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Towards an Integrated Theory of Notational Language. (Classification problems. 79). (Design series. 43).

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[A notational language is an artificial translating language of ordinal numbers meant for securing mechanically the ranks of ideas and subjects. The entities to be translated are (a) component ideas, and (b) relations among component ideas. Therefore, the primary base of a notational language should consist of two distinct corresponding sets of digits. The hospitality of a notational language should parallel the hospitality of the universe of subjects translated by it. For this purpose, each of the two distinct sets of digits should be made to consist of distinct subsets to provide facilities to extend the primary base. The need for extending the primary base arises primarily to accommodate new ideas and new relationships in array as well as in chain. Any new accommodation is either a case of extrapolation or of interpolation. Extrapolation in array is achieved by ordinary Sector Device. Interpolation in array requires to be governed by the Principle of Extending the Base at any Point. This can be implemented by Anteriorising Sector Device and Posteriorising Sector Device. Interpolation in chain is better achieved by "Intermediate Array Device". The Consecutive Extension Device used in UDC is such a device. The distribution of functions among the digits of the base — primary and extended — should be governed by the Principle of Unity of Notation. The agglomerate "Generalia", being always the first class, should be represented by a digit postulated to have the least ordinal value in all situations. No improvisation should introduce any sort of rigidity in the basic structure of the notational language.]

1 Introduction

11 UNCERTAINTY ABOUT THE UNIVERSE OF SUBJECTS

The universe of subjects tends to be an infinite and turbulently dynamic continuum; it is ever-growing. It is practically

impossible to know in advance as to what new ideas are likely to emerge in the future. New ideas — basic ideas, isolate ideas, and speciator ideas — keep coming up from time to time. A basic idea is fit to be deemed to be a subject by itself; and a subject consisting of one and only one basic idea is a basic subject. A basic subject is a simple subject. An isolate idea is not fit to be deemed to be a subject by itself; but, it is fit to be deemed to be a component of a subject. A subject having one isolate idea or more as its component(s) must have, as one of its components, a basic idea; and, in that case, it is a compound subject. A speciator idea is not fit to be deemed to be either a basic idea or an isolate idea, by itself; but, it is fit to be deemed to be a component of a basic idea, or of an isolate idea; and therefore, it is always a qualifier (modifier) to a basic idea or to an isolate idea. Though a speciator is neither a basic idea nor an isolate idea, yet any recognised basic idea or isolate idea may serve as the basis for deriving a speciator idea. Each of these different varieties of new ideas may claim any position in any array and also any position in any chain.

12 WORK IN THE IDEA PLANE

Classificatory work in the idea plane consists of

1 Recognising the new ideas forming components of the different varieties of subjects — such as, simple subjects, compound subjects, and complex subjects;

2 Determining the interrelations between or among the components of the different varieties of subjects; and arranging them in a sequence revealing the nature of their respective interrelations; and

3 Ranking appropriately either the subjects themselves, or their respective components, as the case may be, among the existing ones.

13 WORK IN THE NOTATIONAL PLANE

Classificatory work in the notational plane consists of implementing the findings of the idea plane. This implies the following:

1 Explicit representation of each of the subjects or components of subjects along with the correct interrelations between or among them, by an artificial language of ordinal numbers; and

2 Securing mechanically the rank of the subjects or components of subjects on the basis of the ordinal values of their respective numbers without creating homonym or synonym, and without disturbing the numbers assigned to the existing ones

14 HOSPITALITY OF THE NOTATIONAL SYSTEM

The element of uncertainty about the universe of subjects

imposes a great pressure on the notational system of a scheme for classification. To stand this pressure, each array and each chain of numbers should have great hospitality — tending to infinity. Two varieties of hospitality are recognised unmistakably:

1 Hospitality in Array; and
2 Hospitality in Chain.

Hospitality of the notational system calls for its inbuilt capacity to allow extrapolation and interpolation of new numbers in each array and each chain. Extrapolation in Array denotes the accommodation of any number of new coordinate numbers at the two ends of an existing array of numbers. Interpolation in Array denotes the accommodation of any number of new coordinate numbers between any two already existing consecutive numbers in an array of numbers. Extrapolation in Chain denotes the accommodation of any number of successively subordinate new numbers at the end of a chain of numbers. Interpolation in Chain denotes the accommodation of any number of successively subordinate new numbers between any two already existing consecutive numbers in a chain of numbers. Rigidity or lack of hospitality of the notational system inhibits the work in the idea plane. Since the time of Dewey, the rigidity of notational systems has been found to be responsible for many defects in the design and development of schemes for classification. The history of classification has, in fact, been largely the history of breaking the rigidity of notational systems.

