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dLIST
Digital Library of Information Science & Technology

Chapter 1

HIDDEN ROOTS OF CLASSIFICATION*

S R RANGANATHAN

Points out that a twofold infinity characterises the design of classification — the infinity in the diverse purposes of the readers and that in the dimensions of the universe of subjects. Illustrates the risk in basing the design of classification on conjecture and suggests basing it on the results of a sound statistical study. With the aid of the analogy of roots of flames shows an alternative helpful method to be basing classification on postulates and principles inherent in the near-seminal level. Describes with illustrations a set of postulates and principles. Points out that classification is equivalent to mapping the multi-dimensional universe of subjects along a single dimension and that the crucial problem in such a mapping is, determining which of the many immediate neighbourhood relations among facets to the Basic Subject, should be kept invariant. The Wall-Picture Principle is shown to give the best result in this matter. This Principle fixes the syntactical relations among facets. Raises the issue whether there is an Absolute Syntax, and whether the syntax of facets implied in the Wall — Picture Principle is equivalent to it. Suggests the investigation of this problem by a team of Linguists, Psychologists, Classificationists, Reference Librarians and Statisticians.

0   INTRODUCTION

It has been kind of the organizers of this Symposium to have thought of me for this concluding talk in the series. On my part, I had been eagerly looking forward to be amidst you this week, observe your

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ways of thinking on the subject of the Symposium, and exchange ideas in this fascinating subject of the Foundations of Syntactic Relations in Classification. For, from the list of names of the participants furnished by Mr. Perreault, I knew that I would be in the midst of a galaxy of Classificationists.

0.1 Denial of Opportunity

But the old saw, "Man proposes; God disposes" asserted itself at the last moment. The health of the physical body reached a level which has made medical advisers to pass an "Order of Internment" on me. I have been, therefore, painfully obliged to deny myself the benefit of discussing the very problem in which I am now getting involved deeper and deeper, day by day, and you yourself have chosen for this Symposium.

0.2 First Approximation

However, I had the opportunity to get an inkling of your approach to the problem by a perusal of the introductory "Challenge" Paper sent by Perreault. This enables me to send you this script, as a crude first approximation to my sharing the thought with you in person.

1 PLIGHT OF CLASSIFICATIONIST

The problem to be faced by the Designer of a scheme for the depth classification of nascent micro-thought, gushing forth from the minds of the hundreds of research workers in each of thousands of narrow

subject fields and getting embodied in millions of articles published from year to year – the gravity of the problem of the Classificationist is not easily realized. Because, his design work concerns an invisible, intangible commodity called Thought or Idea. Therefore, I shall use the analogy of design work in a field where what is designed is visible to the eye.

1.1 Plight of Architect

Imagine the plight of an Architect designing a satellite township for a City Extension Board. Imagine one member after another of the Board suggesting changes day after day. Imagine the building material to be used having to be changed several times during the period of design and even during construction. Imagine also the sudden unexpected floods and earth tremors – the first within living memory in the locality – forcing a redesign of the foundation at an advanced stage. Imagine further the machinery and the tools for construction having to be changed frequently.

1.2 Greater Precariousness

The plight of Classificationist is even more precarious than that of the Architect. For, in the universe of ideas turbulent changes are becoming frequent, unpredictable, and violent. The disturbance caused in the universe of ideas by eruptions such as those of Electrons, Laser, Plastics, Statistical Analysis, and Breaking of the Atom are now straining the schemes for classification and even breaking some of them, The purpose of the consumers of ideas is infinitely more varied than those

in the case of township. Each reader wants it all his own way. In fact, the Classificationist has to reckon with a far greater number of factors than the Architect — almost tending to infinity.

2 TWO-FOLD INFINITY

As a matter of fact, a two-fold infinity characterises the domain of Depth Classification. Firstly, there is infinity inherent in the purposes of readers and consequently in their approaches to a collection of documents in the stack or their main entries in the catalogue. Secondly, there is infinity in the dimensions of the universe of ideas to be organized by the Classificationist. Let us leave infinity alone. Let us confine ourselves to large numbers.

3 LARGE NUMBER OF PURPOSES OF READERS

3.1 Problem of Classificationist

The problem of a Classificationist is as follows:

Different readers have different purposes; and even the same reader has different purposes at different times. But the Classificationist cannot provide a different scheme for classification to suit each of the large number of purposes. He cannot simulate the old man of Aesop's, going out with his son and the donkey. Classificationist is obliged to use the statistical idea "Mode". He has to design the scheme

to suit the most dominant purpose prevailing among readers. How to single out one out of many purposes as the most dominant one?

3.2   Method of Conjecture

We cannot deal with a situation involving large numbers in the way followed for small numbers. In dealing with situations involving large numbers, humanity depended, for a long long time, on mere conjecture by persons rich in experience and intelligence. That is what Classificationists are doing till now.

