Lib sc. 3; 1966; Paper M.

DEVELOPMENT IN NOTATIONAL PLANE UPTO PRIMITIVE FACETED NOTATION.
(Teaching of library science. 6).

S R RANGANATHAN
Reported by
GANESH BHATTACHARYYA, *Senior Lecturer, Documentation Research and Training Centre, Bangalore* 3, and M A GOPINATH, *Research Assistant to the National Research Professor in Library Science*

This is a report of three lessons in DRTC, extending over 4 hours, given by Dr Ranganathan, during 28 to 31 December 1965. Explains the concept "wave-front of knowledge" and its significance to documentalists. After showing the near-inseparability of an idea and the word denoting it, elicits that the casual creation of words in a natural language makes alphabetisation generally yield an unhelpful sequence. After referring to the creation of an artificial language of symbols by scientists, mentions the justification for the

creation of the artificial language of ordinal numbers — the classificatory language — by the library profession. The Master-Servant-Relation between the Idea and the Notational Planes is brought out. The development of decimal fractional notation and of faceted notation is traced. Annotations are added at several points explaining the pedagogical value of the way in which the discussion by the students was helped and directed from time to time.

Abbreviations used

T = Teacher. P's = All the Participants.
P1 ··· P8 = Participant 1 ··· Participant 8.

1 WAVE-FRONT OF KNOWLEDGE

T.—As documentalists, we are concerned with the wave-front of knowledge. What do you understand by the term 'Wave-front'?

P's.—(After a few minutes of silence). We have only a vague idea about it.

11 Pebble-in-the-Pond Analogy

T.—You must have a clear idea about the concept denoted by the term 'Wave-front'. Let me help you in understanding it. Let us assume that you are standing on one side of a pond. What do you see on the surface of the water?

P3.—We see ripples.

T.—Let us call it waves. Suppose, a pebble is thrown into the pond. What happens?

P3.—As soon as the pebble falls into the pond, a circle of waves is formed with the centre at the point where the pebble fell. The circle of that tiny wave gradually grows bigger and bigger.

T.—That is right. What happens if another pebble is thrown about the same time near the earlier one?

P7.—A similar phenomenon occurs and the two circles so formed go on intersecting each other as they expand.

T.—Will you please represent this schematically on the black board?

P5.—(Draws two different sets of concentric circles — the pairs intersecting each other).

T.—Let us assume that a number of pebbles have been thrown into the pond, and the different sets of concentric circles so produced, are intersecting one another. You can show it schematically.

P5.—(Draws several sets of concentric circles intersecting one another).

T.—What do you see in this outskirt of the diagram?

P6.—We see a zig-zag line.

T.—The zig-zag line away from you — that is, the forward one constitutes the wave-front.

12 Application to Universe of Knowledge

T.—Does the universe of knowledge admit of such a phenomenon?

P7.—Yes, it does. The pond represents the existing knowledge. The pebbles thrown into the pond are the new seminal ideas. The forward zig-zag line represents the result of the incidence of new seminal ideas. That is the wave-front of knowledge.

T.—Very good. This phenomenon may be explained by Huyghen's Principle. According to it "Each point on a wave-front may be regarded as a source of secondary waves, and the position of the wave-front at a later time is determined by the envelope of these secondary waves at that time." According to this Principle, each point on the wave-front is a centre of new circles. So also each point on the wave-front of knowledge is a source for the creation of new seminal ideas. Thus, the wave-front of knowledge is ever dynamic, ever turbulent, and ever unpredictable. We, as documentalists, are concerned with such a wave-front of knowledge. Our aim is to serve each specialist with the nascent micro thought in the wave-front of his subject-field. We have to devise suitable techniques to achieve this end. To cope with the dynamism of the universe of knowledge, our techniques should also be dynamic. Therefore, the documentalists should be equipped with seminal principles which would help them in devising new techniques to meet new patterns of formation in the universe of knowledge.

13 Annotation

The teacher should be ever watchful to see if his communication is picked up effectively by the students. Whenever a new term or a new concept is introduced, this is particularly necessary. The concept denoted by the term 'Wave-front' should form part of the stock of the general concepts of the students. It was soon found that it was new to the students. It is for this reason that some time was spent on this term with the help of the pebble-in-the-pond analogy.

