Lib sc. 7; 1970; PAPER P.

Seminal Mnemonics as a Pattern for System Analysis.
(Classification problems. 43). (Teaching in library science. 22).

A **Neelameghan,** *Professor, Documentation Research and Training Centre, Bangalore* 3.

[The use of Seminal Mnemonics consists in having the same digit or digit group to denote seminally equivalent ideas in whatever subject they may occur even though different terms may be used to denote the ideas in different contexts. S R Ranganathan's General Theory of Library Classification recommends the use of this device in the design and development of schemes for classification. It has also been found helpful in the actual practice of designing schemes for classification. The denotation of certain groups of ideas by certain numerals is said to have been practised in some ancient traditions, such as that of India and Chaldea. However, the idea of Seminal Mnemonics is often considered something abstract and even beyond the grasp of the average intellect. This has made communicating and teaching about Seminal Mnemonics difficult. As a result, the device is not finding the wide use that it merits. While teaching classification, the two recurring questions about Seminal Mnemonics relate to: (1) The helpfulness of the association of a particular group of ideas with a particular numeral; and (2) The helpfulness of the sequence of ideas derived by this association of a numeral, with an idea. In a class discussion it was found helpful and practicable to consider that (1) The ancient tradition of associating or denoting particular groups of ideas by particular numerals as a means of securing a helpful sequence among these ideas; and (2) The sequence of the ideas thus obtained as representing the sequence of steps generally occurring in planning and designing a system, in systematic thinking, in scientific method, and in problem solving. These points are examined in some

detail with illustrative examples from the field of Management of a Quality Control Programme, Postulate-based Method of Classifying, and generalised version of the procedure for problem solving].

1 Seminal Mnemonics

The use of Seminal Mnemonics consists in having the same digit or digit group to denote seminally equivalent ideas in whatever subject they may occur, even though different terms may be used to denote the ideas in the different contexts. The identity of the ideas is said to be recognizable at great depths beyond the reach of natural language. As and when the idea is recognised in the phenomenal level in a particular context, a term in the natural language is used to denote it in that context (4).

2 Seminal Mnemonics in Ancient Traditions

In his *Prolegomena*, Ranganathan writes: "In the mystic tradition of Chaldea and India, many such equivalences are believed to have been recognised. It gives seminal mnemonic significance to letter as well as numerals. A correct knowledge of it will make the use of digits conform with seminal mnemonics. The forgotten tradition needs to be recaptured. As the deep region of seminal equivalences transcends expression in words alone, communication through the written or printed word is difficult. Seminal equivalences are ineffable, but they get permeated by personal association and communication in a 'School' (5).

3 Use in Colon Classification

Abdul Rahman and T Ranganathan in their study of the genesis, development and use of Seminal Mnemonics in Colon Classification, point out that Dr Ranganathan has used it "intuitively and almost unconsciously" from the very beginning in 1925. They also describe a conversation about the use of mnemonic between Dr Ranganathan and His Holiness Sankaracharya of Kamakoti Peetham, a Saint and mystic, in 1932. It would appear that during the conversation the Acharya pointed out that there was an Indian tradition of using the digit 4 as mnemonic for "Disease" and the digit 5 for "Energy" (1).

4 Difficulty in Understanding The Concept

What has been said in Sec 1 to 3 is likely to give the impression that the concept of Seminal Mnemonics in something outside normal intellectual explanation and comprehension. It becomes difficult to communicate about the concept of Semir[illegible]monics. Its practical use is not easily grasped. As a result, S[illegible] Mnemonics is not finding use to the extent that it merits.

5 A New Approach

In our teaching the concept of Seminal Mnemonics to students of classification, two recurring questions have been about

1 The helpfulness of the association of a particular group of ideas with a particular numeral; and

2 The helpfulness of the sequence of ideas derived by this association of a numeral with an idea.

In a class discussion last year, it was found helpful and practicable to consider that

1 The ancient tradition of associating or denoting particular ideas by particular Indo-Arabic numerals as a means of securing a helpful sequence among the ideas; and

2 The sequence of ideas thus obtained represents the category and sequence of steps, usually occurring in the systematic planning and designing a system, in systematic thinking, in scientific method, and in problem solving.