3.3   Method of Conjecture and Colon Classification

While starting the designing of Colon Classification in November 1924, I had little experience of the purposes of readers. I had to find them out, and also find out the dominant purpose. From 1924 to 1928 – that is, till I completed the "In-Service-Training" of my first staff – I was the only professional librarian in the Madras University Library. While studying in the University College of London in 1924, I had the opportunity to listen to a talk by E C Richardson on what he called, "Research Consultant". His talk made me realise that Reference Service – helping the individual reader – was the *summum bonum* of library service. Therefore, in those early years I spent nearly six hours a day in floor duty – helping the readers. This gave me an insight into the varying purposes and approaches of readers. It also helped me to conjecture the sequence of the facets in a subject, that would serve the dominant purpose and approach of the readers. On this conjecture was based the sequence of facets in subjects going with each Main Subject. In other words, this conjecture helped me to lay down my Facet Formula for different Main Subjects. I began with a library of about 30,000

volumes. By the end of 1928 it grew to about 50,000 volumes. All these volumes were classified on the basis of the different Facet Formulae constructed according to the conjecture about the dominant purpose and approach. On the whole, the arrangement of books appeared to give satisfaction. I began to write out the First Edition of the *Colon classification* in 1929. I also began to teach the subject at that time. While developing the different Facet Formulae, I used to experiment upon the way in which the different students preferred the Facet Sequence. However, as a student of Statistics, I was aware of the limitation of conjecture. Therefore, before completing the press copy of the book, I made an intensive experiment with the senior readers.

4   RISK IN CONJECTURE

In compound subjects going with the Main Subject Law, we often have two facets. Our Law Collection was very meagre. Only a few students of the Law College used it. They had to read mostly Indian Law. They also read British Law to some extent. The Indian Law of those years was largely based on the British Law. This made the students always approach the subject from the angle of the Problem Facet instead of the Community Facet. In other words, the Problem Facet was the first that they would bring up. The Community Facet was quite secondary to them. This had led me to use the Facet Sequence:

Law [Problem] [Community]

as helpful to the dominant purpose and approach of the readers. To check up the validity of this conjecture, I invited some Members of the

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Bar, Judges of the High Court, and experienced Jurists. I used to take them into the Law Gangway. I learnt from them that the Facet Sequence should be the very opposite *viz.*,

Law [Community] [Problem]

This was confirmed by most of the senior readers. They attributed the students' approach, resulting in the false conjecture, to the faulty method of teaching Law. Students were made to know only of the modern Indian and British Laws, which were alike; and they were not told that each country had its own system of Municipal law. I had also a similar experience with Chemistry. In these two Main Subjects all the books had to be reclassified and the class numbers had to be altered in all the places of their occurrence – in several places in the book itself, in the catalogue entries, shelf register, and accession register. This is the price to be paid when risk asserts itself in conjecture. Fortunately, in most of the other subjects the conjecture turned out to be correct. But it is the exception that highlights the "Risk in Conjecture" wherever large numbers are involved.

5   STATISTICAL METHOD

To minimize the risk of conjecture, the determination of the dominant purpose of readers must be based on a statistical study. This in its turn should be based on extensive observations in libraries of all standards – public, academic, and specialist – and in libraries of all countries. This will be far too expensive. At any rate, this has not been done. The result is that a certain amount of risk is taken by most of the

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schemes for classification by basing themselves on conjecture. It is not easy to make a statistical study of the problem of dominant approach of readers, the most helpful sequence of facets, the most helpful succession of characteristics within each facet, and the most helpful sequence of isolates within each array. The library profession has yet to clarify its own ideas in formulating such problems needing statistical study. The precautions to be taken in statistical observation in these cases have yet to be formulated. There is every probability for the digestion of the observed statistical data demanding new statistical techniques. In spite of the immaturity and infancy of this line of statistical approach to classification, I hope that some rich Foundation will arrange for this statistical determination of the dominant purpose and approach of readers. Again, this may have to be repeated in different epochs to find out the change that might occur.

6   LARGE NUMBER OF DIMENSIONS IN THE UNIVERSE OF IDEAS

The statistical negotiation of the large number of purposes and approaches of readers with statistical methods will take long. Depth classification cannot wait till then. Let us therefore turn our attention to the large number of dimensions of the universe of ideas. Let us see whether we can find an *a priori* method for organizing the idea-masses – from Macro through Micro to Spot Idea – in a helpful way and thereby find methods for the design of depth classification. The aim and end of classification is to arrange ideas scattered in many dimensions, along a line – in a linear sequence. How are we to do it?

6.1 Analogy of Roots of Flame

The scatter of the tongues of flame shooting up from a pile of logs cannot be changed to our liking and brought into a line by catching the tongues of flame and rearranging them. The right method will be to manipulate the logs forming the root of the flames. So it is with classification of the universe of subjects — that is, the arrangement of subjects. The universe of subjects is dynamic. It throws forth subjects in a turbulent manner. It is doing so incessantly in our times. The scatter of the subjects so thrown forth is in many dimensions and is unhelpful. To anticipate the subjects and arrange them in advance in a helpful sequence would prove as futile and maddening as manipulating the tongues of flame. Because the subjects will not burn us, we are often tempted to secure a helpful classification of subjects by directly manipulating them. The result is frequent break-down and even the desperate declaration that classification is impossible and alphabetical arrangement by names of subjects is the only sensible way. The subjects are the tongues of flame. They belong to the phenomenal level. It is tiring and ineffective, if not futile, to manipulate the subjects directly and arrange them as desired. It is best to manipulate their roots at the near-seminal level at which all the subject-proliferations are traceable to a few roots. The roots of subjects, are hidden even at the near-seminal level. They are hidden in the sense that they cannot be reached by intellectual analysis. They will have to be apprehended with intuition. If intuition is functioning cent percent the roots can be unerringly and permanently located. Hardly anybody is found with cent