15 CC Notational System

CC has been particularly in the forefront in breaking the rigidity of its notational system. The designing of its notational system is based on a general dynamic theory of notation formulated by the designer of the scheme himself (11). The notational system of CC is endowed with the hospitality of a very high order. This has been achieved by making judicious use of the devices recommended by the general theory of notation. These devices are as follows:

1 Mixed Base Device, for both extrapolation and interpolation in array as well as in chain;
2 Gap Device — gap of array isolate numbers, sector-gap, and zone-gap, for both extrapolation and interpolation in array as well as in chain;
3 Sector Device, for extrapolation in array;
4 New Digit Device, for interpolation in array;
5 Emptying Device, for interpolation in array;
6 Decimal Fraction Device, for extrapolation in chain;

7 Agglomeration Device (Partial Comprehension Device) for interpolation in chain; and

8 Facet Notation Device to spread out the pressure of the universe of subjects on the notational system of the scheme.

16 SCOPE OF THE PAPER

All these techniques and devices are necessary particularly in the design and development of schemes for depth classification. Experience in designing schemes for depth classification has revealed that there has been some rigidities in the notational system of CC. These rigidities have been removed considerably during the course of the preparation of the different schedules for the depth version of CC. As far as practicable, Ed 7 of CC has incorporated the findings of the researches on its notational system. Researches on the notational system of CC have shown that the exploitation by CC of the devices recommended by the general theory of notation has not been adequate to meet the demand for hospitality in certain situations. This paper attempts to

1 Identify the situations still warranting hospitality;

2 Mark out the rigidity of the notational system, as well as the inadequacy of the already exploited devices; and

3 Suggest or refer to the means for removing the rigidities as well as the devices to meet the demand for hospitality.

2 Interpolation in Chain

21 A CONCRETE EXAMPLE

In Ed 6 of CC, the schedule of the canonical divisions of "H Geology" is given as follows:

H1	Mineralogy
H2	Petrology
H3	Structural geology
H5	Dynamic geology (Geomorphology)
..	.. ..

While revising the schedule for Ed 7, literary warrant called for the provision of "Physical geology" in the schedule (8). "Physical geology" is an agglomerate (partial comprehension) comprehending "Mineralogy", "Petrology", "Structural geology", and "Dynamic geology (Geomorphology)". It is also a subdivision of "Geology". Therefore, it is to occupy the position between "H Geology" and "H1 Mineralogy", The ordinal value of its class number has to be higher than the ordinal value of 'H' and lower than that of 'Hlaa'. This is so because, the digit "a" representing "Bibliography" has the least ordinal value among the substantive digits postulated to have anteriorising ordinal value.

In CC, a primary basic subject (main subject) is postulated to be belonging to the array of order 1 of the universe of subjects. 'H Geology' is a primary basic subject. Therefore, it belongs to the array of order 1. According to the existing enumeration, then, each of the canonical subdivisions of "H Geology" belongs to the array of order 2. Now, if the partial comprehension "Physical geology" is introduced in the schedule, in the idea plane, it is to occupy a position in the array of order 2. And in that case, the order of the array to which each of the canonical subdivisions of "H Geology" belongs will change from 2 to 3. If it is not viewed in this way, the alternative will be to deem the value of the order of the array to which "Physical geology" belongs, to be between 1 and 2. In other words, this array may be deemed to be of some "intermediate order". In whatever way we view it, the accommodation of the agglomerate (partial comprehension) "Physical geology" in the existing schedule, turns out to be a case of interpolation in chain. For, in the idea plane, it is a case of accommodating a new link between two already existing successive links of one and the same chain.

22 Consecutive Extension Device in UDC

UDC uses its "Consecutive Extension Device" for interpolation in chain (1). Interpretatively, this appears to be a device to accommodate classes of "intermediate orders". In the notational plane, it consists of writing successively

1 The class number of the first class comprehended by the agglomerate (partial comprehension) concerned;

2 A "/" (stroke or virgule); and

3 The class number of the last class comprehended by the agglomerate (partial comprehension) concerned.

The digit "/" (stroke or virgule), in UDC, is postulated to have anteriorising ordinal value. Interpretatively, it is simultaneously indicative of the order of the class number formed by using it. This order is more than that of the class number immediately preceding it, but less than that of the class number immediately following it. The general principle of arrangement in UDC is "from the general to the particular: that is, the less restrictive before the more restrictive.." (1). To be in conformity with this principle, the prescription for the arrangement of a set of consecutively occurring "extension numbers" has to be in the decreasing sequence of their respective ordinal values. This prescription is not explicitly stated in UDC; but it is implied. The use of the consecutive extension device in UDC is not restricted by any design factor.

If the consecutive extension device of UDC is used in CC for interpolation in chain, the class number for the partial com-

prehension "Physical geology" would be "H1/H4". If the consecutive extension numbers 'H1/H2' and 'H1/H3' also are introduced, the arrangement of the extension numbers would be as follows:

H	Geology
H1/H4	Physical geology
H1/H3	Mineralogy, Petrology and Structural geology
H1/H2	Mineralogy and Petrology
H1	Mineralogy
H2	Petrology
H3	Structural geology
H4	Dynamic geology (Geomorphology)

23 Agglomeration Device (Partial Comprehension Device) in CC

The general theory of notation holds that "No satisfactory device appears to be available to interpolate a missing link or a newly emerging link calling for interpolation in chain" (13). In relation to "stroke notation" used by BNB, it says: "This improvisation makes arrangement difficult as the ordinal value of the stroke .. has not been defined." In its treatment on interpolation in chain, the general theory of notation does not refer to the consecutive extension device in UDC. However, the reason for CC not adopting the device used in UDC appears to be that it might have found the device cumbersome; and that the resulting class number might have been considered to be unnecessarily long.