2 DEPTH CLASSIFICATION

T.—One of the techniques, that a documentalist

employs, is classification. Classification is organisation of the subjects of documents — that is, books, articles etc. When the scheme for classification is designed to organise articles — that is, micro thought —, we call it Depth Classification. The quantity and variety of micro thought in the wave-front of knowledge to be organised, we find to be unmanageably large. In fact, about 2 million articles are estimated to come out each year in about 35,000 periodicals, each covering a different area or sub-area of science. Now, what is the characteristic of the knowledge at the wave-front?

P6.—It is ever changing, ever dynamic.

T.—Can classification, particularly Depth Classification, be dynamic?

P5.—It can be and it should be.

3 DESIGN OF A SCHEDULE FOR CLASSIFICATION

T.—What is the essential aid to classification?

P4.—The classification schedule is the essential aid.

T.—Who designs the schedule?

P3.—The classificationist designs it.

T.—Is it possible to design a schedule for classification once for all to meet the challenge of the universe of knowledge at all times?

P2.—It is not possible to do so.

T.—Why is it not possible?

P3.—Every day there will be some new thought emerging from the horizon.

T.—Use the correct term.

P3.—Emerging from every point in the wave-front of knowledge.

T.—Therefore, the schedule for classification should be able to accommodate the new thought-formations. In other words, the scheme for classification should itself be dynamic with capacity for full hospitality. For this purpose, let us study the work of designing a scheme for classification.

30 ANNOTATION

In spite of the teacher making his thought expressive, some of the students may miss it due to lack of attention. This becomes evident from the incorrect terms used by the student. The teacher requires to be sensitive to such deviations. He should help the students in using the correct term. The term 'Wave-front' has got greater potency than the term 'From the horizon'

31 PLANES OF WORK

T.—The work of designing a scheme for classification is

done in three planes — the Idea, the Verbal, and the Notational Planes. Of these three, which do you think developed last?

P3.—The Notational Plane developed last.

32 IDEA PLANE

T.—That is right. Of the Idea and the Verbal Planes, which developed first?

P2.—If there be no idea, what can we express?

T.—If there be no word, can you develop ideas? (Laughter).

P7.—Words come only when the need for the communication of an idea arises.

T.—The question is very much like "Seed first or Tree first". The argument can be repeated endlessly. It would never lead to a conclusion. That is why, the Cambridge Philological Society made an appeal in the mid-nineteenth century that there should be an end of the controversy about "Idea first or Word first". It is only intuition that can find a firm answer; and the intellect never.

321 Annotation

Sometimes the universe of discourse is such that it is beyond the capacity of intellectual discussion to lead to a conclusion. The teacher is to point out the limitation of the intellect in such a case. "Word first or Idea first" is such a universe of discourse.

33 THOUGHT AND EXPRESSION

T.—Which is the earliest intuitive work in India still extant?

P's.—The Vedas are the earliest intuitive works of India.

P4.—The Puranas also are intuitive works.

T.—Puranas were more like encyclopaedias. They could not have been mainly of intuitive origin. What comes next?

(Silence among students)

T.—Let me give a hint. Till 1400 A D everything — literature, art, or science—was coloured with religion. You should, therefore, look into the field of religion for books of intuitive origin. The next sacred books belonged to Jainism. Can you name them?

P7.—The *Angas* and the *Upangas* are the sacred books of Jainism.

T.—What came next?

P3.—The Tripitakas came next.

P's.—Then came the Talmud, the Bible, the Koran, etc.

T.—These are all intuitive works. The Vedas were the result of direct intuitive comprehension, unmediated by intellect.

In the Vedas there is a story. *Manas* (intellect) and *Vak* (word) went in search of the Absolute. *Vak* came back first. *Vak* was asked whether it had found the Absolute. *Vak* said that it was an impossible task. *Manas* came later and it also admitted its failure. Then *Manas* was asked about the reason for its being late. *Manas* said that it went farther than *Vak* and had formed some new idea; but it had to return because, in the absence of *Vak*, it could not express the idea nor retain it for long. As documentalists, we have to be interested both in the Idea Plane and in the Verbal Plane. In our case it is the Verbal Plane that we meet with first. The Idea Plane has to be entered only thereafter. All the same, it is the work in the Idea Plane that is paramount.

34 HELPFUL SEQUENCE

T.—Our organisation of knowledge involves the arrangement of subjects in a definite preferred sequence. Choice of the sequence belongs entirely to the Idea Plane. Only thereafter, the Notational Plane can step in and take over the maintenance of the sequence and of mechanising it with its notational system.