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percent intuition. Further, in the scale of values of anybody worth cent percent intuition, classification may find itself very near the bottom. Therefore, we have to depend upon whatever can be got through the play of a momentary flash of intuition in some person or other — essentially intellectual. Postulates and Principles are usually disclosed by such momentary flashes. They may go a long way though not the full way. When they cease to be helpful, they may be replaced by another set of Postulates and Principles that may be disclosed at that time.

6.2   Postulates

We have now a set of postulates to guide the design of classification. The attributes "True" and "False" do not apply to postulates. The only attributes applicable to them are "Helpfulness" and "Unhelpfulness". The following set of postulates have proved helpful.

6.2.1   Postulate of Fundamental Categories

There are five and only Five Fundamental Categories – *viz.*, Time, Space, Energy, Matter, and Personality.

These terms and the ideas denoted by them belong strictly to the context of classificatory discipline. They have nothing to do with their use in Metaphysics or Physics. In our context, their significance can be seen only in the statements about the facets of a subject — their separation and their sequence. This set of fundamental categories is, for brevity, denoted by the initionym PMEST.

6.2.1.1 Time

Perhaps the fundamental category "Time" gives the least difficulty in its identification. It is in accordance with what we commonly understand by that term. The usual Time Isolate Ideas — such as millennium, century, decade, year, and so on - are its manifestations. Time Isolate Ideas of another kind — such as day and night, seasons such as summer and winter, time with meteorological quality such as, wet, dry, and stormy — are also taken as manifestations of the fundamental category "Time".

6.2.1.2 Space

The fundamental category "Space" comes next to "Time" in difficulty in its identification. It is in accordance with what we commonly understand by that term. The surface of the earth, the space inside it, and the space outside it, are manifestations of the fundamental category "Space". The usual Geographical Isolate Ideas – such as continents, countries, and counties – and water formations – such as oceans and seas – are taken to be its manifestations. Physiographical Isolate Ideas – such as desert, prairie, rain-forest, plateau, mountain, river, and lake — are also taken to be manifestations of the fundamental category "Space". So also an area occupied by a population-cluster — such as a city, a town, and a village — is taken to be a manifestation of the fundamental category "Space".

6.2.1.3 Scope For Comparative Study

Both CC and UDC give schedules of Time and Space Isolates. Therefore, there is some material for comparative study. On the basis

of this study, it has been possible to cultivate the region of classificatory discipline falling within the purview of the fundamental categories "Time" and "Space". The other schemes have not developed this region to a sufficient degree. CC is the only scheme with distinctive and consciously enumerated schedules of the three fundamental categories "Energy", "Matter"., and "Personality". The "Analytical Subdivisions" of UDC are of a casual nature. They are also mixtures of the manifestations of all the three fundamental categories. Therefore, there is no good scope for comparative study in respect of the manifestations of these three fundamental categories. In the circumstances, as the only meagre scope for comparative study, we have to use different editions of CC.

6.2.1.4   Energy

Even otherwise, the identification of the fundamental category "Energy" is a little more difficult than that of "Space" or "Time" . Generally speaking, its manifestation is an action of one kind or another. The action may be among and by all kinds of entities – inanimate, animate, conceptual, intellectual, and intuitive.

Till now, we have been taking Morphology, Physiology, Disease, Ecology, Hygiene, and some other isolate ideas also as manifestations of the fundamental category "Energy". It was difficult to see any "Action"

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in them. Therefore, we enumerated them in a schedule and labelled them as Energy Isolates. We were led into this position by a sheer accident. This was the use of the term 'Problem' to denote these isolates ideas – from Ed 1 (1933) onwards of the *Colon classification*. This gave rise to a blind tradition of thirty years' standing. Wrong traditions die hard. With the rush of preoccupation with many other ideas in classification and in other branches of library science, hardly any time or inclination was found to look at these 'Problems' critically. But the time has now come to give up this tradition. These isolate ideas are no longer taken to be manifestations of the fundamental category "Energy". Edition 7 of CC will incorporate this change.

6.2.1.5   Matter

The identification of the fundamental category "Matter" is more difficult than even of "Energy". Its manifestations are taken to be of two kinds – Material and Property. It may look strange that property should be taken along with material. But let us take a table as an example. The table is made of the material, timber or steel, as the case may be. The material is intrinsic to the table, but is not the table itself. Moreover, the same material can figure also in several other entities. So also, the table has the property of being two and a half ft. high and the property of having a soft top or a hard top. The property is intrinsic to the table, but not the table itself. Moreover, the same property can figure also in several other entities. Each of the isolate ideas Morphology, Physiology, Disease, etc., mentioned in the preceding section and now being excluded from the manifestations of the fundamental category

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"Energy", admit of being looked upon as Property. As such, they are now regarded as manifestations of the fundamental category "Matter".

