



Ranganathan, Shiyali Ramamrita.
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PART L

**NOTATIONAL SYSTEM FOR A GROWING
UNIVERSE**

CHAPTER LA

PROBLEMS IN THE NOTATIONAL SYSTEM FOR A GROWING UNIVERSE

1 Unpredictability

Viewed from the angle of classification, the essence of a growing universe—such as the universe of subjects or any sub-universe of it—is the unknowability of the new subjects likely to emerge in the future. In addition to the new-comers being unknowable, it is unpredictable as to what would be its helpful or filiatory position among the already existing classes. It may claim any position in any array and also any position in any chain.

2 Pressure on Notational System

The uncertainty mentioned above produces 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. It is also desirable to spread out the pressure by having recourse to Facet Notation. The implications of these are examined in the form of Canons in Chap LB to LG.

3 Pressure on Memory

Such a growing notational system will cause a considerable pressure on memory in correlating each digit to the idea represented by it. Some relief can be got resorting to a mnemonic use of digits and digit-groups. The implication of this are examined in Part K.

CHAPTER LB

CANONS FOR HOSPITALITY IN ARRAY

1 Regions for Accommodation

An array contains a sequence of co-ordinate numbers. It will have to show its hospitality to a new-comer demanding accommodation at anyone of its ends or between any two consecutive numbers in it.

2 Extrapolation

To accommodate the new-comer at one of the ends of the array, it should be possible to extrapolate any number of new co-ordinate numbers in the array. The canon governing this and the notational devices by which it can be achieved are examined in Chap LC.

3 Interpolation

To accommodate the new-comer between any two already existing consecutive numbers in the array, it should be possible to interpolate any number of new co-ordinate numbers between any two already existing consecutive numbers in an array. The Canon governing this and the notational devices by which it can be achieved are examined in Chap LD.

CHAPTER LC

EXTRAPOLATION IN ARRAY

1 Canon of Extrapolation in Array

An array of class numbers or of isolate numbers should admit of any number of new co-ordinate numbers being added at the beginning and at the end of the array.

2 Gap Device

To satisfy this Canon, some digits may be left unused at the beginning as well as at the end of the species of digits used. This is called Gap Device. But, this method can satisfy the Canon only to a limited extent. For, the unused digits may all be used up at some stage; and the array will not thereafter admit of extrapolation.

21 MIXED BASE

Extrapolation to a pure base—such as Indo-Arabic numerals—is also possible by using other species of digits, such as Roman smalls and Roman capitals, to extend the array at the two ends. In effect, this too will prove to be equivalent to the method of leaving Unused Digits.

3 Sectorising Digit

Another method of satisfying the Canon is to postulate the first and the last digits to be empty—for use as sectorising digits (*See Sec HC72*). This method will admit of extrapolation at the beginning and at the end respectively of the array.

31 DECIMAL CLASSIFICATION AND UNIVERSAL DECIMAL CLASSIFICATION

In DC and UDC, the digit 0 and the digit 9—the first and the last digits of the pure base of Indo-Arabic numerals—are used as sectorising digits in some arrays (*See also Sec HC911*). In Ed 16 of DC (1958), 3,267 arrays—that is, 74%—are open arrays—that is, arrays admitting of extrapolation at the ends (*See Sec CE11*). Probably, the percentage for Ed 17 is not very different. But the Array of Order 1 is not an open array. Only the Arrays of Order 2 derived from the first order numbers 2, 4, and 8 are open arrays admitting of extrapolation. The other seven arrays are not open and therefore do not allow of extrapolation. Again, only the 24 arrays of Order 3, listed below, admit of extrapolation.

039, 059, 079, 089, 149, 159, 179, 199, 259, 289, 299, 369, 439,
489, 499, 629, 679, 839, 879, 899, 939, 949, 989

In all these cases, the digit '9' stands for 'Other'. For example,
 149 Other philosophical systems and doctrines

299 Other religions

629 Other branches of engineering

Below "149 Other philosophical systems and doctrines" we get the following co-ordinate numbers.

149.1 Nominalism and conceptualism

149.3 Mysticism

149.5 Optimism

Thus, the "Other Device" is the same as the "Sector Device".