In the succeeding sections, the above points are examined further with illustrative examples. In the discussion, it has been found helpful to categorise the denotation of ideas as belonging to two planes:

1 The Idea Plane; and

2 The Practical Plane.

6 Association of Idea with Numeral

61 NUMERAL 1

A systematic approach to the design, development and management of a system would involve, as Step 1, the idea of a Starting Point, Beginning, or Origin. Thus, in this step, in the idea plane, the system is brought into existence as it were, into the conscious level of thinking about it. In the practical plane, this may be provided for by a Problem, a Hypothesis, a set of Fundamental Normative Principles, a Statement of Objectives, or of Purpose, or of Goals, or of Policy.

In conformity with this, the numeral 1 denotes such ideas as "First in evolution", "Beginning", and "Origin" and also "Principle", "Fundamental Law", "Policy", and cognate ideas.

62 NUMERAL 2

Having recognised and stated the objectives of the system, in Step 2 the designer may consider the input necessary to achieve the objectives. In the idea plane, this would amount to considering the particular components of the system and their interrelatio[illegible] a view to securing a helpful arrangement and coordin[illegible] the components of the system in the subsequent steps. [illegible] in Step 2, in the idea plane, the system takes a form

and structure. In the practical plane this may be provided for by working out the constitution, or enumerating parts and their interrelation. It is worth noting that a study of the structure or constitution of a system is a basic "source of information" about the attributes of the system itself.

In conformity with this, the numeral 2 denotes such ideas as "Structure" and "Morphology" and also "Constitution", "Source of knowledge", "Etiology", "Epistemology", and cognate ideas.

63 NUMERAL 3

Step 3 in the design of the system would generally involve, in the idea plane, a consideration of the functions of each of the components in relation to the function of the system as a whole. In the practical plane, such a consideration may be aided by a detailed analysis of the different parts, their respective attributes and filiations, responsibility, and limitation, or setting up a model to represent the relation between the different variables involved.

In conformity with this, the numeral 3 denotes such ideas as "Function" and "Syntax", and also "Analysis", "Detection", "Diagnosis", "Equation", and cognate ideas.

64 NUMERAL 4

In designing a system the factors securing maximum efficiency and economy of operation of the system would necessarily receive attention. The designer would, however, also recognise that an artefact may not be perfect. This realisation leads to a consideration of the possible deviation of the system from the initially set norms of working. In the practical plane, the result of deviation from the norm may be recognised as a pathological state, a wastage, an error, or a failure of the system.

In conformity with this, the numeral 4 denotes "Pathology" and also "Wastage", "Failure", "Error", and cognate ideas.

65 NUMERAL 5

The economical and efficient working of a system is dependent on its internal and external environment. In Step 4 the possibility of wastage due to deviation of the system from the norms set has been recognised. In Step 5, therefore, the designer would consider the environment in which the system is to function and the factors or parameters arising from the interaction of the system with its environment, affecting the design, development, and operation of the system. In the practical plane, the consideration may be to protect the system from the environmental factors that adversely affect the efficiency of the system.

In conformity with this, the numeral 5 denotes such ideas as "Environment", and "Ecology", and also "Prevention",

"Control", "Protection", and cognate ideas.

66 NUMERAL 6

In Step 6, in the idea plane, the designer may think of extending the life of the system. This extension of the life of the system may be thought of in terms of environments other than that in which it was initially designed to work. Such new environments are also likely to come up over a period of time — that is in the future. The ideas developed at Step 5 may indicate that the system must evolve itself to meet the requirements of the future. For this purpose, an inner self-driving, self-perpetuating mechanism should be built into the methodology of the design of the system itself. The genetic mechanism in the biological world is an analogy. In the practical plane, a method for extending the life of the system may be by developing methods for correcting or treating any failure or fault, or finding solutions to problems wherever they occur, and bringing the system back to its normal state of functioning.