341 Helpful Sequence for Children

T.—Let us next turn to the question of sequence and see the nature of our responsibility in that respect. Suppose, there is a toy-seller. The kinds of toys he has are Beast, Reptile, Bird, Insect, etc. It is expected that he would keep his toys arranged in a definite sequence. In what sequence would he arrange his toys?

P3.—In a helpful sequence.

T.—That is saying the obvious. The answer should go beyond that. The question is, "How will he arrive at the helpful sequence?"

P2.—For this purpose, he has to choose the relevant characteristic to determine the helpful sequence.

T.—Relevant to what?

P2.—The characteristic should be relevant to the purpose of the toy-seller.

T.—This is again saying the obvious. What is the purpose of the toy-seller?

P3.—His purpose is to sell them largely to children.

T.—What are the characteristics likely to be relevant to this purpose?

P4.—One of the relevant characteristics is the "taste of the children".

T.—Is it ascertainable at all? If so, how will he ascertain the taste of the children?

P3.—It is not possible to ascertain the taste of the children.

T.—Then, what will be the relevant characteristic?

P4.—Evolution of the entities represented by the toys may be one of the relevant characteristics.

T.—Will a child ask for a toy belonging to a particular stage of evolution?

P5.—No. A child will not approach like that.

T.—How does a child ask for a toy?

(After a few minutes of silence).

P3.—A child asks for its toy by the name of the toy.

T.—Therefore, what is the relevant characteristic for the arrangement of the toys?

P4.—The name of the toy.

T.—What will be the relevant sequence for the purpose of selling toys to children?

P3.—The alphabetical sequence by the name of the toy will be the relevant sequence for the purpose of selling toys to children.

T.—I gave you some boundary condition. You were unmindful about it. That a child is the chooser of the toys is an important consideration. If you become unmindful about this, it is difficult to sense the relevant characteristic and sequence. In any intellectual discussion, it is an essential requirement that the participants should remain fully aware of the boundary conditions all through. Now, write the names of the toys in alphabetical sequence on the black board.

P4.—(Writes on the black board). Beast, Bird, Insect, Reptile, ...

342 Annotation

Sometimes the students become unmindful of the boundary condition of the universe of discourse and fail to sense the essence of a question. This becomes evident from their rolling in the Verbal Plane and failing in answering the question pinpointedly. The teacher is to go slow on such an occasion. He should help the student to realise his not making any progress in the Idea Plane. His stepping unaware outside the boundary of the universe of discourse being due to his having neglected the boundary condition.

343 Helpful Sequence for Specialists

T.—Suppose, live animals are sold in a farm which is frequently visited by scientists in order to choose the requirements for their laboratory. What should be the characteristic to satisfy

the Canon of Relevance in this case? I have now changed the boundary condition concerning the users.

P4.—Evolution seems to be the most relevant characteristic.

T.—Please write the names in the evolutionary sequence on the board.

P1.—(Writes on the black board). Insect, Reptile, Bird, Beast, ···

T.—That is right. Do you see the method of arriving at a relevant characteristic and sequence? These will be different for different purposes.

(Pointing to the black board) Here we have two extreme sequences. One for the children and the other for the sophisticated scientists — the alphabetical sequence for the former and the taxonomic sequence for the latter. As documentalists, which world are we to serve? Is it the world of children; or the world of scientists — that is, specialists?

P7.—It is the world of specialists that we are to serve.

4 NEED FOR ARTIFICIAL LANGUAGE

41 UNHELPFULNESS OF ALPHABETISATION BY NATURAL LANGUAGE

T.—What do we serve to the specialist?

P1.—We serve the specialist with information contained in the documents, relevant to his purpose.

T.—What is a document?

P3.—A document is an embodied expressed thought.

T.—If we turn our attention towards expression, we find that the natural language is the most widely used medium of expression. Words constituting a language denote concepts. Words have been all along created casually. At the time of the creation of a word, the possibility of making alphabetical sequence the helpful sequence had never come into consideration. Let us see how the words get created. The Tamil word for "chair" is 'Narkkali'. It means "something with four legs". Perhaps, for the first Tamilian who saw it, the four legs that attracted his attention more than anything else. While creating that word he would not at all have thought of making alphabetical arrangement helpful. Thus, the natural language had not been meant to yield a helpful sequence if alphabetisation were used.

