

## Facet, Facet Analysis and Facet-Analytic Theory

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S. R. Ranganathan is credited with introducing the facet-analytic approach to subject analysis and knowledge organisation. It has been the single most important development impacting information retrieval tools and technologies at least since the middle of the 20<sup>th</sup> Century. The British Classification Research Group (CRG) issued a manifesto in 1955 suggesting that faceted classification should be the basis of all information retrieval. The manifesto also suggested that Facet Analysis should be viewed as a general methodology for the design of systems of knowledge organisation. The notion of Facet is central to Facet Analysis and any theory of faceted classification. While the notions of *Facets* and *Facet Analysis* have been with us for nearly a century, there is still no universally accepted standard use of these notions. Is the facet-analytic approach a theory or is it primarily a methodology? Clear and distinct definition and uniform use of the notions central to any approach are not merely desirable but constitute an essential requirement for developing a general theory of Facet Analysis and faceted classification. It is questionable whether such clear definitions of the central concepts that govern the faceted approach exist. This paper examines the use of the notion of 'Facets', including inconsistencies in its application and suggests a definition of the term 'Facet'. The scope is largely limited to examination of the use and application of the terms in the writings of Ranganathan, his associates, and members of the CRG. However, references to comparatively more recent papers have been made. The objective is to define Facet, Facet Analysis, and explain the facet-analytic approach to a theory of knowledge organisation.

**Keywords:** facet, facet analysis, facet analytic theory, knowledge organization, Ranganathan, S. R., Classification Research Group

### 1. Working Definitions

Ranganathan himself was very particular about clear and unambiguous definition of technical terms. In fact, most of his papers would begin with a section on terminology, providing working definitions of technical terms used in the text. Following his methodology, working definitions of some key terms in this paper follow. These working definitions are largely derived from Ranganathan's *Prolegomena*<sup>1</sup> and another paper<sup>2</sup>.

**Entity:** An existent. For example, an object, an event, a phenomenon, a process, an attribute in the real world or what is imagined in the abstract.

**Idea:** A product of thinking, reflecting, or imagining about an entity formulated by the intellect by integrating, with the aid of logic, a selection from the apperception mass and/or what is directly apprehended by intuition. The terms *concept*, *thought*, and *notion* are near synonyms of *Idea*.

**Knowledge:** Knowledge is the totality of ideas conserved by human beings at any point in time. In

this sense, knowledge is synonymous with 'Universe of ideas'.

**Subject:** A systematized account of an entity or a group of entities (an idea or a group of ideas) whose intension and extension are likely to fall coherently within the field of interest and field of inevitable specialization of a normal person. E.g., Each one of '*Multilingualism and social tensions: Case studies*', '*Sociology*', and '*Social Conflicts*' is a subject. On the other hand, the totality of all that is covered in, say, *Encyclopaedia Britannica* is not a subject.

**Isolate Idea:** An idea which by itself is not a subject, but which can go with a Basic Subject to form a component of a subject.

### 2. Introduction:

Knowledge organisation is a sub-discipline of Library and Information Studies (LIS) with roots in philosophy. For philosophers, knowledge organisation has traditionally been primarily an exercise in the logical mapping and ordering of the branches of knowledge. In the context of LIS, however, it is an application-oriented sub-discipline and has been an

area of interest at least since the 19<sup>th</sup> century as librarians were confronted with two major tasks:

- Organising artefacts in the form of printed books, pamphlets, and similar knowledge resources on the shelves of libraries in a helpful and logical sequence to support browsing and recall; and
- Building catalogues/indexes and similar tools to facilitate search and retrieval.