In its place, CC has introduced its own Agglomeration Device (Partial Comprehension Device). It consists of using the digit 'Z' as an emptying digit generally with the class number for the subject immediately preceding the first subject comprehended by the agglomerate (partial comprehension) concerned. As a device, this is perhaps neater than the consecutive extension device in UDC. The digit 'Z' in such a case is not an empty digit; but it is postulated to be simultaneously emptying and indicative of agglomeration (partial comprehension). An implication of deeming it as the indicator for an agglomerate (partial comprehension) should have been that it has also the quality of creating an "intermediate array". But, according to the explicitly stated postulates used by CC, a class number formed by suffixing the agglomeration (partial comprehension) digit 'Z' is coordinate with any one of the class numbers comprehended by it. In that case, interpretatively, the use of the agglomeration device (partial comprehension device) is to be deemed to have always for its complement the use of an associated telescoping in array. The successful implementation of the findings of the idea plane by the

notational plane can be argued only in the light of this interpretation. As a result of the introduction of the agglomeration device (partial comprehension device) in this way, in CC, the problem of interpolation in chain has been reduced to the problem of extrapolation at the beginning of array.

24 Inadequacy of Agglomeration Device (Partial Comprehension Device)

In CC, the use of the agglomeration device (partial comprehension device) in its native form is found to be restricted by many design factors. For example, for obvious reason, this device cannot be used, as it is, to accommodate "Physical geology". Therefore, the need arises to seek solution by using some other device. It has already been mentioned that there is no device available in CC by which a class number of some "intermediate order" can be created or interpolated in a chain. And due to that, in CC, the problem of interpolation in chain has been reduced to the problem of extrapolation at the beginning of array. Therefore, there remains the only possibility of extrapolating a coordinate class number at the beginning of the array of the class numbers comprehended by it; and the ordinal value of the extrapolated class number has to be lower than that of the class number constructed by adding the anteriorising digit-pair 'aa' to the class number for the first subject comprehended by the agglomerate (partial comprehension).

25 Ranganathan's Solution

In relation to the problem of accommodating the agglomerate (partial comprehension) "Physical geology", Ranganathan gave his solution as follows:

"The class number representing the partial comprehension "Physical geology" should be a class number later than any class number beginning with "H, ··· " but earlier than any class number beginning with "H1a". Actually, the number "H-" secures the immediate position needed. Shall we use the number "H-" as a class number? It is not happy to end a class number with the indicator digit "-". What then shall be added after hyphen? Can we add a digit after "-"? Yes, if that digit represents a main subject. Such a number will have no meaning since the digit "-" is used as an indicator digit only for superimposition of two foci within one and the same facet; and two main class digits are not foci in one and the same facet. The next problem to decide was the choice of the main class digit to be added after "H-". It would be preferable if the digit to be added is suggestive of "Partial Comprehension". The digit "Z" carries that suggestion. Thus, the class number arrived at to represent

"Physical geology" is "H-Z". This is a case of the application of the Principle of Burnt Chariot-Lost Horse. The class number "H-Z" goes without use but occupies the very position for which no meaningful class number to represent the subject "Physical geology" can be found by following normal practice" (8).

Evidently, the use of the digit pair "-Z" to represent "Physical geology" has been admitted to be a deviation from the normal practice. Further, by implication, its use is restricted to the arrays of agglomerates (partial comprehensions) of simple basic subjects alone. It may be noted that the use of '-Z' also has amounted to be an extrapolation at the beginning of array. For, the addition of the digit '-' does not change the array. Again, it is not clear in what status the digit 'Z' has been used. If it is used as an emptying digit, as it is generally used in the other cases of agglomerates (partial comprehensions), then it would deprive the preceding rich digit 'H' of its power of representing the idea "Geology". This is not desirable; for, "Physical geology" is a subdivision of "Geology". Certainly it cannot be used as an empty digit. If it is used as a rich digit by itself, the class number "H-Z" would be a case, and perhaps the only case, where the digit 'Z' is used as a rich digit in an array other than the array of main subjects. This practice would introduce another exceptional use of the digit 'Z'.

26 GUPTA'S SUGGESTION

Evaluating Ranganathan's solution, A K Gupta remarked that the class number "H-Z" for the agglomerate (partial comprehension) "Physical geology" contained the indicator digit for superimposition (speciator indicator); and that looked very much like a compound basic subject, though that was not really so. He suggested the following solutions (2):

1 The class number "H0Z" may be used as the class number for the agglomerate (partial comprehension) "Physical geology" instead of the class number "H-Z" suggested by Ranganathan. The class number "H0Z" may be arrived at by additionally (a) assigning the digit "0" (zero) the ordinal value between the digits "z" and "1"; and (b) by using the digit "0" (zero) as a sectorising digit.

or

2 The class number "HzZ" may be used as the class number for the agglomerate (partial comprehension) "Physical geology" instead of the class number "H-Z" suggested by Ranganathan. The class number "HzZ" may be arrived at by (a) exceptionally depriving the digit "z" of its anteriorising ordinal value; and (b) by using it, as usual, as a sectorising digit.