6.2.1.6 Personality

The fundamental category "Personality" presents the greatest difficulty in its identification. It is too elusive. It is ineffable.

6.2.1.7 Method of Residues

If a certain manifestation is easily determined not to be one of "Time" or "Space" or "Energy" or "Matter" it is taken to be a manifestation of the fundamental category "Personality". This is the Method of Residues. For, according to the postulate, there are five and only five fundamental categories. Therefore, any entity, which is not a manifestation of "Time" nor of "Space" nor of "Energy" nor of "Matter", should be a manifestation of "Personality". The application of this Method of Residues may not be easy in certain cases. But experience will lead to the establishment of reflex action in recognizing the fundamental category manifesting itself in any isolate idea, even as experience leads to the establishment of a reflex action in recognizing Chinese, Indians, Egyptians, Italians, French, Germans, and Russians. This does not amount to saying that there is no difficulty at all. There are still some areas of doubt in distinguishing between manifestations of the fundamental categories "Energy", "Matter", and "Personality". These difficult areas do not turn up very often. Therefore, we can get along, in spite of this difficulty, for the time being, and solve it in due

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course as experience increases. We cannot give up the proven advantage of Classification Guided by Postulates and Principles, and say, "We shall begin to use them only when all the difficulties about them are finally solved".

6.2.2 Postulate of Basic Facet

Every Compound Subject has a Basic Facet.

This is implied in the very definition of the term 'Compound Subject'. A subject may have two or more basic facets. Then it will be a case of phase relation between the basic facets themselves or between the compound subjects of which they are the respective basic facets or a case of one of the subjects figuring as an isolate facet in a compound subject going with the other basic facet.

6.2.2.1 Recognition of the Basic Facet

To recognize the Basic Facet of a Compound Subject, a general knowledge of the schedules of Basic Subjects is necessary. Most of the Schemes for Classification give roughly similar schedules of them. The indication, by the title of a document of the Basic Facet of its subject may be either:

1 Explicit; or 2 Implicit in the context; or 3 Absent. Here are examples of the first two possibilities.

SN	Indication	Title	Basic Facet
1	Explicit	1.1 Treatise on coal mining	Mining
		1.2 Agricultural diseases	Agriculture
		1.3 Text-book of Indian History	History
2	Implicit	2.1 Structure of proteins	Chemistry
		2.2 Care of cows	Animal husbandry
		2.3 Income-tax	Economics

6.2.2.2 Absence of Indication

If the title does not express the subject at all but is oblique or fanciful, the contents-page and even the whole document may have to be perused to determine the Basic facet. Most of the Works in Literature and many Classics in diverse subjects come under this group.

6.2.3 Postulate of Isolate Facet

Each isolate facet of a compound subject can be deemed to be a manifestation of one and only one of the five Fundamental Categories.

It is generally easy to identify isolate ideas that are manifestations of the fundamental categories: Time, Space, Energy, and Matter. As already stated in Sec. 6.2.1.7 any isolate idea, not found to be a manifestation of any of these four categories, has a good chance to be a manifestation of the fundamental category "Personality". Its manifestation can also be directly sensed in some cases. Some examples are given in the succeeding sections.

6.2.3.1 Biological Sciences

1. In the Subjects in Botany — Plant Group. Plant.

2. In the Subjects in Agriculture — Cultivar Group. Cultivar.

3. In the Subjects in Zoology — Animal Group. Animal. Organ.

4. In the Subjects in Animal Husbandry — Animal. Organ.

5. In the Subjects in Medicine — Human Body. Organ.

6.2.3.2 Socia l Sciences

1. In the Subjects in Education – Child. Adolescent. Adult, Genius. Imbecile. Blind.

2. In the Subjects in History and Political Science — Head of the State. Executive. Legislature. Party. Public. Local Body. Judiciary. Civil Service.

3. In the Subjects in Sociology —— Rural Folk. City Folk. Professional Group. Working Class. Royalty. Aristocracy. Middle Class. Military Class. Nomadics. Aryans. Semetics. Hindus. Christians. Muslims. Indians. Chinese. British.

4. In the Subjects in Law — Legal Personality. State. Association. Property. Contract. Treaty. Tort. Crime. Cause of Action. Court.

6.2.3.3 Humanities

1. In the Subjects in Linguistics — a Language. Phoneme. Syllable. Word. Phrase. Clause. Sentence. Piece of Composition. Punctuation.

2. In the Subjects in Religion — Vedic Religion. Hinduism. Vaishnavism. Saivism. Jainism. Buddhism. Christianity. Islam. Shintoism. Sikhism. Zoroastrianism. Sacred Book. Church. Sects.

3. In the Subjects in Psychology — Child. Adolescent. Adult. Genius. Imbecile. Blind.

4. In the Subjects in Literature — Poetry. Drama. Fiction. Author. Work.

6.2.3.4   Mathematics

1. In the Subjects in Arithmetic — Prime Number. Partition of Numbers. Arithmetical Function.

2. In the Subjects in Theory of Equation — Simple Equation. Quadratic Equation. Abelian Equation.

3. In the Subjects in Higher Algebra — Binary Form. Linear Form. Cremona Transformation.

4. In the Subjects in Differential Equation — Linear, Quadratic, Cubic, Quartic, Quintic, Sextic. First Order. Second Order. Third Order. Fourth Order. Fifth Order. Sixth Order.