42 POSSIBILITY OF ARTIFICIAL LANGUAGE

T.—Let us then examine whether there can be any kind of language other than natural language for use in arrangement. In this connection, let us remember that it took nearly 2,000 years to create 40,000 words in English in this casual way. These words are not sufficient to express new ideas created by

the world of specialists today. A specialist is often caught in a corner for want of a word to express a newly created thought. He has to create a new word to express his thought uniquely. Besides this, in certain situations, the special purpose of unique economic expression calls for a kind of language quite distinct from natural language. Have you ever experienced any such language?

(Silence for a few minutes)

T.—You seem to be dazed! Let me help you. You must have learnt the addition of numbers in your schools. How do you express the concept of addition in arithmetic?

P3.—We express the concept of addition by a '+' (plus) sign.

T.—To which language does this '+' (plus) sign belong?

P7.—Generally, it belongs to symbolic language; but specifically it belongs to mathematical language.

T.—Is it a natural language like English?

P4.—No, it is not a natural language; it is an artificial language.

T.—Very good. Do you find any special advantage in an artificial language?

P5.—One advantage is that it can be used along with the words in any natural language to express the idea of "addition".

T.—It is exactly so. The Mathematician has been able to overcome the barrier of natural language by taking advantage of such an artificial language. Another advantage of an artificial language is the precision with which it communicates the thought. Can you name any other profession having its own artificial language?

P3.—The Chemist has his own artificial language.

P4.—The Physicist also has his own.

43 Classificatory Language

T.—What about the Librarian?

P6.—He too, has an artificial language.

T.—What is it called?

P3.—It is called classificatory language.

T.—What is it made up of?

P7.—It is made up of ordinal numbers.

T.—Why is it ordinal numbers only?

P3.—The technique of classification is for the arrangement of documents in a sequence helpful to the readers. Ordinal numbers are the numbers used for arrangement.

T.—How do the ordinal numbers help arrangement?

P1.—It mechanises the process of arrangement of thought in the preferred helpful sequence.

44 ANNOTATION

The Discussional Method is effective in teaching. But it does not rule out the teacher choosing a particular situation to give a short talk in order to build up the background knowledge for a fruitful discussion. The interpolation of the short talk (in Sec 41 and 42) amidst the discussion is an example.

5 SCHEME FOR CLASSIFICATION

T.—Who designs a classificatory language?

P2.—It is designed by a classificationist.

T.—Yes. His work of designing a scheme is spread over three planes. Do you know the three planes of work?

P8.—They are, 1 Idea Plane; 2 Verbal Plane; and 3 Notational Plane.

T.—A scheme for classification has got two columns. The first column is occupied by ordinal numbers. It belongs to the Notational Plane. The second column is occupied by the terms represented by the respective ordinal numbers. This belongs to the Verbal Plane. Both these planes are visible. But the Idea Plane is not. And yet, it is the most potent. It is behind the number in the first column representing it and equally behind the term in the second column denoting it. Further, the numbers and words are there only to express it.

51 MASTER AND SERVANT

T.—The main function of the Notational Plane is to implement the decisions of the Idea Plane. In this sense, the Idea Plane is the Master and the Notational Plane is the Servant In the Master-Servant-Relation, who will suffer if the servant is inefficient?

P8.—The master will suffer.

T.—What will the master do in that situation?

P6.—He will drive that servant away and get another.

T.—You have become unmindful of the boundary condition. In our discussion, there are only two persons postulated—one master and one servant. There is none else. The master has no scope for getting any other servant nor the servant any other master. The inefficiency of one will make the other suffer. In our context, the suffering will be of the master. The servant, not being capable of carrying out the decisions of the master, will make the master less and less active. He will grow despondent. He will be gradually inhibited. Out of sheer inaction, the master will even lose his creative ability.

52 RIVER-BED ANALOGY

T.—Have you ever seen getting water by digging

a small pit in a sandy river-bed?

P's.—Yes.

T.—Fresh water will not come from the underground unless the old water is taken out. So also with the work in the Idea Plane. Can you tell me the implications of this statement?

P5.—Unless the Notational Plane implements the findings of the Idea Plane, the Idea Plane will gradually cease to function up.

T.—Now coming back to our problem—we have the Idea Plane as the master and the Notational Plane as the servant. If the Notational Plane is inefficient, should the master continue to suffer like this or should he try to get rid of these sufferings by some means? How can he get rid of these sufferings?