In conformity with this, the numeral 6 denotes such ideas as "Evolution" and "Genetics" and also "Treatment", "Resolution", "Correction", "Repair", and cognate ideas.

67 NUMERAL 7

The different steps in the design of the complete system are covered in Steps 1 to 6. However, Steps 2 to 6 are concerned with the details of the structure and function of the components of the system. Each of them gives only a truncated view of the system. Good management requires taking a total view of the system, which may present characteristics of its own, not found in the components. Therefore, in Step 7, the designer may consider, in the idea plane, an integrated or total view of the system. In the practical plane, this may consist in examining the successive stages of the growth and elaboration of the system, from the elemental or rudimentary to the fully developed stage.

In conformity with this, the numeral 7 denotes such ideas as "Ontogeny", and "Development" and also "Personality", "Integral view", "Holism", and cognate ideas.

68 NUMERAL 8

Having completed the conceptual planning and design of the system in Steps 1 to 7, in Step 8, the designer may consider, in the idea plane, the means to implement the findings and to ensure the necessary inputs and maintenance of the system for its continued efficient working. In the practical plane, the purpose may be sought to be achieved by setting up an agency for administering or managing the system.

In conformity with this, the numeral 8 denotes such ideas as "Management", "Organisation", and cognate ideas.

7 Sum Up

In Sec 61 to 68, the possible rationale behind the denotation of a particular group of ideas by a particular numeral has been viewed as representing the successive steps usually followed in the design and development of a system. These steps are generally helpful in systematic thinking and planning. It was also noted that there could be parallel sequences of sets of ideas — one for the idea plane and the other for the practical plane. This is summarised in the following table.

Step	Numeral	Idea denoted in	
		Idea Plane	Practical Plane
(a)	(b)	(c)	(d)
1	1	Origin. Beginning	Principle. Fundamental Law. Hypothesis. Statement of Objectives. Policy Statement. Problem.
2	2	Components and their interrelation	Structure. Constitution. Form. Source of Knowledge.
3	3	Function. Syntax.	Analysis. Detection. Establish equation, model etc.
4	4	Deviation from norm	Pathology. Wastage. Failure. Error.
5	5	Environment, Ecology	Prevention. Protection.
6	6	Evolution. Genetics. Phylogeny.	Treatment. Resolution.
7	7	Ontogeny. Development.	Integrated view. Personality.
8	8	Implementation.	Management. Organisation

8 Pattern in Applied Research and Planning

In the succeeding sections three examples of work involving a systematic approach to system development are presented. The first two examples are from the field of management and of classifying a book respectively. The third example is a generalised procedure for problem solving. In each of the examples the work in the successive steps 1 to 8 parallel the sequence of the numerals 1 to 8 obtained by the association of particular ideas with a particular numeral discussed in Sec 61 to 68 and summarised in the table in Sec 7.

81 MANAGEMENT OF QUALITY CONTROL PROGRAMME

The following account is based on a lecture by a SQC expert given at the Statistical Quality Control Unit in Bangalore in the evening of the day we had discussed the new approach to the understanding of the concepts Seminal Mnemonics. The lecturer had been in USA for some months for study and observation of the design, development, implementation and other managerial aspects of quality control programmes in different organisations. In his lecture, he enumerated the successive steps generally adopted by the organisations and also recommended by the bodies concerned with quality control in USA in managing quality control programmes. The following table (*See* P 360) mentions in parallel columns the steps 1 to 8 in the design, development, and management of a quality control programme and the mnemonic idea denoted by each of the numerals 1 to 8 in the discussion in Sec 61 to 68.

The name for each of the steps mentioned in the second column in the table is the same as that used by the lecturer. The implication of each of the steps in its practical implementation is mentioned in the third column. Here too the terms used and interpretations given by the lecturer are mentioned as far as possible. The close parallel between the sequence of ideas involved in the implementation of a programme for improving product-quality and the mnemonic ideas denoted by the successive Indo-Arabic numerals 1 to 8 is worth noting.

