CHAPTER L

STRUCTURES OF RANGANATHAN'S SILS

1 INTRODUCTION

A detailed study on Ranganathan's language of Colon Classification complemented by his language of Chain Indexing has been carried out (7). The findings of that study that are directly relevant for the purpose of logical interpretation of the General Theory of SIL are synthesized in this chapter.

2 DEVELOPMENT OF SILS PRIOR TO RANGANATHAN

The developments in the field of SILs prior to Ranganathan have been dealt with, as far as practicable, in precise terms in chapters H, I, J, and K. The chronological treatment of these developments has especially emphasized the evolutionary aspects of these developments in the field of SILs. All these developments can be summed up as follows:

(1) The developments up to the middle of the 19th century are characterized by (a) the treatment of subjects as if they were all simple subjects; (b) the approach for generating organizing classification in
the verbal plane using as its basis a predesigned scheme for verbal classification; and (c) by the strategy of complementing the organizing classification by associative classifications manifesting as an alphabetical subject index to the systematic part of the catalogue.

(2) The developments in the hands of Cutter are characterized by (a) the conscious recognition of compound subjects and their accommodation in subject-propositions; (b) the perception of linguistic problems associated with the preparation of subject-propositions, and a systematic approach to their solution; (c) the rejection of the organizing classification in the verbal plane of subjects primarily treated as if they were all simple subjects, and the rejection of the predesigned schemes for verbal classification which failed to guide the preparation of specific subject-propositions; (d) the introduction of a system for generating associative classifications in the verbal plane, and for complementing it with organizing classification effect through referencing; and (e) the realization of the value of a predesigned scheme for verbal classification for vocabulary control, preparation of specific subject-propositions, and for creating organizing classification effect within the framework of associative classifications.

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The developments in the hands of Dewey are characterized by (a) the realization of the value of "systematics" in information retrieval; (b) the identification of the root cause of the failure of the prede­signed systematic schemes for verbal classification, and to solve this problem (c) the introduction of organizing classification in the notational plane on the basis of an adequately designed scheme for notational classification; and (d) the introduction of a system for generating associative classifications to complement the organizing classification on the basis of the class numbers of his scheme for notational classification.

The developments in the hands of Cutter and Dewey were all oriented towards the general purpose of information retrieval without any emphasis on specific requirements of users engaged in a specific discipline or a set of disciplines, or a particular "business", or a mission. The developments in the hands of Kaiser are characterized by (a) the realization of the inadequacy of a general purpose-oriented system or scheme for meeting the requirements of a specific purpose; (b) the conscious realiza­tion of the need for recognizing the elementary structure of compound subject­propositions; (c) the explicit postulation of elementary categories of constituents of compound subject-proposition; (d) the prescription of the syntactic structure of compound subject propositions; and by these
strategies (e) improving the methodology of generating associative classifications in the verbal plane; and (f) the continuation of the system of creating organizing classification effect through referencing.

3 FUNDAMENTALS AND PROCEDURE OF RANGANATHAN'S SILS

Ranganathan examined the merits and demerits of each of the outstanding system for subject indexing introduced by the different authorities at different points of time. He marked out the advantages and the limitations of each system. His study, research, experiments and experience revealed to him about the essentiality of certain features of the systems introduced before his taking up the profession of librarianship. Among these features, the most fundamental ones may be enumerated as follows:

(1) The essentiality of recognizing the different kinds of subject.

(2) The essentiality of preparing specific subject propositions.

(3) The essentiality of organizing classification complemented by associative classification.

(4) The essentiality of postulating the elementary structure, and the syntactic
structure of compound and complex subject propositions.

(5) The essentiality of a methodology to recognize and systematize the semantic structure of the manifestations of each of the elementary categories, as well as that of compound and complex subjects.

(6) The essentiality of a general purpose-oriented system that can take care of or form the basis for generating specific purpose oriented systems.

(7) The essentiality of introducing a system which would have the advantages of the earlier systems, but at the same time would have their limitations reduced to minimum.

As a consequence of this realization, Ranganathan's research and experiments aimed at filling up the gaps of essential features, and at inventing a new system. He was crowned with a remarkable success. He made outstanding contributions to the development of SILs. Research in the field of SILs gained a definite direction for further development through the contributions of Ranganathan.
Ranganathan developed a general theory of classification (63, 64). He used this theory to develop a completely new species of scheme for notational classification (60, 61). He used this scheme for designing his classified Catalogue, and to derive subject-propositions for the Dictionary Catalogue (6, 58, 59, 65, 66). He developed a methodology of deriving subject-propositions from class numbers of notational schemes for classification (58, 59, 66), or from the result of facet-analysis (65). In the context of earlier developments, Ranganathan's contributions may be regarded as a revolutionary jump. He succeeded in filling up the gaps identified by him; and he invented new systems, and developed new SILs.