Like the solution given by Ranganathan, each of the solutions suggested by Gupta amounts to a deviation from the existing grammar of the notational language of CC. Gupta arrives at his first alternative solution by assigning an additional ordinal value and role to the digit "0' (zero), being encouraged by the fact that the digit "0" (zero) in the notational system of CC has already been enjoying multiple ordinal values and roles. He arrives at his second alternative solution by introducing an exceptional ordinal value to one of the digits of the species "Roman smalls", perhaps being encouraged again by the fact that the CC notational system does not explicitly rule out exceptions. Again, as in the case of Ranganathan's solution, the status of the digit "Z" in both the numbers is not clear. If it is used as an emptying digit as it is generally used in the other cases of agglomerates (partial comprehensions), then it would deprive the preceding rich digit "H" of its power of representing the idea "Geology". This is not desirable; for "Physical geology' is a subdivision of "Geology". Certainly it cannot be used as an empty digit. If it is used as a rich digit by itself, the class number 'H0Z' or 'HzZ' would be a case, and perhaps the only case, where a non-existent digit-group (according to CC notational system) would be used for an array division. This practice would introduce another exception to the grammar of the notational language of CC.

27 Root Cause of "Exceptions"

The notational system of a scheme for library classification is an artificial language of ordinal numbers. A notational language has to be free from homonyms and synonyms. The prescriptions for "exceptions" in the grammar of a notational language are primarily meant to avoid the incidence of hymonyms and synonyms. Consideration of economy in the notational system may sometimes suggest some exceptions to be necessary and unavoidable. But normally exceptions are not desirable. For, a solution sought through an exception is not generally logically justifiable. In the majority of cases, they are "forced solutions"; and they are to be accepted because of the non-availability of any other satisfactory solution. In fact, exceptions, by themselves, are indicative of the weakness of the intellectual foundation of the theory of notational language. These points become evident from the analysis of the solutions given by Ranganathan and Gupta (*See* Sec 25 and 26). The above findings have led to the investigation of the root cause of exceptions. For this purpose, the role of the set of digits 'a to z, (excluding i, l, and o) in the CC notational system may be analysed. The digits 'a to z' forms part of the base of the notational

system of CC. Each of them is prescribed to be used without any indicator digit immediately preceding it, to represent a "form of document" in a class number. Any class number followed by any one of the digits 'a to z' shall have precedence over the original class number. In other words, in such a case, each of these 23 digits is entrusted with one and the same responsibility of endowing a class number with an anteriorising ordinal value. In a class number, the digit or digit-group representing a "form of docoment" is deemed to be analogous to any one of the other isolate facets of the class number. For each category of isolate facet in a class number, there should be a distinct indicator digit with appropriate ordinal value. This principle has been gradually realised by CC; and it has implemented the principle as far as it has found it necessary and sufficient. In the case of a facet representing a "form of document", it prescribes absence of an indicator digit. And the responsibility of indicating the category of facet falls on the rich digit representing the "form of document". If this notational policy is analysed, it is found that it admits of

1 Entrusting multiple digits with the responsibility of performing individually one and the same function;

2 Entrusting one and the same digit simultaneously with more than one responsibility; and

3 Interchange of function between different categories of digits for example, use of a rich digit as an indicator digit and *vice versa*.

The result of this notational policy has been the restriction of the use of the set of digits 'a to z' to represent isolates in the array of order 1 only. In other words, this notational policy has introduced rigidity in the notational language. To overcome the disadvantages of the rigidity so introduced, need arises to introduce exceptions. The first exception introduced has been that each of the digits 'a to z' endow the immediately preceding digit with anteriorising ordinal value, provided that it is a rich digit; for example, Aa, A, Ba, B, Ca, C, etc. On the contrary, this power of the digits 'a to z' will be inoperative if the immediately preceding digit is an empty digit; for example, 9a, 9b, 9c, etc. This prescription again called for another exception to exception: If the immediately preceding digit is either 'z' or 'Z' representing "Generalia" and "Law" respectively, the anteriorising power of the digits 'a to z' will remain operative. This phenomenon confirms that once the flood-gate of exception is opened, there is always a temptation to find solutions through exceptions, and that results in chains of exceptions. One of the illustrative examples of chains of exceptions centres round the

digit "0" (zero) in the CC notational system. It has been assigned multiple roles and ordinal values — such as,

1 The role of a phase indicator, having the ordinal value immediately lower than that of the indicator digit for time-facet;

2 The role of a rich digit in a number representing a time isolate idea or an idea of a chemical element, having the ordinal value immediately lower than that of the rich digit '1';

3 The role of a rich digit in representing a quantitative measure in cardinal value, having the cardinal value immediately lower than that of the integer '1';

4 The role of an indicator digit for the absence of level 1 in round 1, having the ordinal value immediately lower than that of the indicator digit for time-facet; and

5 The role of an empty sectorising digit, having the ordinal value immediately lower than that of the indicator digit for time-facet.

On the basis of the above analysis, it may be concluded that the root of all prescriptions for exceptions in the grammar of a notational language is its rigidity. Some of the important factors contributing to the rigidity of a notational language are the policy of (1) entrusting multiple digits with the responsibility of performing one and the same function; (2) entrusting one and the same digit simultaneously with more than one responsibility; and (3) interchanging function between different categories of digits. Rigidity and exceptions enrich each other.