P8.—The master should educate his servant and make him more efficient.

T.—So also, the Idea Plane should cultivate the ability of the Notational Plane to make it carry out its decisions efficiently. How the efficiency of Notational Plane has been increased we shall examine later. Let us assume for the time being that the Notational Plane has acquired all the versatility necessary to implement any finding of the Idea Plane. Here, I may say as an aside that the Notational System of CC is fast approaching such a state of versatility. You will realise this shortly. We shall now consider the relation between the Idea Plane and the Notational Plane assuming the latter super-efficient.

53 Restraint on a Super-efficient Servant

T.—A super-efficient servant should not usurp the power of decision-making for the master. The Notational Plane should not force on the Idea Plane any particular sequence of the subject as the most helpful. I shall tell you a story to illustrate this. This is an episode from the ancient epic the *Ramayana*. While in exile, Rama wanted to have a hut on the banks of the Godavari. He asked Lakshmana to choose a nice and safe site. Lakshmana said, "You are the master. It is your job to find a nice and safe site. I am the servant. My job is only to put up the hut as per your specification."

54 Occasional Delicate Duty of the Servant

T.—This restraint on the servant does not mean that he should not occasionally act as a remembrancer. Occasions do arise when the Notational Plane can make a gentle suggestion to the Idea Plane in respect of helpful arrangement—specially when the Idea Plane had been for long inhibited by the earlier inefficiency of the Notational Plane itself. I shall tell you a story to illustrate this. This is also an episode from the ancient epic the *Ramayana*. While going to the exile, Rama was carrying

the sword with him. Sita said, "The custom is to leave all the arms behind while going in exile. I do not teach you; I only remind you out of my love and regard for you."

6 NOTATION THROUGH A CENTURY

T.—Now, let us look back to see how the Notational Plane has gradually increased its ability to meet the demands of the Idea Plane.

61 DECIMAL FACTIONAL NOTATION

T.—Can you guess what the system of notation was till the second half of the nineteenth century?

P7.—Perhaps, it was integral notation.

T.—Yes, it was. But in 1876, a great event took place in our subject-field. What was it?

P6.—It was the year of birth of the Decimal Classification.

T.—What was the new feature of its notational system?

P5.—It was Decimal Fractional Notation.

T.—It was the genius of Melvil Dewey that first popularised the application of this device in constructing a Class Number. Decimal Fractional Notation provided infinite Hospitality in Chain. This proved sufficient to meet the needs of the Idea Plane in those days as most of the subjects embodied in document were single-faceted.

62 INADEQUACY OF DECIMAL FRACTIONAL NOTATION

T.—Consider the following two sets of DC Numbers:

632 Plant diseases	633 Field crops
632.4 Fungus disease	633.1 Cereals
632.42 Basidium Fungus	633.18 Rice
632.427 Smut Fungus	

Do you find Hospitality in Chain in the above set of examples?

P8.—Yes.

T.—Is there in DC a number for smuts in rice plant?

P3.—No.

T.—What shall we do then for the Class Number of this subject?

P7.—We should give it either the Class Number for Rice—that is, 633.18; or, the Class Number for Smuts in Plants—that is, 632.427.

T.—How are we to choose between the two? It is a dilemma.

P6.—Each library should choose one and follow it consistently.

T.—William Stetson Merrill surveyed how different libraries

made the choice in several such cases of dilemma. He published the result of his survey in his *Code for classifiers* (1939). Generally speaking the choice was equally divided. This proved that equal weight should be given both to the crop and to the disease. To do so both should be represented in the Class Number. But this cannot be done with mere Decimal Fractional Notation.

63 PRIMITIVE FORM OF FACETED NOTATION

T.—How did the UDC get out of the dilemma?

P3.—UDC represented the subject by the following number:

633.18–2427

T.—How will you arrive at the CC Number for the same subject?

P2.—In CC, we have the following numbers:

Smuts in plants	J;43371
Rice plant	J381
Smuts in rice plants	J381;43371

T.—This is called solution by faceted notation. If we do not put the connecting digit the facet preceding its position cannot grow; in other words, it is frozen. This first attempt gave only a Primitive Form of the Faceted Notation.

P5.—Is there a more evolved form of Faceted Notation?

T.—Yes. You are daily using it. And yet you do not seem to recognise it. We shall take it up next time.