Five Laws of Library Science as one; otherwise we have eleven Laws that govern the design of classification according to Ranganathan.
- x)
- xi) Facet Analysis began in 1924 (Ranganathan, 1967, 566), whereas Faceted Classification surfaces in 1933 with the first edition of the Colon Classification. This is a distinction (not consistently held) that we can do analysis without notation, but once we do analysis and add notation we are doing classification.
- xii)
- vii) Round and Level Analysis started in 1950, whereas Analytico-Synthetic Classification guided by Postulates and Principles begins in 1957 (Ranganathan, 1967, 566).
- viii) Facet Analysis began in 1924 (Ranganathan, 1967, 566), whereas Faceted Classification surfaces in 1933 with the first edition of the Colon Classification. This is a distinction

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xv)