28 Rectification at the Root

281 *Releasing "0" from Bondage*

A conscious attempt to rectify at the root has been made by A Neelameghan (6). He has pointed out the advantages and disadvantages of the practice of assigning multiple roles and ordinal values to the digit "0" (zero) in the CC notational system. The investigation clearly shows how such a practice ultimately goes on introducing rigidity more and more, leaving no other alternative but to accept forced solutions only in chains of exceptions. Out of this analysis, emerges the fact that the hospitality of a notational system largely depends upon the implementation of a principle which can be expressed as follows:

One and only one notational unit for one and only one ordinal unit and one and only one functional unit.

For convenience of reference, this principle may be named "Principle of Unity of Notation". The usefulness of this principle in developing a notational language has been elaborately demonstrated by Neelameghan. Considering the different aspects of the problem, he has recommended the use of "0" (zero) as a

sectorising digit only with the ordinal value immediately lower than that of 1. As a phase indicator he has recommended the use of the new digit "&" (ampersand) with the ordinal value immediately lower than that of the indicator digit for time-facet. His recommendation has been accepted and extensively used in the preparation of Ed 7 of CC. The recommended practice has removed the rigidity of the CC notational system to a considerable extent; as if this has released "0" from its perennial bondage, and in return, it has endowed the CC notational system with ample hospitality. This hospitality can be helpfully utilised for extrapolation at the beginning of an array whether actual or as a substitute for interpolation in chain. This is not a forced and *ad hoc* solution for "Physical geology" alone, through a prescription for exception; but a comparatively natural and permanent solution for the problem of extrapolation at the beginning of the array consisting of the Sector (S — 1). It is now clear that the agglomeration device (partial comprehension device) by using 'Z' as an emptying digit simultaneously as an indicator digit for agglomerates (partial comprehensions) is not adequate to meet the demand for hospitality in array in the CC notational system. It may prove adequate only for the agglomerates (partial comprehensions) of primary basic subjects (main subjects). For the agglomerates (partial comprehensions) of canonical basic subjects or of compound basic subjects, this device may not work always. For this purpose, one has to take recourse to numbers suitable for extrapolation at the beginning of the concerned array.

In this circumstance, a question still remains unanswered. Is it helpful to reduce the problem of interpolation in chain into a problem of extrapolation at the beginning of array? Is it not worthwhile to re-examine the potentiality of the consecutive extension device used in UDC, in this connection?

282 *Releasing Zone (Z—a)*

Another evidence of a conscious attempt to rectify at the root, is the release of Zone (Z—a) from its bondage (7). It has been noted in Sec 271 that the notational policy of entrusting multiple digits with the responsibility of performing individually one and the same function results in a rigidity of very high order in the notational system. It has been shown through detailed analysis that the CC practice with Sector (S — a) is an example *par excellence* of such a notational policy (*See* Sec 271). The chains of exceptions arising out of this rigidity have been illustrated. Considering the disadvantages of this practice, it has been recommended that the digit "double inverted comma" (") be used as

an indicator digit for "anteriorising common isolates" with an anteriorising ordinal value; and Zone (Z—a) be released for being used in any array (7). This recommendation has been accepted and extensively used in the preparation of Ed 7 of CC. It has removed the rigidity of the CC notational system considerably. Zone (Z—a) is now released from its bondage, and, in turn, it has endowed the CC notational system with ample hospitality. This hospitality can be helpfully utilized for extrapolation at the beginning of an array, whether actual or as a substitute for interpolation in chain. In addition, Zone (Z—a) can now be used to represent ideas in an array of any order. This is again a comparatively natural and permanent solution for the problem of extrapolation at the beginning of the array consisting of Sector (S—0a).

3 Extrapolation in Array

31 Extrapolation at the Beginning of Array

In the schedule of primary basic subjects (main subjects) and agglomerates (partial comprehensions) of primary basic subjects in CC (Ed 6), we find the following enumeration:

z Generalia
1 Universe of knowledge
2 Library science
3 Book science
4 Journalism

In the above enumeration "Generalia" is an agglomerate (partial comprehension); and "Universe of Knowledge" is a primary basic subject (main subject). By postulate, a primary basic subject (main subject) belongs to the array of order 1. Therefore, the order of the array to which "Generalia" belongs is lower than 1. In the notational plane the digit "z" is coordinate with the digit "1". The finding of the idea plane has been implemented here through a telescoping in array. If a new main subject claims its position before "Universe of Knowledge", in the idea plane, its accommodation would be a case of extrapolation at the beginning of array. But, in the notational plane, its accommodation would be a case of interpolation in array.

Ed 7 of CC, under preparation, has already recognised many new main subjects formed by distillation and fusion. Many more will be recognised in future. The possibility of some of them claiming positions before "1 Universe of Knowledge" cannot be ruled out. That situation, in the idea plane, will call for extrapolation at the beginning of array. In the notational plane it will be an interpolation in array. For that purpose, numbers coordinate with "z" and "1" but having ordinal values between that of "z" and "1" will be required. Earlier it would

have been difficult. But after the rectification at the root (6), it has now become possible. According to this suggestion the digit "0" (zero) is now being used only as a sectorising digit with the ordinal value immediately lower than that of 1. This has given 265 coordinate digit-groups, under the boundary condition of maximum 3 digits. In the notational plane all of them are available for interpolation between z and 1. In the idea plane, through judicious distribution they can be used to represent classes warranting extrapolation at the beginning of array, interpolation in array, or interpolation in chain.