Modern library classification may be said to have begun with the publication of the first edition of Dewey's Decimal Classification (DDC) in 1876 under the title *A Classification and Subject Index for Cataloging and Arranging the Books and Pamphlets of a Library*. Dewey's system was almost immediately adopted by libraries for shelf arrangement of books, though not for building classified catalogues (which evidently was Dewey's intention, judged by the title of the first edition). Two decades later, Paul Otlet and La Fontaine used the scheme as the base for building the Universal Decimal Classification (UDC). There are suggestions that the roots of the facet analytic approach to knowledge organisation can be traced to UDC<sup>3</sup>. In fact, even the early editions of DDC were not entirely enumerative in nature and had synthetic features, e.g., in the form of common form divisions, common area divisions, etc. Undeniably, there are examples of the use of the analytico-synthetic approach before Ranganathan<sup>4,5</sup>. Kaiser's Systematic Indexing, a category-based verbal subject indexing developed in the late 1890s also exhibited features of the facet-analytic approach to subject indexing. Metcalfe even suggests that Kaiser's was probably the best mind that has ever applied itself to subject indexing<sup>6</sup>. However, it is Ranganathan who is generally credited with introducing the facet-analytic approach to subject analysis and knowledge organisation. He elaborated it and established it as a scientific approach and developed a comprehensive theory of classification based on Facet Analysis, thereby introducing a more scientific and logical approach to knowledge organisation. The facet-analytic approach has been the single most important development impacting the design of knowledge organisation systems, information retrieval tools, and associated technologies at least since the middle of the 20<sup>th</sup> Century. The Classification Research Group (CRG) even issued a manifesto in 1955 suggesting that faceted classification should be the basis of all information retrieval<sup>7</sup>. A major and important

suggestion made in this manifesto is that 'facet analysis should be viewed as a general methodology for design of systems of knowledge organisation'.

At the turn of the twenty-first century, the notion of Facet had found applications not only in library classification, but also in such areas as enterprise knowledge management (KM) and information architecture (IA)<sup>8,9</sup>. Crystal even went on to suggest that "rather than thinking of facets as a way to improve IA, we should think of facets as the foundation of IA"<sup>10</sup>. Also, Beghtol has pointed out that the notion of facet is not unique to information-related disciplines and has found parallels between Ranganathan's ideas and those of Louis Guttman, an Israeli behavioral sciences researcher who also developed a form of facet theory. If Beghtol sees this as evidence that facet principles may be cognitively available to all human beings, regardless of language, culture, or academic discipline, she also suggests that the ambiguity surrounding the term Facet, with its numerous synonyms, makes it difficult to relate literatures and to perceive links between different fields of knowledge<sup>11,12</sup>.

### 3. The Notion of Facet

The notion of Facet is central to Facet Analysis and any theory of faceted classification. The theory consisting of postulates, principles, and canons around Facets and Facet Analysis has been seen as Ranganathan's major contribution to LIS, with a strong "theoretical, cognitive and methodological background, rather than a simple empirical accumulation and description"<sup>13</sup>. While the notion has been with us for nearly a century, there is still no universal acceptance and standard use of the term. Clear definition and uniform use of the notion central to any approach is not merely desirable but is an essential requirement for developing a comprehensive theory of faceted classification. It is questionable whether such clear definitions of the central concept that govern faceted approach exist. In this context, this paper seeks to examine three related concepts centered on Facet:

- The notion of Facet itself;
- Facet Analysis; and
- Facet-Analytic theory.

A schema of categories of concepts (e.g., Ranganathan's Fundamental Categories; Vickery's categories) needs to be clearly defined and

distinguished from the notions of Facet and Facet analysis. While application of the notion of *Facet* and the facet-analytic approach are essential for developing a schema of categories of concepts, the two are not identical. It is important to define and understand each one of them. It is not that the issue has not been recognized by the knowledge organisation community. In an article in IEKO on 'Facet', Michèle Hudon writes: '... if the concept of "facet" is now more popular than in Ranganathan's own time, it does not mean that a definitive characterization of this abstract notion has been achieved, or that all those who discuss and use facets are entirely clear as to the nature and function(s) of this handy device'<sup>14</sup>. The concept is an abstraction, its intension more difficult to circumscribe than that of any term designating an object that can be physically observed and manipulated. Even after decades of usage, the meaning of the term is yet to be standardized. In the context of knowledge organisation, variations in the usage of the term can also be attributed to the existence of several different traditions: Ranganathan's own General Theory of Classification expounded in his *Prolegomena to Library Classification* (the Indian tradition), the British tradition, which is largely the work of members of the Classification Research Group, and the Classification Research Study Group in the U.S.A. Maniez points out that, after decades of usage, the meaning of the term remained to be standardized, the term being used both in highly specialized domains and in popular usage, and routinely applied in the context of any grouping process in diverse settings<sup>15</sup>.