Ranganathan has dealt with the fundamentals and procedure of his languages of Colon Classification, and of Chain Indexing as elaborately as desired. Nothing seems to be implied about them which needs to be distilled out from their practice, demonstrations, and examples. Every pertinent postulate, principle, working concept, and rule of procedure have been explicitly spelt out and their uses have been exemplified or demonstrated in the documents referred to above. Besides, all those that are relevant to his languages of organizing
and associative classifications, have been consolidated in the article "Chain Procedure and Structuring of Subjects" (7). For this reason, no attempt is made here to enumerate them in this study. For the specific purpose of logical interpretation of the General Theory of SIL, Ranganathan's "Facet Formula" is readily available and to show its relationships with his languages of Colon Classification and Chain Indexing reference would be made to Illustration 3 given in Section D 323.

4 SURFACE STRUCTURE OF THE LANGUAGE OF CC

Ranganathan himself has formalized the surface structures of his language of Colon Classification. By consolidating its different parts, the generalized surface structure may be presented as follows:

BS, P; M.S 'T "ACI
BS,P;M:E,P;M:E,P;M:E ...

Note: Each of the elements except for E is amenable to "Speciation" (Modification). This exception is due to the introduction of the concept of "Round", which was introduced long before the potentiality and implications of the concept of "Speciator" was fully realized (24). According to this exception, a Speciator which is P-based or M-based is treated as if it were a manifestation of P or M, as the case may be. If E is
allowed to be "speciated", they will be treated as Speciators to $E$; and the concept of "Round" will lose its practical usefulness. I had long personal discussions with Ranganathan about the inconsistency especially in the context of the concept of Speciator. Ultimately, he agreed to remove this inconsistency. A schedule for the depth classification of subjects going with "Leather Technology" was designed in which $E$ was shown to have its Speciators (37), although they were enumerated under the schedule designated 2P. Neelameghan also raised questions about this conflict and showed how $E$ can have Methods as Speciators (50,52).

In the formulae cited above,

$$\begin{align*}
BS &= \text{Basic Subject} \\
P &= \text{Personality} \\
M &= \text{Matter (Material)} \\
E &= \text{Energy} \\
S &= \text{Space} \\
T &= \text{Time} \\
ACI &= \text{Anteriorizing Common Isolates}
\end{align*}$$

Each of the concepts mentioned above, has been defined and exemplified by Ranganathan in his works. They were all consolidated in one place under his approval (7). Some of these definitions are enumerated below for the purpose of logical interpretation of the General Theory of SIL.
(1) **Subject.**— A subject manifests itself as an organized or systematized body of ideas, whose extension and intension are likely to fall coherently within the field of interest and comfortably within the intellectual competence and the field of inevitable specialization of a normal person.

(2) **Elementary Constituents.**— An elementary constituent of a subject is either a Basic Subject or an Isolate Idea.

(3) **Isolate Idea.**— An Isolate Idea is an idea or idea-complex fit to form a component of a subject, but not by itself fit to be deemed to be a subject.

(4) **Fundamental Categories.**— An Isolate Idea is a manifestation of any one of the following five Fundamental Categories: Personality (=P); Matter (=M); Energy (=E); Space (=S); and Time (=T).

(5) **Time.**— Ideas, such as, millenium, century, decade, year, day, night, summer, winter, dry period, stormy period, are the manifestations of the fundamental category "Time".

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(6) **Space.**—The ideas denoting the surface of the earth, the space inside it, and the space outside it, are the manifestations of the fundamental category "Space".

(7) **Energy.**—An action *qua* action of one kind or another is a manifestation of the fundamental category "Energy". The action may be among and by all kinds of entity—inaanimate, animate, conceptual, intellectual, and intuitive.

(8) **Matter.**—The manifestations of the fundamental category "Matter" are taken to be of three kinds: Matter (Material); Matter (Property); and Matter (Method).

(9) **Matter (Material).**—Ideas, such as elements, or constituents, or substance, or basic matter of something physical are the manifestations of "Matter (Material)".

(10) **Matter (Property).**—Ideas, such as, quality, quantity, trait, attribute, characteristic, and distinguishing feature of an entity are the manifestations of "Matter (Property)".