Step	Managerial action enumerated in the lecture		Numeral	Idea mentioned in Sec 61 to 68	
	Idea Plane	Practical Plane		Idea Plane	Practical Plane
1	Management commitment.	Statement of the quality Policy Goal of the corporation	1	Coming into conscious existence of the system. Beginning	Fundamental Law. Principle. Statement of policy.
2	Quality improvement team.	Formation of team to carry out program. Enumeration of components of the program	2	Input. Components	Structure. Constitution
3	Quality measurement	Analysis of operations to be done. Determining the data to be collected.	3	Function	Analysis. Detection. Establish equation.
4	Cost of quality	Wastage: Its kinds, causes and cost of each	4	Factors adversely affecting efficiency.	Defect. Failure. Wastage.
5	Quality awareness	Awareness of the environmental factors affecting quality of product. Prevention of deviation from prescribed standards.	5	Environment. Ecology.	Prevention. Protection.
6	Corrective action	Systematic method of resolving *for ever* the problems sensed.	6	Evolution. Genetics.	Treatment. Correction.
7	Defect prevention audit	Taking an integrated view of all the components involved, to define the ability of the system to produce quality goods/ services.	7	Ontogeny. Development.	Integrated view. Total personality.
8	Carrying out the quality improvement programme	Supervisory training.	8	Ensuring continued functioning.	Management aspects.

82 POSTULATE-BASED CLASSIFICATION

The Postulate-based Method of Classifying a subject gives a step-by-step *systematic procedure* for classifying (6). It would, therefore, be useful to examine the work involved in the successive steps in the method in relation to the ideas represented by each of the successive numerals 1 to 8, as discussed in Sec 61 to 68. The following table presents, in brief, the steps 1 to 8 in classifying according to the Postulate-based Method and the corresponding mnemonic idea for each of the numerals 1 to 8. It may be noted that the steps are serially numbered starting with 1 and not from 0 (Zero) as is usually done in applying the Postulate-based Method.

821 *Classifying: System Analysis*

Step N	Particulars	Numeral	Mnemonic idea (*See* Sec 61–68)
(a)	(b)	(c)	(d)
1	Raw Title (The first step is to take the Raw Title from the title-page of the document). (Starting point)	1	Origin. First in evolution.
2	Expressive Title (The Title is to be structured so as to express coextensively the subject of the document by bringing out all the necessary component ideas). (Structuring).	2	Structure. Constitution.
3	Kernel Title (Determining the substantive functional terms, and dropping the puffs and auxiliary terms). (Analysis of function).	3	Detection. Analysis. Function
4	Analysed Title (This is a "Problem" step because of the artificiality and constraints imposed by the particular theory of classification to be used in determining the nature of the component ideas). (Constrains and difficulty).	4	Problem. Pathology.
5	Transformed Title (Placing each Kernel Idea denoted by each Kernel Term in its appropriate context, so as to express the correct strength of bond among them). (Context and environment).	5	Environment. Ecology. Context.

Step N	Particulars	Numeral	Mnemonic idea (*See* Sec 61–68)
(a)	(b)	(c)	(d)
6	Title in Standard Terms (Correcting the non-standard terms with the aid of the schedule, thesaurus, etc.) (Correction)	6	Treatment. Correction.
7	Title in Kernel Numbers (Assembly of the elements into the Kernel Number preparatory to forming the Class Number). (Form whole).	7	Integral view. Whole personality.
8	Class Number (Omitting the labels and forming the Class Number for use). (Organisational work with respect to the Class Number).	8	Organisation. Management.

83 Scientific Method and Problem Solving

In a more or less generalised version of the scientific method and steps in problem solving for making decisions in applied research, Ackoff and others (2) have enumerated the sequence of steps 1 to 8 mentioned in column (b) of the table in Sec 831. Column (d) gives the mnemonic idea denoted by each of the numerals 1 to 8 in the discussion in Sec 61 to 68.