32 PROVISION FOR THE FUTURE

The design of the CC schedule for basic subjects and agglomerates (partial comprehensions) of basic subjects, does not admit of extrapolation before "z Generalia". The reason is that there cannot be any subject more general than "Generalia". But the new primary basic subjects (main subjects) and their agglomerates (partial comprehensions) that would be recognised in future may be far more than what could be comfortably accommodated through a judicious distribution of 265 coordinate digit-groups. Therefore, it is now necessary to provide for a hospitality of even higher order.

For this purpose, Neelameghan has suggested to assign to "Generalia" the first number of the earliest sector of the notational system of CC (3). "For example", he says, "if we use the digits in Zone (Z—a) in this way, then we can have 287 coordinate numbers in 16 sectors earlier to Sector (S—0a), with no one digit combination having more than 3 digits." In this connection, he has demonstrated how new zones can be created for extrapolation before the number "a". These are all very useful suggestions. Because, these are the practicable means to achieve the ideal of investing the CC notational system with a hospitality tending to infinity. They are all now accepted, and will be used in the future developments of CC. All these suggestions provide inspiration to suggest further that while "Generalia" is always the first class in the schedule of primary basic subjects (main subjects) and agglomerates (partial comprehensions) of primary basic subjects (main subjects), a new digit — such as, "@" (at the rate of sign) — may be used to represent "Generalia". The ordinal value of "@" may be postulated to be the least in all situations among the digits forming the base of the CC notational system. This will solve the problems of interpolation after "Generalia" once for all.

4 Still More Hospitality in Array

41 NEELAMEGHAN'S SUGGESTION

One of the suggestions for extrapolation earlier to "a",

given by A Neelameghan consists of suffixing a digit — such as, "*" (Asterisk) or "↑" (upward arrow) — to "a" as an empty-emptying and sectorising digit with the lowest ordinal value among the anteriorising digits (4). Under the condition that no digit-group shall have more than 3 digits, this suggestion would make provision for 3 sectors giving a total of 53 digit-groups for extrapolation earlier to "a".

His suggestion relating to the choice of a digit to indicate an agglomerate (partial comprehension) is to choose either one with the ordinal value higher than that of "(" (Starter), or one with the lowest ordinal value among the anteriorising digits, whichever is suitable in a particular situation (5). He has preferred to use "↓" (downward arrow) for the former and "*" (asterisk) for the latter. The use of asterisk has been accepted in Ed 7 of CC (10).

42 New Line of Approach

All these suggestions have triggered a new line of approach. The sector device is used for increasing the capacity of an array with the aid of an empty digit. Essentially, this is a device to extend the base of a notational system. The sectorising digits, postulated so far, has succeeded to extend the base only at a few points — for example, either at the beginning or at the end of a species of digits forming part of the base. The idea of hospitality tending to infinity for extrapolation and interpolation demands for devices to extend the base at any point. This problem has been solved to a great extent by postulating the digits T, V, and X as emptying digits and the digits U, W, and Y as emptying-empty digits (9). The nature of this solution can again be described to be based on the principle of exception. As a result, it has introduced some degree of rigidity in the notational system of CC. And to overcome the disadvantages of this rigidity, a chain of exceptions has been introduced.

Neelameghan's suggestion (4, 5) draws our attention to something fundamental regarding the devices to extend the base of a notational system without introducing rigidity. We can now seize the "Principle of Extending the Base at Any Point". This principle can be formulated as follows:

To extend adequately the base of a notational system at any point, it is necessary to introduce devices to create, for every rich digit in the base, two sets of coordinate digit-groups — one having immediately anteriorising ordinal value and the other, immediately posteriorising ordinal value in relation to the ordinal value of the digit concerned.

For example, let there be a postulate that the overlining of a digit in the base is an emptying-empty and sectorising device

which endows the resulting digit with an immediately anteriorising ordinal value. Similarly, let there be another postulate that the underlining of a digit in the base is an emptying-empty and sectorising device which endows the digit with an immediately posteriorising ordinal value. If "c" is a digit in the base, then by overlining it, it would be possible to create several sectors of coordinate digit-groups with their respective ordinal values anterior to "c". Similarly, by underlining "c", it should be possible to create several sectors of coordinate digit-groups with their respective ordinal values posterior to "c". Under the boundary condition of two digits other than the sectorising digit, the coordinate digit-groups anterior and posterior to "c", in this case would be as follows:

$\bar{c}0$ to $\bar{c}y$, $\bar{c}1$ to $\bar{c}8$, $\bar{c}B$ to $\bar{c}Y$ (51 digit-groups)

$\underline{c}0$ to $\underline{c}y$, $\underline{e}1$ to $\underline{c}8$, $\underline{c}B$ to $\underline{c}Y$ (51 digit-groups)

The use of overlining and underlining here, is merely to illustrate the principle. In fact, they can be any other digits. But, the "Principle of Unity of Notation" — that is, "One and only one notational unit for one and only one ordinal unit and one and only one functional unit," would suggest to use them specifically for one and only one purpose. It may be noted that the "Principle of Extending the Base at Any Point" would call for the following two devices:

1 Anteriorising Sector Device.— A device for extending the base at the point immediately preceding any rich digit in it, with the aid of an eptying-empty digit with an anteriorising ordinal value in relation to the digit concerned; and

2 Posteriorising Sector Device.— A device for extending the base at the point immediately following any rich digit in it, with the aid of an emptying-empty digit with a posteriorising ordinal value in relation to the digit concerned.