The other seventy-six arrays are not open and therefore they do not allow of extrapolation. Abdul Rahman and T Ranganathan have made a more exhaustive study of this problem in respect of Ed 16 of DC [2].

Total N of Arrays	Open Arrays		Arrays with Unused Digits		Closed Arrays	
	N	%	N	%	N	%
4,408	189	4	3,078	70	1,141	26

UDC had been using '0' (zero) as an Empty Digit for extrapolation at the beginning of array of Order 2. DC is now doing similarly.

CN	UDC	DC
00	Prolegomena. Fundamentals of knowledge and culture	Generalities
001	Sciences and knowledge in general	Knowledge
01	Bibliography and catalogues	Bibliographies and catalogues

The term 'Generalities' need not have been inserted to make it appear as if the second '0' (zero) were not empty but semantically rich.

32 EXPANSIVE CLASSIFICATION AND LIBRARY OF CONGRESS CLASSIFICATION

In EC and LC, there is no provision for sectorising digits.

33 COLON CLASSIFICATION

CC uses a mixed base. Each species of digits forms a Zone in an

Array (See Sec HC751). There is a sectorising digit for each zone—z for Roman smalls, 9 for Indo-Arabic numerals, and Z for Roman capitals. Thus, it provides for any number of extrapolations at the end of each zone of an array. Further, extrapolation at the end is also possible by using packet notation. This amounts to extrapolating a whole zone at the end. CC Ed 6 makes 1,311 arrays—that is, 96% of the total—open arrays (See Sec CE11) [2]. The remaining 4% of the arrays are not open. These arrays originate from 1933 when the Concepts of Open Arrays and Sector Device were not consciously used. The improvisation of inverted V—Λ as a new Empty—Emptying digit is being considered. Its ordinal value will be greater than that of the starter bracket (See Sec HA77). Its use will make any number of extrapolations at the end possible. Some experiments are being made in using "0" (zero) as an Empty Digit to extrapolate another zone at the beginning of certain arrays. [91].

Example in Zone (Z—1)

- R6 Indian philosophy
- R68 Dvaita philosophy (Dualism)
- R691 Charvaka philosophy (Materialism)

34 BIBLIOGRAPHIC CLASSIFICATION

In BC, there is no provision for extrapolation either at the beginning or at the end of an array. This is because it has not used the concept of "Sector Device".

35 RIDER'S INTERNATIONAL CLASSIFICATION

In RIC, there is no provision for extrapolation either at the beginning or at the end of an array. This is because it has not used the concept of "Sector Device". However, occasionally RIC leaves unused digits at the end of an array.

Example

In the class "LU Economics of specific products" the array of Order 3 is used from

LUA General Works to LUU Optical goods etc and the number LUV to LUZ are left unused for extrapolation.

CHAPTER 1D

INTERPOLATION IN ARRAY

1 Canon of Interpolation in Array

An array of class numbers or of isolate numbers should admit of the interpolation of any number of new co-ordinate numbers at any point in the array.

2 Gap Device

Gap device consists of leaving gaps in notation for interpolation of new classes or isolates, as the case may be, at some of the points of an array. But a gap may get choked up.

3 Mixed Base

When the base is a mixed one, extrapolation to a zone or a sector, other than the first and the last ones, may also be looked upon as a case of interpolation.

Example

91 is an extrapolation to the sector (S—1). It can also be looked upon as interpolation between '8' and 'A'.

4. Introduction of New Species of Digits

A digit of a new species, with a defined ordinal value, can be interpolated between any two digits in an array.

5 Emptying Digits

Interpolation of a new number between any two existing class numbers or isolate numbers, as the case may be, in an array is possible with the aid of Emptying Digits. Emptying digit is a digit with its usual ordinal value and also semantic value, and further having the power to deprive the preceding rich digit of its power of representing an idea. [142].

61 DECIMAL CLASSIFICATION AND UNIVERSAL DECIMAL CLASSIFICATION

In DC and UDC, casual gaps occur in some arrays. But they do not have Emptying Digits. Therefore, interpolation is possible only at the points, where the casual gaps occur.