(11) **Matter (Method).**—Ideas, such as, way means, mode, manner, fashion, system, style, skill, technique, process, procedure, rules, design, and plan of or for performing an action are the manifestations of "Matter (Method)".

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(12) Personality.- An idea which cannot be categorized as Time, Space, Energy, and Matter is a manifestation of "Personality".

Note: A typical subject going with a particular Basic Subject is essentially a study of the attributes and actions associated with a typical entity in a particular environment or condition qualified by space and time. For example, in the subjects going with Botany, the typical entities are plants, their varieties, and their organs. The entities in relation to which the attributes and actions are studied are the manifestations of "Personalities" in subjects going with a Basic Subject. (50, 52).

(13) Basic Subject.- A Basic Subject is a subject without any Isolate Idea as a component. A Basic Subject is either a Main Basic Subject, or a Non-Main Basic Subject. There is no means of defining a Main Basic Subject; and therefore, it is postulated. A Main Basic Subject is deemed to be a subject belonging to the array of order 1 of the universe of subjects. It neither comprehends any other Main Basic Subject; nor is it comprehended by any other Main Basic Subject. The presumption is that no Main Basic Subject can be expressed in terms of the other Main Basic Subjects. The array of Main Basic Subjects is a discontinuous open array -- that is, it admits of extrapolation and interpolation. This array includes (a) the traditional pure disciplines - such as, Mathematics, Physics, and Chemistry;
(b) the applications of the traditional pure disciplines - such as, Engineering, Chemical Technology, and Agriculture; (c) comparatively new pure disciplines "distilled" from practice-in-action - such as, Systemology, Cybernetics, and Management Science; and (d) disciplines emerging due to fusion of two or more existing disciplines - such as, Biomechanics, Biophysics, and Biochemistry. A Non-Main Basic Subject is either a Canonical Basic Subject, or a Compound Basic Subject. A traditional subdivision of a Main Basic Subject not necessarily derived on the basis of a definitely ascertainable characteristic, is a Canonical Basic Subject, e.g. Fundamentals of Physics, Properties of Matter, Sound, Heat, Thermodynamics, Light, Electronics, Electricity, Magnetism, and Transport Phenomena are the Canonical Basic Subjects derived from the Main Basic Subject "Physics". A compound Basic Subject is a Basic Subject with one or more Speciator derived on the basis of one or more of the following characteristics: (a) By Specials, e.g. Medicine-Child (Child Medicine); (b) By Environment, e.g. Medicine-Industrial (Industrial Medicine); and (c) By System, e.g. Medicine-Ayurveda (Ayurvedic Medicine). (51, 60, 61, 64, 67).

(14) Anteriorizing Common Isolate.- Ideas, such as, Bibliography, Concordance, Table, Formula, Atlas, Encyclopaedia, Dictionary, Periodical, Serial, Conference Proceedings, History, Biography,
Collected Works, Programme of Instruction, Syllabus, Synopsis, Scope, Standard and Specification, Case Study, Digest, Administrative Report, Statistics, Commission Report, Survey, Plan, etc. are manifestations of Anteriorizing Common Isolates. These are deemed to be "Approach Materials" to the study of a subject. And therefore, in the sequence of documents they are brought earlier to those embedding general treatment on the subject concerned. This is the significance of the term 'Anteriorizing'.

(15) Speciator.- A Speciator is an idea or idea-complex used or intended to be used as a qualifier going with a host Basic Subject, or a host Isolate Idea.

(16) Simple Subject.- A Simple Subject consists of a Basic Subject alone.

(17) Compound Subject.- A subject with a Basic Subject and one or more Isolate Ideas as components is a Compound Subject.

(18) Facet.- A Facet is either a Basic Facet (Basic Subject Component), or an Isolate Facet (Isolate Idea Component) of a Compound Subject.

In addition to the definitions enumerated above, it will be helpful to take note of a few relevant postulates and principles of sequence for the purpose of logical interpretation of the General Theory of SIL.
They are as follows:

(19) Every compound subject has a basic facet.

(20) Every compound subject has one or more isolate facets.

(21) A compound subject with a manifestation of the fundamental category "Energy" is a compound subject with Round.

(22) In a compound subject the basic facet should be the first facet.

(23) When arranged according to their decreasing concreteness, the five fundamental categories fall in the following sequence: P M E S T

(24) In a compound subject without Round — that is, in which no manifestation of the fundamental category "Energy" occurs — the isolate facets should be arranged in the decreasing sequence of the concreteness of the fundamental categories of which they are respectively the manifestations.