Let us begin by quoting a few sentences in different articles in the International Encyclopedia of Knowledge Organisation (IEKO) to illustrate the issues related to the use of 'Facet'.

"The essence of Facet Analysis is the sorting of terms in a given field of knowledge into homogeneous, mutually exclusive facets, each derived from single ....."

"Facet Analysis separates out the various elements of a compound subject, by means of relating them to certain general categories..."

"The key idea of Facet Analysis is that works should be classified in terms of a set of → facets. ISKO scholars have debated the nature of facets..."

The term has also been used in the context of search and information retrieval. Facet is seen as a group of concepts considered to be equivalent by the

searcher [i.e., synonymous]. There may be several facets in a search, but usually there are no more than three or four'<sup>16</sup>.

### 3.1 What is a Facet?

*Merriam Webster's Dictionary* gives the following definitions of the term:<sup>17</sup>

- Any of the definable aspects that make up a subject (as of contemplation) or an object (as of consideration)
- A small plane surface (as on a cut gem)
- The external corneal surface of an ommatidium (one of the units of a compound eye found in insects)
- A smooth flat circumscribed anatomical surface (as of a bone).

The last three definitions are technical definitions intended for gemmologists, geologists, and entomologists respectively. The first one relates to knowledge organisation.

To consider a few definitions of Facet in the literature on knowledge organisation, Ranganathan, who has traditionally been credited with introducing the notion, says that a Facet is "the totality of subclasses based on a single train of characteristics of a main class [...] A facet carries the same name as the train of characteristics to which it is related"<sup>18</sup>. Surely, not easily comprehensible to anyone who is not familiar with Ranganathan's terminology! Initially, Ranganathan used the term 'train of characteristics' to suggest that Facets are inherent to the subject.

Hudon in her encyclopaedia article goes on to cite two other definitions of Facet. One formulated by Reitz states that Facet is the "entire set of subclasses generated when a class representing a subject in a classification system is divided according to a single characteristic, for example, the subclasses 'children', 'adolescents', and 'adults' generated by the division of the class 'people' according to the characteristic 'age'. In a more general sense, a Facet is any one of several distinct aspects of a subject".

The other from the ISO 25964-1:2011 defines a Facet as a "grouping of concepts of the same inherent category"<sup>19</sup>.

Facet has also been defined as: "categories of concepts of a same nature or represented from a same perspective such as phenomenon, process, property, tool, allowing for discipline-independent groupings of concepts"<sup>20</sup>.

The *ALA Glossary of Library and Information Science* defines Facet as "a distinct metadata element

that can be used to describe one characteristic... In some databases and catalogs, facets can be used in narrowing a search"<sup>21</sup>. It further goes on to say that to get a sense of the nature and function of the Facet, it is necessary to understand what Facet Analysis is, and defines *Facet Analysis* as: "in classification, the analysis of a subject to determine its fundamental characteristics".

It should be clear that, even within the context of knowledge organisation, the term is used to denote several different concepts: a category, a class, a cluster, a characteristic, to mention a few. This is mainly due to the lack of clarity in the definitions of Ranganathan that is continued in the writings of members of the CRG and others. This has allowed for wide interpretation of the concept.

Among the common issues in the definition of the term are:

- a) Viewing *Facet* as a characteristic of division.
- b) Viewing *Facet* as a set of subclasses obtained when a class is divided by a characteristic of division.
- c) Viewing *Facet* as a category of concept.
- d) Viewing *Facet* as a group of concepts that belong to the same category.
- e) Viewing *Facet* as a distinct metadata element.