6.2.3.5   Physical Sciences

1. In the Subjects in Properties of Matter — Solid. Glass. Crystal. Liquid-Surface. Liquid. Gas.

2. In the Subjects in Sound — Audible Sound. Infra Sound. Ultra Sound.

3. In the Subjects in Radiation — Light. Ultra-Violet Ray. X-Ray. Gamma Ray. Infra-Red Ray. Hertzian Wave.

4. In the Subjects in Electricity — Current. Direct Current. Alternating Current. Weak Current.

5. In the Subjects in Magnetism — Dia-Magnetism. Para-Magnetism. Terrestrial Magnetism.

6. In the Subjects in Nuclear Physics — Neutron. Nutrino. Proton. Beta Ray. Meson. Cosmic Ray.

7. In the Subjects in Chemistry — Inorganic Substance. Hydrogen. Calcium. aluminum. Carbon. Bismuth. Oxygen. Fluorine. Iron. Metal. Non-Metal. Alloy. Basic Oxide. Acid. Salt.

8. Organic Substance. methane. Phenophthalene. Carbohydrate. Starch. Aromatic Compound. Benzene. Heterocyclic Compound. Alkaloid. Amino Acid. Protein. Vitamin. Hormone. Chlorophyll. Enzyme.

6.2.3.6 *Recognition of Isolate Ideas*

The indication, by the title of a document, of the isolate facets of its subject may be either (1) Explicit, or (2) Implicit in the context, or (3) Hidden within a derived composite term, or (4) Absent. The basic

subject of the document will be of help in sensing the absence of the indication of a necessary facet of the compound subject. Experience will develop the capacity for sensing this. In that case, the contents page or even the whole document should be perused to find the absent isolate ideas, if any. Again, experience will develop the capacity to sense the derived composite terms in a title and to break it into its fundamental constituent terms. Some examples are given in the following table. In each example, against each isolate idea appropriate symbol is given to indicate the fundamental category of which it can be deemed to be a manifestation.

Symbols used:

(BF) = Basic Facet   [S] = Space Facet
[E] = Energy Facet   [P] = Personality Facet
[M] = Matter Facet   [T] = Time Facet

SN	Indication	Title	Basic and Isolate Facets
1	Explicit	1.1 Coal washing	Mining (BF). Coal [P]. Washing [E].
		1.2 Control of virus diseases of the stem of rice plant in the winter of 1967 in Madras	Agriculture (BF). Control [E]. Virus disease [M]. Stem[P]. Rice plant [P]. Winter [T]. 1967 [T]. Madras [S].

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SN	Indication	Title	Basic and Isolate Facets
	Explicit	1.3 Election of the President of the Congress Party in India in 1967	History (BF). Election [E]. President [P]. Congress Party [P]. India [S]. 1967 [T].
2	Implicit (The implied facets are in italics)	2.1 The structure of protein and electron microscope	*Chemistry* (BF). Structure [M]. Protein [P]. *Determination* [E]. Electron microscope [M].
		2.2 X-ray diagnosis in cow farming	*Animal husbandry* (BF). X-Ray [M]. Diagnosis [E]. Disease [M]. Cow [P].
		2.3 Tape-record and protection of the folk songs of the Todas	*Sociology* (BF). Taperecord [M]. Dying out [M]. Protection [E]. Folk songs [M]. Todas [P].
3	Hidden within a Derived composite term (the hidden facets are in italics)	3.1 Phthisis	*Medicine* (BF). *Lungs* [P]. *Tubercular disease* [M].
		3.2 Indian franchise in 1967	*History* (BF). India [P]. *Citizens* [P]. Franchise [M]. 1967 [T].
		3.3 Birth control essential in India today (1966)	*Sociology* (BF). *Overpopulation* [M]. *Prevention* [E]. Birth control [M]. India [S]. Today [T].

6.2.4   Postulate of Rounds for Energy

The fundamental category "Energy" may manifest itself in one and the same subject more than once. The first manifestation is taken to

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Pauline Atherton.

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end Round 1 of the manifestation of the three fundamental categories "Personality", "Matter", and "Energy". The second manifestation is taken to end Round 2. And so on.

We shall denote the manifestations of the fundamental category "Energy" in Rounds 1,2 etc., by the respective names Round 1 Energy Facet, Round 2 Energy Facet, etc. We shall represent them by the respective symbols [1E], [2E], etc. Which manifestation of the funda- mental category "Energy" should be deemed to be the Round 1 which the Round 2 will be determined by the Wall-Picture Principle.

6.2.5 Postulate of Rounds for Personality and Matter

Each of the fundamental categories "Personality" and "Matter" may manifest itself in Round 1, Round 2, and so on.

We shall denote the manifestation of the fundamental category "Personality" in the Rounds 1, 2 etc., by the names Round 1 Personality Facet, Round 2 Personality Facet, etc. We shall represent them by the respective symbols [1P], [2P], etc.