The anteriorising sector device and the posteriorising sector device would satisfy the canon of extrapolation in array as well as the canon of interpolation in array in a considerably adequate measure.

5 Need for More Sectorising Digits

The general theory of notation prescribes that a method of satisfying the canon of extrapolation in array is to postulate the first and the last digits of each species of rich digits forming part of the base of the notation, to be empty digits for use as sectorising digits (12). This method admits of extrapolation at the beginning and at the end respectively of the array consisting

of the digits of the species concerned. The CC notational system has not yet used this method fully. For example, it is only the first digit and the last digit of the species Hindu-Arabic numerals that have been postulated to be empty for use as sectorising digits. In the species "Roman small" it is only the last digit that is postulated to be empty for use as a sectorising digit; so also with the species "Roman capitals". It will certainly prove helpful if the digits "a" and "A" also are postulated to be empty for use as sectorising digits.

6 Fundamentals of Notational Language

61 Fundamentals of Classification

"No structure, no classification" — is a fundamental principle of classification. "Structure" refers to the parts of the entities to be classified; and also to the different interrelationships between and among their respective parts. Classification, in the idea plane, is either grouping, or grouping *cum* ranking.

A subject is an idea or idea-complex that summarises indicatively one or several bodies of systematised ideas — that is, information. A subject may be simple, compound, or complex. An idea constituting a simple subject is a basic idea; and that is why, it is also a basic subject. The component ideas of a compound subject are one and only one basic idea, and one or more isolate ideas. The components of a complex subject are subjects — simple or compound. A basic idea may be simple or compound; so also an isolate idea. An unqualified basic idea is a simple basic idea. A qualified (modified) basic idea is a compound basic idea. So also is the case with an isolate idea. The qualifying idea (modifying idea), in both the cases, is a speciator idea.

Any constituent, or component idea of a subject has its connotation and denotation, which consists of its "part-ideas" — that is, the ideas comprehended by it. Similarly, the connotation and denotation of a compound or complex subject consists of its "part-subjects" — that is, the subjects comprehended by it. This attribute of any constituent idea, component idea, or of any subject may be referred to as its "Semantic structure". The semantic structure of any idea or subject may be deemed to be its intrinsic structure.

For the purpose of grouping alone, the semantic structure of ideas or subjects is necessary and sufficient. But, for the ranking of compound ideas and subjects, and complex subjects, their respective semantic structures, are necessary, but not sufficient.

Ranking of compound ideas and subjects, and complex subjects calls for recognising additionally a different variety of

structure of those ideas and subjects. This structure may be referred to as "Linear Structure". The linear structure of an idea or subject may be deemed to be its physical structure. The linear structure of a compound idea — basic or isolate — is concerned with the sequence of its qualifying speciator ideas. The linear structure of a compound subject or complex subject is concerned with the sequence of its component ideas — simple or compound.

It is, perhaps, impossible to establish that a compound idea or subject, or a complex subject has a natural linear structure. Therefore, depending upon the purpose, it becomes necessary to impose an artificial linear structure to every idea or subject warranting it. This is done through a coherent set of postulates about the linear structure of compound ideas or subjects and of complex subjects. This set of postulates consists of two distinct sub-sets as follows:

1 A set of postulates pertaining to the recognition (a) of the different varieties of elementary constituents — such as, basic ideas, isolate ideas, and speciator ideas — that take part in the formation of the different varieties of subjects; and (b) of the different categories of the different elementary constituents; and

2 A set of postulates pertaining to (a) the recognition of the different relationships between or among the different constituents and components of the compound ideas or subjects, and of complex subjects, and (b) the linear sequence of those constituents and components revealing the recognised relationships.

62 Artificial Verbal Language

The expression (term or terms) used to denote an idea, is a name-of-idea. The expression (term or terms), used to denote a subject, is a name-of-subject. A name-of-idea or subject containing the term(s) denoting the constituent idea(s) or all the component ideas, necessary and sufficient in a definite context, and also, wherever warranted, the relationships between or among them, is a coextensive name-of-idea or subject, as the case may be. A co-extensive name-of-idea or subject in a natural language, wherever necessary, uses auxiliary words to denote the different relationships between or among the constituents, or components, or subjects. And therefore, it does not require to pay more attention to the sequence of the constituents, or components, or subjects than what is warranted by the rules of the grammar of the natural language concerned. A coextensive name-of-idea or subject in a natural language is not always readily suggestive of its rank among other ideas or subjects. For this purpose, it requires to be structured in a standard pattern. The set of postulates referred to in Sec 61 of this paper form the foundation