Example of casual gaps

In DC Ed17, in the class "770 Photography and Photographs" we have

773 Pigment processes of printing



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778 Specific fields of photography

The numbers 774 to 777 are left unused.

In UDC, in the class "232 Christology" we have

232.3 Work of Christ

232.8 Humanity of Christians

The numbers 232.4 to 232.7 are left unused.

62 LIBRARY OF CONGRESS CLASSIFICATION

In LC, gaps of some length are left at frequent points among class numbers. The gaps in LC are of much greater size than in SC. In spite of this, the provision made for interpolation is limited (*See also* Sec LF31). Realising this limitation, LC makes the makeshift arrangement of using the decimal point to provide additional class numbers and adds the following remarks. "A decimal, therefore, does not necessarily imply sub-arrangement, for it may have been employed as in DC369 merely because no whole number happened to be available at that particular place" [80].

Example

Here is an extract from the schedule of 'DC History of France'.

36 Biography (collective). General Works

36.2 Women

36.4 Public Men

36.6 Rulers, Kings, etc.

36.8 Houses, Noble families

36.9 Historiography . . . General Works

37 History. General Works

The use of decimal fraction notation for interpolation is easily seen in the above extract. It should also be noted that the class "36.9 Historiography" is co-ordinate with the class "36 Biography" while the others are subordinate to it. Thus, the array formed by decimal fraction notation is a mixed one. It is only the class "36.9 Historiography" which is truly interpolated in the array containing it. The others belong to a different array which has "36 Biography" as its immediate Universe.

63 SUBJECT CLASSIFICATION

In SC, gaps of some length are deliberately left among class numbers. There are about 10,000 such gaps in the whole scheme. This number, however large, sets a limit to number of interpolations. Realising this limitation, the scheme makes an additional provision in the following words. "If any new or other subject is found unrepresented in the tables . . . at a general covering head . . . the place for it can be made at any point by treating the existing numbers as decimals and adding the units from 0 to 9 as found necessary" [27].

64 COLON CLASSIFICATION

In CC, each of the digits T, U, V, W, X, Y, and Z is postulated to have the power of emptying, in certain contexts, the semantic value of the preceding digit but allowing it to retain its ordinal value (See also Sec HA77). Thus, for example, the numbers AZ, BZ, CZ ... HX, KX, and SX, are of the same order as the digits A, B, C, D, etc. Further, the digits V, W, Y, and Z are prescribed to be both Empty and Emptying Digits [142]. This provides for any number of interpolation. CC also provides occasionally a gap between two existing (used) class numbers for use in interpolation. The improvisation of the inverted 'V' (Λ) as a new Empty and Emptying Digit is being considered. Its ordinal value will be greater than that of the starter bracket (See Sec HA77 and LC33).

Example

1 In the schedule of Main Classes

K	Zoology
KX	Animal Husbandry
L	Medicine

2 In the schedule of Space Isolates

44	India
44T	Nepal
44U1	Sikkim
44U2	Bhutan
44V	Ceylon
44X	Pakistan
45	Iran

65 BIBLIOGRAPHIC CLASSIFICATION

In BC, gap device is the only provision for interpolation in an array. This is because it has not used the concept of "Emptying Digit Device". However, it provides for gaps in notation.

Example

1 In the class "BK Electro kinetics" we have

BKR	Thompson Effect
BKS	
BKT	Thermionic Emission

2 In the class "ED Morphology in Biology" we have

EDI	Stoichiology
EDJ	
EDK	
EDL	Transformed cells

66 RIDER'S INTERNATIONAL CLASSIFICATION

In RIC, there is no provision for interpolation in an array. This is because it has not used the concept of "Emptying Digit

Device". However, it provides for gaps in notation.

Example

In the class "P Arts of War etc" we have

PR Air Transportation

PS

PT Communication. Telegraphy

CHAPTER LE

CANONS FOR HOSPITALITY IN CHAIN

1 Regions for Accommodation

A chain of numbers (See Sec CF1) contains a succession of subordinate numbers beginning with the number representing the whole universe of entities. It will have to show its hospitality to a new-comer by accommodating it only either at the end or between any two consecutive succession of subordinate numbers; for a subordinate number cannot obviously be accommodated above the number at the top which is the largest in the chain.