So also we can have Round 1 Matter Facet, Round 2 Matter Facet, etc. We shall represent them by the respective symbols [1M], [2M], etc.

6.2.6 Postulate of Round for Space and Time

Ordinarily, any of the fundamental categories "Space" and "Time" may manifest itself only in the last Round in a subject.

We shall represent them by the respective symbols [S], [T].

6.2.7   Postulate of Level

Any of the fundamental categories "Personality" and "Matter" may manifest itself more than once in one and the same Round within a subject; and similarly with "Space" and "Time" in the Last Round. The first manifestation of a fundamental category within a Round will be said to be its Level 1 Facet in that Round. Its second manifestation within that Round will be said to be its Level 2 Facet in that Round. And so on.

6.2.7.1   Personality and Matter

We shall call the successive manifestations of the fundamental category "Personality" in the Round 1 by the respective names Round 1 Level 1 Personality Facet, Round 1 Level 2 Personality Facet, etc. We shall represent them by the respective symbols, [1P1], [1P2], [2P1], [2P2], etc. Similarly, [1M1], [1M2], [2M1], [2M2], etc.

6.2.7.2   Space and Time

Since Space and Time Facets can occur only in the last round of a subject, there is no need to indicate the Round in their names or their symbols. It is sufficient if we represent them by the respective symbols [S1], [S2], [T1], [T2], etc.

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6.2.7.3   Energy

The fundamental category "Energy" can occur only once within a Round. Therefore, no Level in its case.

6.2.8   Postulate of First Facet

In a Compound Subject, the Basic Facet should be the first facet.

Every Compound Subject, should have a Basic Facet. Again, Isolate Facets can form a subject, if and only if they are attached to a Basic Facet. Helpfulness requires that all the Compound Subjects going with a Basic Facet should be arranged together. To secure this, the Basic Facet should be given the First Position among the facets of a Compound Subject.

6.2.9   Postulate of Concreteness

The five fundamental categories fall into the following sequence, when arranged according to their decreasing concreteness: P, M, E, S, T.

This Postulate conforms to what the majority of persons think in respect of the relative concreteness of the isolates which are manifestations in each of the five respective fundamental categories.

6.2.10   Postulate of Facet Sequence Within a Round

In any Round of Facets of a Compound Subject in which each of any of the first three fundamental categories occurs only once, their

sequence should be: Personality Facet, Matter Facet, and Energy Facet.

6.2.11   Postulate of Facet Sequence Within the Last Round

In the Last Round of facets of a Compound Subject, in which each of the fundamental categories other than Energy occurs only once, the sequence of the facets should be Personality Facet, Matter Facet, Space Facet, and Time Facet.

6.2.12   Postulate of a Level Cluster

Facets of different levels of the same fundamental category within a Round of facets in a Compound Subject should be kept together.

6.2.13   Alternative Sets of Postulates

It will be helping the cause of classification, if an alternative set of postulates is forthcoming. This will happen when the present set of postulates begins to prove unhelpful. This conjecture is based upon the history of science and upon the formulation of fundamental laws such as Postulates, Canons, Principles, and Hypotheses.

6.3   Wall-picture Principle

If two facets A and B of a subject are such that the concept behind B will not be operative unless the concept behind A is conceded, even as a mural picture is not possible unless the wall exists to draw upon, then the facet A should preceded the facet B.

1. In "Cure of Disease" the concept behind the term 'Cure' is not operative unless the concept behind the term 'Disease' is conceded. Therefore, when expressed in transformed skeleton form, we shall have 'Disease. Cure'.

   In this case, the application of the Wall-Picture Principle has determined that the Round to which the concept 'Disease' should be assigned as the one preceding the Energy Facet 'Cure'.

2. In "Prevention of Disease" also, the concept behind the term 'Prevention' is not operative unless the concept behind the term 'Disease' is conceded. Therefore, when expressed in transformed skeleton form, we shall have 'Disease. Prevention'.

   Thus, the application of the Wall-Picture Principle has determined that the Round to which the concept 'Disease' should be assigned as the one preceding the Energy Facet 'Prevention'.

3. A comparison of examples 1 and 2 leads to an important warning in applying the Wall-Picture Principle. In example 1, 'Disease' actually comes in before 'Cure' begins. But in example 2, 'Disease' does not come in at all. Indeed, 'Prevention' is to secure that it does not come. In the former the concept as well as what is conceived are conceded before 'Cure' begins. In the latter, the concept 'Disease' alone is conceded, but not

'Disease' itself, before 'Prevention' begins. Thus, in applying the Wall Picture Principle it is only the concept that should be conceded, but not the correlate of the concept existing outside the mind.

4. In "President of India", the concept behind the term 'President' is not operative unless the concept behind the term 'India' is conceded. Therefore, when expressed in transformed skeleton form, we shall have 'India. President'.

In this case, the application of the Wall-picture Principle has determined the respective Levels to which the concepts 'India' and 'President' should be assigned.

5. Consider "Release of Contract in India". The concept behind the term 'Release' is not operative unless the concept behind the term 'Contract' is conceded. Further, the concept behind the term 'Contract' is not operative unless the concept behind the term 'India' is conceded. Therefore, when expressed in a transformed skeleton form, we shall have 'India. Contract Release'.