of the process of structuring in a standard pattern. The result of applying the postulational process of standard structuring to a coextensive name-of-idea or subject in a natural language, is another name of one and the same subject. This name does not use any auxiliary words of the natural language concerned. Each of the substantive words used is either a noun or an adjective. The relationships between or among the different constituents, or components, or subjects are largely expressed by their sequence and relation indicators. A structured name-of-idea or subject can, therefore, no more be deemed to be in the natural language concerned, though it has used the substantive terms of the natural language. For convenience of reference, the language of the postulationally structured names-of-idea or subject can be called an "Artificial Verbal Language". The set of postulates constitutes the foundation of the grammar of the artificial verbal language. Naturally, the grammar of such a language is very much concerned with syntactics; for, the semantics of such a language is largely dependent of its syntactics. An artificial verbal language is a translating language for ranking names-of-idea or subject. A name-of-idea or subject in an artificial verbal language is readily suggestive of its rank among other ideas or subjects.

63 Artificial Language of Ordinal Numbers

The purpose of notational language is to secure mechanically the respective ranks of the ideas or subjects represented by the numbers constructed according to its grammar. Obviously, such numbers have to be ordinal numbers. Therefore, a notational language is an artificial language of ordinal numbers. It is again a translating language meant for securing mechanically the ranks of ideas and subjects. Therefore, the entities, to be translated in a notational language, fall into two primary groups:

1 Component ideas; and
2 Relations among component ideas.

This analysis suggests that the primary units in a notational language should consist of two distinct set of digits:

1 Digits to represent component ideas; and
2 Digits to represent the different relations among the component ideas.

This line of functional categorisation of the digits forming the primary base of the notational language, should prove helpful.

64 Primary Base and Extended Base

The universe of component ideas is evergrowing. The number of relationships among the component ideas is not predictable. These elements of uncertainty are to be given proper

weightage in the choice of the two sets of digits. The universe of subjects has its in-built capacity to accommodate comfortably and appropriately any new component ideas or any new relationships among the existing ones; its hospitality tends to infinity. The translating language — that is, notational language — must have a parallel in-built capacity. For this purpose, much attention is to be paid to two facets of the notational language.

1 The choice of the primary base; and
2 The devices to extend the primary base.

65 CHOICE OF DIGITS FOR PRIMARY BASE

Obviously, for all practical purposes, the set of digits constituting the primary base should essentially consist of distinct sub-sets of different orders. Such a composition of the primary base of the notational language has to be built up through an integrated approach. Such an approach would suggest that

1 The set of digits to be used to represent component ideas should necessarily be made distinct from the set of digits to be used to represent the relationships among the component ideas; and
2 Each of these two distinct sets of digits should be made to consist of distinct subsets to provide facilities to extend the primary base.

66 DEVICES TO EXTEND THE PRIMARY BASE

The need for extending the primary base of the notational language arises primarily to accommodate new ideas and new relationships in array as well as in chain. Any new accommodation takes the form of either extrapolation or interpolation. The different devices, already used or that may be used in different situations for different purposes are indicated in the following subsections of this section.

661 *Extrapolation in Array*

Extrapolation in array calls for a device to extend the subsets of different orders of the primary base at their respective beginning and end. The ordinary sector device is such a device. For the purpose of the sector device, at least the first digit and the last digit of each subset of different orders are to be treated as sectorising digits.

662 *Interpolation in Array*

Interpolation in array requires to be governed by the Principle of Extending the Base at any Point (*See* Sec 42 of this paper). This principle calls for devices to extend the base at the

point between any two consecutive digits. The anteriorising sector device and the posteriorising sector device are two such devices (*See* Sec 42 of this paper).

663 *Extrapolation in Chain*

Extrapolation in Chain calls for a device to create arrays of successive orders at the end of an existing chain. The decimal fraction device is such a device.

664 *Interpolation in Chain*

Interpolation in chain calls for a device to create arrays of "intermediate orders" between two existing links of successive orders in a chain. For convenience of reference this device may be called "Intermediate Array Device". The consecutive extension device used in UDC (1) is such a device. An alternative to this device is to reduce the problem of interpolation in chain to the problem of extrapolation at the beginning of array associated with telescoping in array. This alternative device increases pressure on the devices for extrapolation in array; and carries the potentiality of introducing some sort of rigidity in the notational language.

67 Distribution of Function

The distribution of functions among the digits of the base requires to be governed by the Principle of Unity of Notation: One and only one notational unit for one and only one ordinal unit and one and only one functional unit.

68 Digit to Represent "Generalia"

"Generalia" should be the first agglomerate class in any scheme for classification. To facilitate extrapolation or interpolation, as the case may be, immediately after "Generalia", the digit or digit-group representing it may be one which admits of being postulated to have the least ordinal value, in all situations, among the digits of the base.

69 Future Improvisation

Introduction of any improvisation requires to be governed by the following principle:

No improvisation at a future date should introduce any sort of rigidity in the basic structure of the notational language. Rigidity in notational language is the source of prescriptions for exceptions. Exceptions and rigidity enrich each other at the cost of the effectiveness of the notational language.

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