2 Extrapolation

To accommodate a new number at the end of a chain—that is, to accommodate numbers of higher order than the number at the end—it should be possible to extrapolate any number of a new succession of subordinate numbers to the chain. The canon governing this and the notational devices by which it can be achieved are examined in Chap LF.

3 Interpolation

To accommodate a new number between any two already existing consecutive numbers in the chain, it should be possible to interpolate any number of a new succession of subordinate numbers between any two already existing consecutive numbers in a chain. This problem is examined in Chap LG.

CHAPTER LF

EXTRAPOLATION IN CHAIN

1 Canon of Extrapolation in Chain

A chain of class numbers or isolate numbers should admit of the extrapolation of any number of successive links at its end. In other words, the notational system should admit of the chain, ending with any number, being lengthened to any extent found necessary.

This Canon is needed to implement the Canon of Decreasing Extension in the case of a growing universe (See Chap ES). Any of its chains may have to accommodate, in course of time, an indefinitely large number of classes or ranked isolates, as the case may be, derived by a succession of independent additional characteristics. The efficiency and the enduring capacity of a scheme for classification will therefore depend largely on the devices employed in the Notational Plane, to secure compliance with this Canon of Extrapolation in Chain. A scheme not providing hospitality in chain will break down sooner or later.

2 Devices

Various devices may be used for securing Extrapolation in Chain. Here are some of them.

- 1 Gap Device; and
- 2 Decimal Fraction Device.

3 Gap Device

Some schemes use the numbers left unused after a particular number in an array, as if they were subdivisions of that specific number. This is Gap Device. This device obviously violates the Canon of Hierarchy and the Canon of Expressiveness. Even then, this method can satisfy the Canon of Extrapolation in Chain only to a limited extent. The limit will be even more severe if the same gap is used for interpolation in array as well as extrapolation in chain. Thus, the Gap Device is not suited for the classification of any growing universe. Schemes for the classification of the universe of subjects should avoid it. New classes often crop up, as if spitefully, in gaps already choked up. This is a recurring phenomenon with integer notation. Therefore, schemes with integer notation are driven to the adoption of makeshifts to receive new classes.

31 LIBRARY OF CONGRESS CLASSIFICATION

LC has adopted integer notation. When new classes have to be accommodated between two consecutive integers, it takes re-

course to the insertion of a point after the integer and adding either an Indo-Arabic numeral or a Roman capital followed by Indo-Arabic numeral.

Example

1 From Class "H Social Sciences", Ed 3 (1959).

HJ9805 General accounting office. General works.

HJ9805.A Auditor

HJ9805.C Comptroller

HJ9805.P Pay-master

HJ9805.T Treasurer

HJ9807 Internal Revenue

2 From Class "R Medicine", Ed 3 (1959).

RA965 Medical centres. Miscellaneous. Minor works.

RA965.5 Public relations. Hospital and community.

RA965.7 Hospitals and the law.

RA966 Medical centres (General).

3 From Class "S Agriculture", Ed 3 (1959).

SD1429 Documents of the International Institute of
Agriculture

SD1429.A1-5 Its publications

SD1429.A6 Preliminary documents

SD1429.A7-Z By country

SD1430 Non-official

32 SUBJECT CLASSIFICATION

In SC, the categorical table and the provision for the further division of any class geographically or linguistically goes some way in satisfying the Canon of Extrapolation in Chain. Reference has also been already made to the suggestion of the intercalation of five digit numbers in connection with providing interpolation in Array (See Sec LD63). Hospitality in Chain is also expected to have a share in this intercalation. But, as already remarked, apart from the mention of this possibility, the details of this device have not been gone into and no attempt has been made to secure uniformity of treatment.

4 Decimal Fraction Device

The Decimal Fraction Device consists of treating each class number as a pure decimal fraction.