Clearly the ambiguity and lack of clarity surrounding the denotation of Facet suggests the need for refining the terminology at least in the immediate context of knowledge organisation within LIS. To overcome the ambiguity, Maniez had suggested recognition of two types of Facets -- *Categorical facets* and *Structural facets* relating the former with semantic aspects and latter with syntagmatic aspects. This approach is not new as even Jack Mills had identified two general types of Facets: *Basic* and *Relational*. According to him, *Basic Facets* included Space, Time, and Material, while *Relational Facets* included *Kind, Part, and Property*<sup>22</sup>. For Mills, Facets are categories of concepts, like the Fundamental Categories of Ranganathan or the categories in Vickery's schema. It is questionable if such classifications of Facets will overcome the ambiguity and lead to a better understanding of the nature and function of Facets in knowledge organisation.

In a biographical essay on Ranganathan, Raghavan has suggested that Facet should merely be seen as a component of a subject<sup>23</sup>. There can be any number of Facets in a subject. Such an approach necessitates adopting a systems view of a subject<sup>24,25</sup>. Ranganathan

also categorised subjects into Simple and Compound Subjects (He also identifies a third type, viz., Complex Subjects). He postulated that every subject has a Basic Subject. (The need for the notion of Basic Subject (like Main class) is clearly understandable as he was building a scheme for library classification.) Simple Subjects are those that consist of a Basic Subject without any isolate ideas attached to it. A Compound Subject is one that consists of a Basic Subject with one or more isolate ideas attached to it. For example, 'History' is a Simple Subject, whereas 'History of India' is a Compound Subject (It has the Basic Facet 'History' and an additional Facet/isolate idea 'India' attached to it).

It appears that the first definition of Facet given in the *Merriam-Webster's Dictionary* captures the essence of what a Facet is or should be, including in the context of knowledge organisation, and it is proposed here that the definition of Facet as "any of the definable aspects that make up a subject" be adopted. Surely, Facet is not a category; it is not a characteristic of division; not a group of concepts that belong to a category; not a set of subclasses obtained when a class is divided by a characteristic of division. Facet includes Basic Subject type ideas as well as Isolate ideas.

**4. Facet Analysis:** Just like Facet, Facet Analysis too has been defined variously. Is the facet-analytic approach a theory or is it primarily a methodology? Again, to begin with a definition provided by Ranganathan: 'Facet analysis is the mental process by which the possible trains of characteristics which can form the basis of classification of a subject are enumerated'<sup>26</sup>. According to Vickery, 'Facet Analysis is the sorting of terms in a given field of knowledge into homogeneous, mutually exclusive facets, each derived from single characteristic of division'<sup>27</sup>. Kaiser's Systematic Indexing probably represents the first major attempt in applying the facet-analytic approach to subject indexing<sup>28</sup>. Kaiser developed a schema of categories for subject analysis even though these categories were limited. Today, however, it is generally conceded that the beginnings of a formal facet-analytic theory of classification are found in the work of S.R. Ranganathan in the first half of the 20<sup>th</sup> Century. This was carried forward by Ranganathan and his associates in India (Library Research Circle, Delhi and later at the Documentation Research and Training Centre (DRTC), Bangalore) and by the CRG

in the U.K. However, in the traditional form of facet-analytic theory, especially that carried forward by the CRG, it is difficult to separate the notion of Facet from that of Category and they are used interchangeably. I suggest that this is one of the principal causes leading to ambiguity in defining the notion of Facet and in understanding Facet Analysis. Facet analysis must simply be viewed as a general methodology for conceptual analysis to identify the components (Facets) in a subject independent of any schema of categories of concepts. Research has clearly shown that Facet analysis has applications in:

- Analyzing and identifying the facets of the subject of a discourse, e.g., the subject of a document; or the subject of a user's query.
- Query Processing<sup>29</sup>
- Building a faceted classification scheme<sup>30</sup> – a classification scheme for a specialised area (such as those that were developed by members of the CRG) or a general classification scheme (e.g., Colon Classification, second edition of the Bibliographic Classification, the Broad System of Ordering (BSO), the Information Coding Classification (ICC) of Dahlberg) This requires examining the literature – published books, papers published in journals, etc. – in the area concerned to identify the concepts that occur in the domain.
- Database Design<sup>31, 32</sup>
- End User Interface Design.
- Website Design / Information Architecture<sup>33</sup>
- E-commerce applications.