In this case, the application of the Wall-Picture Principle has determined the respective Levels to which the concepts 'India', 'Contract'. and Release' should be assigned.

6. Consider "Hamlet by Shakespeare, the English Dramatist". The concept behind the term 'Hamlet' is not operative unless the concept behind the term 'Shakespeare' is conceded. Again,

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the concept behind the term 'Shakespeare' is not operative, unless the concept behind the term 'Drama' is conceded. So also, the concept behind the term 'Drama' is not operative unless the concept behind the term 'English' is conceded. Therefore, when expressed in transformed skeleton form, we shall have 'English. Drama. Shakespeare. Hamlet'.

In this case, the application of the Wall-Picture Principle has determined the respective Levels to which the concepts 'English', 'Drama', 'Shakespeare', and 'Hamlet' should be assigned.

7. Supplementary to Postulates. — The Wall-Picture Principle and the Postulates for Facet Sequence will produce the same result wherever they are both applicable. In those cases, we need not invoke the aid of the Wall-Picture Principle. But in the examples given above, the Postulates by themselves cannot determine the Round and the Levels indicated. Thus, the use of the Wall-Picture Principle is supplementary to the use of the Postulates. The former is more versatile than the latter.

6.3.1   Whole-Organ Principle

If, in a subject, facet B is an organ of facet A, then A should precede B.

Consider "The Public Accounts Committee of the Parliament of India". The Facet 'Public Accounts Committee' is an organ of the facet 'Parliament'. the facet 'Parliament' itself is an organ of 'India', When

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expressed in a transformed skeleton form, we shall have 'India. Parliament. Public Accounts Committee'.

This sequence of Levels can also be inferred directly from the Wall-Picture Principle.

However, the Levels shown for a subject in Law, and the Levels shown for a subject in Literature, are not in the relation of 'Whole' and 'Organ'. Therefore, those Levels can be inferred only by directly invoking the Wall-Picture Principle.

6.3.2   Cow-Calf Principle

If a facet A and another facet B belonging to the same subject are not to be separated though they are distinct from each other and thus separable, A and B should be kept together in the same Round, even as a milch cow and its unweaned calf are not separately sold out though they are distinct entities and thus separable, but are kept together in possession of the same owner.

Consider "Enforcement of the Functions of the President of India". Here, the three facets 'India', 'President', and 'Functions' are not to be separated and put into different Rounds, although they are separable. They should all be put together in Round 1— that is, before the Energy Facet, 'Enforcement'— or after it. We cannot put any one of them in Round 1 and the other two in Round 2. The Cow-Calf Principle determines only that all the three facets should be put in one and the

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same Round. To decide which Round it should be, we should invoke the direct aid of Wall-Picture Principle. This Principle would definitely assign them to Round 1. Therefore, when expressed in transformed skeleton form, we shall have 'India. President. Function. Enforcement'.

We can also get the same result by repeated application of the Wall-Picture Principle.

6.3.3 *Actand-Action-Actor-Tool Principle*

If, in a subject, facet B denotes action on facet A by facet C, with facet D as the tool, then the four facets should be arranged in the sequence A, B, C, D.

Consider "Charkha Cotton Spinning by Girls". (Charkha is a simple spinning instrument revived and brought into great prominence by Mahatma Gandhi during the days of Freedom Movement.) Here, the Action is 'Spinning'; the Actand is 'Cotton'; the Actor is 'Girls'; and the Tool is 'Charkha'. Therefore, when expressed in transformed skeleton form, we shall have 'Cotton. Spinning. Girls. Charkha'.

This result can also be got by the repeated application of the Wall-Picture Principle.

6.4 Linear Arrangement of Subjects and its Necessity

The human mind is, after all, at a very early stage in its evolution. Although we can speak of many dimensions, it usually works, more or

less, in one dimension. Even mathematicians have to work "bit by b along the line". There may be exceptions; but most serious thinkers have to think out one thing at a time in succession. In particular, the documents in the stack and their main entries in the catalogue have to be in linear sequence. The search for any one document or its entry has to be made by scanning along the line. But the universe of subjects has many dimensions. Let us say, *n* dimensions, where *n* is a large positive integer. The subjects in the Universe of Subjects have to be arranged in a line for the convenience of readers.

6.5   Mathematical Transformation and Mapping

To state this in mathematical terms, we have to transform the n-dimensional space into one-dimensional space. In other words, we have to map an n-dimensional space on a one-dimensional space. This is the problem in classification.

6.6   Invariant Among Immediate-Neighbourhood- Relations

Consider the five points spread out on a plane.

```
        C           B
            A
        D           E
```

Here B, C, D, and E each claims Immediate-Neighbourhood-Relation with A. Let us arrange all the five points in one line. Let us put A at the left end. Then there can be only one Immediate-Neighbourhood-Position after A.

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$$\frac{X}{A}$$

We can give that position *only to one* of B, C, D, and E and not to all. To which shall we give that position? In other words, which of the four Immediate-Neighbourhood-Relations should be kept invariant while arranging the five points along a line? Consider the points as subjects. This lays bare our inescapable problem in classification. It is a mischief created by the mathematics of transformation and mapping. If we begin to ask which of B, C, D, and E should be given the benefit of keeping invariant its Immediate-Neighbourhood-Relation with A, the chances will be equal to all the four elements.   This tantalising problem attains colossal dimensions when we have to arrange millions of micro-subjects.