In using this device, every class number without exception is treated as a pure decimal fraction. No class number is treated as an integer or as a mixture of an integer and a decimal fraction. There is, therefore, no need at all to use the decimal point. Indeed, it is taken as understood before every number. Incidentally, the omission of a dot satisfies the Law of Parsimony though to a trivial extent.

A new class or a new isolate is created in a chain by subdividing the class or isolate forming its last link on the basis of a new additional characteristic. To conform to the Canons of Hierarchy and Expressiveness, this should result in the addition of a digit to the number of the last link. The subdivision may have to be continued *ad infinitum*. In other words, the chain may have to be lengthened *ad infinitum*. The decimal fraction device will give a distinct helpful number to each new class or isolate, as the case may be, because it provides for the addition of digits without disturbing the ordinal value of any existing class number. Thus, the decimal fraction device provides for infinite extrapolation in chain. CC, DC, and UDC use decimal fraction notation; but LC does not.

BC	CC		DC	UDC
GY	K97	Mammalia	599	599
GYD	K972	Marsupialia	599.2	599.2
GYDD	K9721	Diprotodontia	599.22	599.22

CHAPTER LG

INTERPOLATION IN CHAIN

1 Canon of Interpolation in Chain

A chain of class numbers or of isolate numbers should admit of the interpolation of any number of links between any two consecutive links in the chain.

2 Abundant Caution

The Canon of Interpolation in Chain will not become operative at points where the step from one link to the next in the chain has satisfied the Canon of Modulation. Normally the Canon of Modulation is satisfied in any standard scheme for classification (See Chap ET).

But in a universe of entities in which the emergence of new entities can be capricious and unpredictable, it may not be possible to satisfy the Canon of Modulation at all points in a chain, at the time of the design of the scheme. The universe of political and administrative areas in Geography is a universe of this uncertain kind.

Therefore, the Canon of Interpolation in Chain may be taken to be one dictated by abundant caution.

3 Missing Link

No satisfactory notational device appears to be available to interpolate a missing link or a newly emerging link calling for interpolation in a chain.

31 STROKE NOTATION. EXAMPLE 1

In certain situations, the British National Bibliography uses "Stroke Notation" for interpolation in a chain in DC, as shown in the following example :

220/280 Christianity

626/627 Hydraulic engineering

In the schedule for Religion in DC, the first link 2 represents Religion and the second links, such as, 22, 23, etc, represent some subdivisions of Christianity. Thus "Christianity" corresponds to a missing link in the chain of numbers. Therefore, "Christianity" has to be represented by the whole Array of Numbers 220 to 289. Ed 16 gives 220-289 Christian Religion. Ed 17 gives 220-280 Christian Religion. This also means using a whole Array of Numbers to represent a missing link. This improvisation makes arrangement difficult as the ordinal value of the stroke or hyphen has not been defined.

32 STROKE NOTATION. EXAMPLE 2

Working with Ed 14 of DC, the British National Bibliography had the following interpolation in chain in DC, with the aid of "Stroke Notation":

626/627 Hydraulic engineering
as the missing link between '62 Engineering' and the array '626 Canal engineering' and '627 River engineering'. In Ed 16 (1958) and Ed 17 (1965), DC has rearranged this region as follows:

Ed 16 (1958)	Number	Ed 17 (1965)
[Left unused]	626	[Left unused]
Hydraulic engineering	627	Hydraulic engineering and construction works
Inland water way engineering	627.1	Inland waterways
River and lake engineering	627.12	Rivers
Canal Engineering	627.13	Canals
[Not used]	627.14	Lakes

33 B N B EXTENSION NOTATION

In certain cases, the British National Bibliography uses its own improvised '[1] Extension Notation', as shown in the following example:

621.313	Dynamo Electric machinery
621.313 [1] Motors	Motors
621.313 24	Continuous current motors
621.313 44	Synchronous motors
621.313 64	Induction motors
621.313 65	Series alternating current motors
621.313 66	Repulsion motors

This improvised notation does not succeed in bringing all kinds of motors as an array under 'motors'.

In Ed 16 and Ed 17 the chain is not taken up to the link 'motor'. Each kind of motor is shown without its distinctive number in the list of terms given under different appropriate upper links.



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