Reference has already been made to the work of Guttman in Israel who used the concept of Facets to enhance quantitative research methods to accommodate qualitative data. Hjørland sees *Facet Analysis* as an *a priori* approach to knowledge organisation grounded in rationalism<sup>34</sup>.

Broughton writes: '... there is evidence of the impact of facet analysis on a wide range of conventional indexing tools and on more recent tools developed for digital resources retrieval'<sup>35</sup>.

OCLC has collaborated with the Library of Congress to develop FAST (Faceted Application of Subject Terminology)<sup>36</sup>. There is also research demonstrating the use and application of facet analysis in building ontologies<sup>37</sup>. Facet Analysis has also been used for geo-spatial modeling<sup>38</sup>.

Evidently the use of Facet Analysis is by no means limited to creating classification schemes for shelf

arrangement of documents or metadata records in surrogate files. That the application of Facet Analysis was by no means confined to design of classification schemes was made amply clear by Ranganathan. One of his papers, entitled "Subject heading and facet analysis" and published in the *Journal of Documentation*, demonstrates the application of Facet Analysis to alphabetical subject indexing<sup>39</sup>. This line of research at DRTC eventually led to POPSI (Postulate-based Permuted Subject Indexing)<sup>40,41</sup>. Given this very wide range of applications, it is important to view Facet Analysis as a general and universal analytical approach and methodology. It is almost cognitive in nature and is not linked to any specific schema of categories of concepts.

An important issue that arises in applying the facet-analytic approach is the extent to which analysis should be carried out. At the definitional level practically, every concept can be further broken down and expressed in terms of the relationships obtaining between other concepts. For example, the concept of 'Thermometer' can be expressed as such using the lexical expression 'Thermometer' or further analysed into the concepts, 'Instrument', 'Temperature', and 'Measurement'. This is where we move from the Idea Plane (Plane of Logic) to the Verbal Plane (Plane of Language). The general rule should be to employ the word/term if the language in question provides a unique word/term for a concept and not to seek further semantic factoring of it. This is largely a function of the natural language in which the concept is being expressed. Closely related to this is the issue of compound terms. To give an example, the concept of 'girl students', which, in English, is expressed by qualifying the noun 'students' using the adjectivally-used noun modifier 'girl' has a unique word in practically every Indian language (e.g., *vidyaarthini* in the Kannada language and *maanavi* in the Tamil language are equivalents of English *girl students*)

## 5. Facet-Analytic Theory:

There are two important components of any facet-analytic theory of knowledge organisation. The first is a schema of semantic categories and the second one is a set of rules of grammar that allow combining concepts categorized into semantic categories to represent a compound subject. It has already been mentioned that the facet-analytic theory contrasts with earlier systems of knowledge organisation in that it is a bottom-up approach and adopts a systems view of

subjects. It deals with elementary conceptual units/isolate ideas represented by isolate terms, which are grouped into a set of predefined categories. The first comprehensive attempt at providing a theoretical basis for the facet-analytic approach was laid down by Ranganathan in his *Prolegomena to library classification*. His *Colon Classification* itself is a result of the application of the theory laid down in the *Prolegomena*. While the CRG published a manifesto endorsing Ranganathan's approach, there is not much in the early publications by members of the CRG contributing to facet-analytic theory in the form of normative principles and postulates that we see in Ranganathan's writings. However, the BC second edition contains a detailed description of the theory on which it is based. Broughton writes: 'In CRG analysis a concept may move from one category to another depending on the context'. She further goes on: 'For example, 'Straw' is an entity in Botany, a byproduct in Agriculture, a material in Construction and the Arts...., whereas in Colon Classification it will always have Personality status'<sup>42</sup>. Yet Ranganathan's theory does make allowances for having a concept manifest as different categories in different contexts. For example, a geographical area generally occurs as a manifestation of 'Space'; however, in the context of 'History' and some other social sciences, it has the status of Personality (as it represents a society/community).