(25) In a compound subject with Round, the isolate facets in each Round should be arranged in the decreasing sequence of the concreteness of the fundamental categories of which they are respectively the manifestations.

(26) Ordinarily, any of the fundamental categories "Space", and "ime may manifest itself only in the last of the Rounds in a compound subject with Round. They are to be arranged in the last Round in the sequence, S followed by T.
(27) Unless otherwise specified, the subject analysis is to be completed according to the working concepts, postulates, and principles enumerated above before an Auteriorizing Common Isolate (ACI) is introduced at the end of the result of analysis. An ACI may have facets going with it; they are to be added according to their specific facet formulae.

41 Semantic Structure

Reference is made to Illustrations 1, 2 and 3 in Sections D 321, D 322, and D323 respectively. The schedule structure for organizing classification of Colon Classification closely parallels the semantic structure of Illustrations 1, and 2. Part A of Illustration 3 displays the semantic structure of compound subjects according to Colon Classification. Evidently, the semantic structure of Colon Classification is built up on the principles of "Whole-Type" (Genus-Species), "Whole-Part", and "Inter-Facet" relationships, forming part of the General Theory of SIL.

42 Elementary and Syntactic Structures

The working concepts, postulates, principles and the generalized facet formulae enumerated in Section L4 above taken along with the Part A of Illustration

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3 given in Section D 323 reveal the elementary and syntactic structures of the language of Colon Classification. According to the definitions, postulates, principles, and examples, the equivalence of these structures in terms of the elements and modifiers of the General Theory of SIL would be as follows:

- **BS** = Discipline (D)
- **P** = Entity (E)
  - Matter (Property) = Property (P)
- **M** = Matter (Material) = Entity (E)
  - Matter (Method) = Modifier to Action (m to A) (Entity-based)
- **E** = Action (A)
- **S** = Common Modifier (mC) (Entity-based)
- **T** = Common Modifier (mC) (Entity-based)
- **ACI** = Common Modifier (mC) (Property-based)

We have noted earlier that each element is amenable to modification individually. The positions of S, T, and ACI in the generalized facet formulae shows clearly that a combination of two or more facets is amenable to modification.

The above analysis in terms of elements and modifiers, admits of the logical abstraction of a surface structure as follows:
Base = Discipline (D)
Core = Entity (E)
Other Facets = Action (A)/ Property (P)

The surface structure analyzed above may be represented as follows:

\[(D-m, E-m; P-m : A-m) - mC\]

Obviously, the model of surface structure has emerged from the source deep structure through its manipulation by techniques, such as the following:

(a) Decisions about the Base and the Core.
(b) Rules for analyzing categories.

Besides this, it may be noted here that the elementary and syntactic structures of the language of Colon Classification closely parallels the structure of the Basic Chain, which says "The sequence D followed by E (both modified or unmodified) appropriately interpolated or extrapolated by A and P (both modified or unmodified) is a logical sequence of the elements of a Basic Chain manifesting in a compound subject-proposition. Any A or P may have A and/or P directly related to it. Their positions are always after the A or P to which they are related. This sequence may be used as the basis for generating an organizing
classification; and which in turn may form the basis of associative classifications. For this reason, this sequence may be called the basic sequence. The logic behind the proposition is based on the purpose of generating a "General to Specific" sequence in the vertical arrangement of subject-propositions."

The fixed positions of A and P in the formula may be interpreted as a case of deviation from the structure of the Basic Chain. But, for the language of Colon Classification, this formula is to be interpreted in the light of Ranganathan's Principles of Facet Sequence - especially, the Wall-Picture Principle. The result of using this principle to implement the formula is, indeed, the Basic Chain.

An important point to be noted here is that Ranganathan has followed a different structure for compound subject-propositions not involving any specific Entity. For example, for the subject-proposition "Human Anatomy", Ranganathan has prescribed the following structure:

\[ L; 2 = \text{Medicine}; \text{Anatomy} = \text{Discipline}; \text{Property} \]

This has happened in spite of the fact that Ranganathan
has recognized "Human bodies and their Organs" (Entities) as the Core of the Base "Medicine" - a Discipline. Under this condition, the Core should not have been omitted. In a personal discussion when I brought this inconsistency to his notice, he mentioned the "purpose of economy" as the reason for this deviation. But he agreed that a system should not deviate from its basic structure unless it is absolutely essential. On the basis of this discussion, he prescribed the use of 'O' (Zero) to represent the whole human body. Part A of Illustration 3 in Section D 323 has been worked out on the basis of this prescription.