831 *Steps in Problem Solving*

Step N	Particulars	Numeral	Mnemonic idea (*See* Sec 61–68)
(a)	(b)	(c)	(d)
1	Sensing of *Problem* by decision maker	1	Starting point. Problem etc.
2	Formulating the problem: (Complete identification of the components of the decision maker's problem)	2	Structure. Components of the system.
3	Model construction: (Establishing functional relation between the variables with the aid of equations)	3	Analysis. Establishing equation.

Step N	Particulars	Numeral	Mnemonic idea (*See* Sec 61–68)
(a)	(b)	(c)	(d)
4	Error, Consideration of	4	Error.
5	Parameters appearing in the model, Evaluation of. Control of error.	5	Environment. Control.
6	Solution from model	6	Treatment. Resolution.
7	Consideration of model and solution as a whole	7	Integral view.
8	Implementation and organization of decision.	8	Organisation. Management.

84 PRESENTATION OF IDEAS

The helpfulness of Seminal Mnemonics in structuring the text of a document — such as, a book, an article, and a technical report — has been discussed elsewhere. The particular advantage is the helpful sequence in which the ideas get arranged and the increase in productivity in formulating the work (3).

9 Conclusion

91 GENERAL PATTERN FOR SYSTEM ANALYSIS

From the examples given in Sec 81 to 84 it may be seen that the representation of certain ideas successively by the numerals 1 to 8 is a helpful method in the conceptual analysis of a system, to find out its characteristics and as an aid in its design and development. In fact, what we are using (by way of the concept of Seminal Mnemonics) is a general systematic procedure for system analysis itself. Indeed, in the currently widely accepted definition of a "system", the following attributes of the system are usually recognised:

1 A system has an *objective* or *goal.*

2 A system may have several *components.*

3 Each of the components is designed for a specific function.

4 In a dynamic system, there is interaction among the components themselves and between the components and their external environment, which put *pressure on the functioning* of the system and thereby affect it.

5 At different stages and levels of functioning of the system, there is a *feed-back from the environment* to and between the appropriate components of the system.

6 On the basis of the feed-back, the system *corrects* itself or is corrected so as to put it along the line of maximum efficiency or normal working.

7 The development of a system requires consideration not only of the structure and function of each of the components of the system, but also taking a *whole view* of the system.

8 To ensure continuous working of the system at maximum efficiency, there needs to be an *agency* for the necessary input and maintenance.

92 PLANNING APPLIED RESEARCH

It may be possible to work out different sequences for the various groups of ideas denoted by each of the numerals. In this paper one such sequence has been discussed from the angle of the design, development and management of a system. It is also only a conjecture that in some of the ancient traditions the assignment of mnemonic significance to numerals might have been used as an aid in systematic thinking and planning. Nevertheless, the use of Seminal Mnemonics can aid rational planning of applied research and system development. It is true that brilliant, critical, intuitive insight cannot be planned. But the systematic application of theories and techniques in the pursuit of an objective or in finding solution to a problem can be planned to a large extent. Such a systematic approach increases productivity in work, relieves the intellect of thinking out the routines, and promotes its concentration on the deeper aspects of the problem on hand.

93 Bibliographical References

1 Sec 3 ABDUL RAHMAN and RANGANATHAN (T). Seminal mnemonics. (An lib sc. 9; 1962; Paper E, Sec 04).

2 Sec 83 ACKOFF (R L) and others. Scientific method: Optimizing applied research decisions. 1962.

3 Sec 84 NEELAMEGHAN (A). Books and articles: Guiding principles for preparation of text. (Lib sc. 5; 1968; Paper B, Sec 553, Para 2).

4 Sec 1 RANGANATHAN (S R). Prolegomena to library classification. Ed. 3. 1967 Chap KE, Sec 1.

5 Sec 2 ——. ——, ——. Sec 2

6 Sec 82 ——, ——. Chap XSB.