The semantic categories in any scheme are limited in number and are usually postulated by the designer of the scheme based on what is deemed helpful and adequate for categorizing concepts occurring in different subject fields. There are two broad approaches to defining categories. The first one is to define a set of categories considered valid across all domains. Ranganathan in his *General Theory of Classification* has postulated five Fundamental Categories (FC) (apart from basic subjects and anteriorising common isolates/form divisions), viz., Personality, Matter, Energy, Space and Time. At the Dorking Conference, Vickery proposed thirteen categories of concepts: Substance (product), Organ, Constituent, Structure, Shape, Property, Object of action (patient, raw material), Action, Operation, Process, Agent, Space, and Time<sup>43</sup>. Bhattacharyya has postulated four Elementary Categories: Discipline, Entity, Property and Action. Jason Farradane adopted a slightly different approach. In his *Relational Indexing* he developed and adopted a schema of

categories of relations between concepts rather than categories of concepts<sup>44</sup>. All the category schemes mentioned above are deemed to be valid across subject fields. The second approach is to define a set of categories deemed appropriate to a specific area or a group of subject areas. Initially, members of the CRG argued that the nature and number of categories should be a function of the subject field and proposed different sets of categories for different subject fields. Whatever the approach, a schema of categories is an essential component of a facet-analytic theory, and all faceted systems are based on a scheme of semantic categories, even though the nature and number of categories may vary. The philosophical basis of the different categorical schemes has also been the subject of discussion. It has been suggested that Ranganathan, in postulating his Fundamental Categories, has been influenced by Indian philosophy, especially the Vaisesika system<sup>45</sup>. A criticism often made is that Ranganathan did not clearly define the meaning of Fundamental Categories and their connotation<sup>46</sup>. However, the meaning and connotation of the Fundamental Categories of Ranganathan have now been made clear<sup>47</sup>.

### 5.1 Principles for Facet Sequence

In addition to a schema of semantic categories of concepts, another important component of facet-analytic theory intended for building a classification scheme or structured subject headings for compound subjects, is a set of syntactic principles (i.e. rules of grammar) governing the sequence of component ideas in a compound subject. The sequence of facets is determined by the rules of grammar (syntax) of the scheme of classification. As far as Ranganathan's theory is concerned, the sequence of component ideas in a compound subject is governed by the Wall-Picture Principle and its derivatives (referred to as the Principle of Dependence by Hutchins<sup>48</sup>). Stated in simple terms, the principle suggests that a concept follows the component to which it is subordinate in a classificatory or grammatical sense. In other words, a 'part' follows the 'whole' of which it is a part; a 'property' follows the manifestation of which it is a property; 'Action' follows the manifestation in relation to which it is an action; a speciator (qualifier) follows the manifestation in relation to which it is a modifier. However, the importance of syntactic principles in knowledge organisation is not of the

same order today in the context of machine-based search and retrieval as it was in the days of structured pre-coordinate indexes.

## 6. Concluding Remarks

Even a century after it was first conceived, the facet-analytic approach is relevant and continues to impact information retrieval and knowledge organisation. There is no question that the facet-analytic approach represents the single most important contribution to the theory and practice of knowledge organisation in the 20<sup>th</sup> Century. It is true that researchers in knowledge organisation, including Ranganathan and members of the classification research groups in different parts of the world, have not been consistent in their understanding and definition of Facet. I suggest that Facet should merely be seen as a component of a subject and Facet Analysis as a general methodology of identifying the Facets of a subject. While the facet-analytic approach is rationalistic in nature, it has been argued that the different schemas proposed within the school represent a pragmatic approach<sup>49</sup>. In postulating his set of Basic Subjects and the five Fundamental Categories, Ranganathan appears to have adopted a pragmatic approach i.e., an approach that valorizes what is helpful and adequate for a given purpose. As Miksa observes, one cannot easily miss how nicely Ranganathan's formulation of the Facet idea seems to fit certain subject areas, and this may be reason enough to adopt it as a standard approach, regardless of whether it has any sound scientific basis or whether it always serves well<sup>50</sup>. The facet-analytic approach has proved to be portable across time and technology, and even into the Internet era clearly demonstrating its resilience, adaptability, and flexibility. David Weinberger wrote in *Forrester* in 2012<sup>51</sup>:

--- It is as if Ranganathan designed his Classification in 1933 specifically for the kind of instant reshuffling that computers made feasible decades later.

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