It may be noted further that the special treatment of "Space", "Time", and "Anteriorising Common Isolate" in the language of Colon Classification is in conformity with their treatment in the General Theory of SIL. Only in the context of the concept of "Speciator" (Modifier) their distinct categorization may be regarded as an exception to the concept. However, they do not create any problem in practical use. In actual use, they are as good as Common Modifiers.
The surface structure of the language of Colon Classification designed by Ranganathan closely parallels the structure of the Basic Chain under the guidance of the Principles of Facet Sequence. As a result, it has a very high potentiality of ensuring an ideal organizing classification in the verbal plane. Chains according to Ranganathan's structure when augmented to Modulated Chains by interpolating and extrapolating successive superordinates of each component of compound subject-propositions, they generate more or less an ideal organizing classification in alphabetical arrangement. An experiment has confirmed this fact very convincingly (23).

5 SURFACE STRUCTURE OF THE LANGUAGE OF CHAIN INDEXING

Ranganathan used the term 'Chain Procedure' to denote the procedure for deriving class index entries from a class number, in a more or less mechanical way. He demonstrated the use of the Chain Procedure to derive class index entries for the classified catalogue and specific subject entries, subject analyticals, and see also subject entries for the dictionary catalogue (58, 59, 66). Later on he demonstrated the use of this procedure for deriving subject-propositions through the
Facet Analysis of names of subjects (65). A thorough study of the Chain Procedure revealed its high potentiality (7). Based on the results of this study, a revised definition of the Chain Procedure was proposed as follows:

Chain Procedure: Any systematic method of deriving subject headings for a specific subject which involves the determination of the Chain in which the subject concerned is the last link (6, 7).

This definition was approved by Ranganathan. It takes care of deriving subject headings from class numbers, as well as from the result of facet analysis. In foreign literature, the Chain Procedure is often referred to by the term 'Chain Indexing'. Seeing the popularity of the term, in this study the term 'Chain Indexing' has been used uniformly to refer to the Chain Procedure.

The Chain Indexing based on class numbers - consists, in simple terms, of translating each substantive component of the class number into its natural language term sequentially, and to use the result as the basis for deriving subject-propositions according to a set of rules formulated for this purpose.
The following is a simple demonstration of subject analysis for Chain Indexing:

**Class Number**
L, 0, 45; 421 = Medicine, Man, Respiratory system, Lung; Disease; Infections disease; Tuberculosis

= Tuberculosis of lungs (in natural language)

**Facet Analysis**

Tuberculosis of lungs

= In Medicine, Tuberculosis of Lungs

= Medicine (BS) Lungs (P) Tuberculosis (MP)

= Medicine, Man, Respiratory system, Lung; Disease; Infections disease; Tuberculosis

(by interpolating the superordinates of each facet)

**Note:**

(1) The term 'Man' stands for the whole human body.

(2) The result of "translating", and of "facet analysis" is the same - a modulated chain in the verbal plane.

(3) The modulated chain in the verbal plane forms the basis for deriving the subject-propositions.

An elaborate set of rules has been formulated to derive subject-propositions from the modulated chain. A few important ones are enumerated below:
(1) A Class Index Entry is to be given using as Heading the term represented by the last digit of each of the Sought Links of the Chain representing the Class Number.

(2) If the term derived for the Heading does not by itself individualize it, it is to be taken as the Main Heading in a Multiple Subject Heading.

(3) The Subheadings necessary to secure individualization are to be derived, with the aid of the Canon of Context, from the last digit of one (or more) of the upper sought Links in the Chain.

(4) The minimum number of such links, necessary and sufficient for individualization, are to contribute the Subheadings.

(5) The terms used as Headings or Subheadings are to be the standard ones.

This set of rules is directly useful for Chain Indexing based on class numbers. But their spirit is equally useful for Chain Indexing based on Facet Analysis. Following the spirit of these rules, we can derive the following subject propositions from the modulated chain:

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An examination of these subject propositions as well as those given in Part B of Illustration 3 in Section D 323 would reveal that the structures of compound subject propositions for Chain Indexing, in all cases, are just the reverse order of the components of modulated chains or class numbers, on which they are based. Therefore, it can be said that these structures emerge from the structures of modulated chains or class numbers.

(1) Through the rules for reversing their sequence; and
(2) Through the rules for eliminating the redundant manifestations.

Consequently, these surface structures are derivable from the deep structure of SILs. These reverse structures are meant to avoid parallelism with the organizing classification ensured by modulated chains or class numbers, and to generate associative classi-
fications. In his Chain Indexing meant for the Dictionary Catalogue, Ranganathan has used cross referencing to generate the organizing classification effect.