6.7   Descent Towards the Seminal Level

In the phenomenal world there are millions and millions of subjects.   We do not know which of the Immediate-Neighbour-hood-Relations should be kept invariant in arranging the subjects in a helpful way along a line. A suitable method would be to descend from the phenomenal level nearer to the seminal level. According to the Postulate of Fundamental Categories, we should descend down and down, and down and down, and allow the various subjects and ideas to become absorbed and reassembled, reabsorbed, and again reassembled, and so on, until we find only five ultimate generic ideas — seminal ideas, Fundamental Categories — standing out.

7   PRACTICAL CLASSIFICATION

7.1   Steps in Practical Classification

Classifying a document consists of the following steps in succession.

Step 0.— Raw Title (= Title as found in the document).

Step 1.— Full Title (= Title expressing each of the relevant basic and isolate ideas in the subject of the document, got by filling up all the ellipses in the Raw Title).

Step 2.— Kernel Title (= Full title minus all the auxiliary or apparatus words and with each composite term denoting a composite idea replaced by the fundamental constituent terms denoting its fundamental constituent ideas).

Step 3.— Analysed Title (= Kernel Title with each kernel term marked by a symbol, denoting the fundamental category of which the idea denoted by the term is a manifestation and also the round and the level to which it is assigned in conformity to the Postulates of Classification).

Step 4. — Transformed Title (= Analysed Title with the kernel terms rearranged according to the symbols of analysis attached to them).

Step 5. — Title in Standard Facet Terms (= Transformed Title with the kernel terms replaced, wherever necessary, by their respective equivalent terms as given in the appropriate schedules).

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Step 6. — Title in Facet Numbers (= Title in Standard Terms with the kernel terms replaced by their equivalent numbers from the schedules).

Step 7. — Class Number (got by removing the symbols of analysis and inserting the appropriate Connecting Symbols between the facet numbers in accordance with the Rules).

The work in Steps 1 to 4 are done according to the principles enumerated in Sec 6.2 and 6.3 respectively. This work amounts to the analysis of the subject into facets and the determination of the sequence of the facets. This is done in the idea plane. The work in Step 7 amounts to synthesis of the facet numbers in the notational plane. The work in the idea plane deals in reality with the Syntax of the Facets; and this is reflected in the notational plane also.

7.2 Analytico-Synthetic Classification

By 'Analytico-Synthetic Classification' is meant a scheme for classification involving analysis and transformation in the idea plane and synthesis in the notational plane according to stated postulates and principles.

7.3 Advantage of Postulates and Principles

Practical classification based on the stated postulates and principles bypasses the work of thinking about all the subjects at one and the same time, analysing each of them in a helpful sequence in such a way that, in the finally resulting sequence of subjects, the intended

Immediate-Neighbourhood-Relation remains invariant. The *ad hoc* decision of these for each document is tantalising. Nightmare is often the result. For example, the number of the possible sequences of the facets in the diverse subjects, out of which one and only one is to be chosen consistently, is very large.

7.4 Example of Tantalisation

Let me illustrate with a small fringe of the problem. Consider the subject

"Agriculture of Wheat"

It has only two facets — Basic Facet "Agriculture" and Isolate Facet "Wheat". The sequence of these facets does not give much trouble. Maintaining deeper consistency in such cases is quite easy. But, consider the micro-subject "Leaf virus of wheat and spraying of chemicals from aeroplane in the coastal areas of Florida during the wet summer months in the present decade". This has 14 facets. The following 11 facets are explicitly mentioned in the title — Leaf. Virus. Wheat. Spraying. Chemicals. Aeroplane. Coastal area. Florida. Wet. Summer. Present decade. The following three facets are implied in the title – Agriculture. Disease. Cure.

There are 87,178,297,200 possible sequences in which these can be arranged. How are we to select the most helpful of these eighty-seven thousand million sequences? How are we to be consistent in their selection – consistent also at a deeper level, at which the same pattern of sequence of facets is followed in diverse subjects? An *ad hoc* decision of this in each case is tantalising.

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7.5   Bypassing the Tantalisation

But step 5 in practical classification — described in Sec 7.1, and based on Postulates and Principles — secures consistency without undue strain to the mind — without being tantalised. Further, when all the subjects are given their respective class numbers as shown in Step 7 in Sec 7.1 and are arranged by their class numbers, they all fall automatically into a helpful sequence. This is the advantage of using an Analytico-Synthetic Classification guided by Postulates and Principles.

7.6   Helpfulness for the Majority of Readers

The sequence secured by the postulates and principles is found to be helpful to the majority of readers. This has now been tried out not only in the arrangement of books and of their main entries in libraries, but also in the arrangement of the main entries in documentation lists of current articles in about a hundred very specialised subjects, such as Production Engineering of Screw, Production of Diesel Engine, and Nuclear Medicine. The concerned expert specialists have expressed satisfaction with the sequence secured by this classification.

7.7   Minority Groups Among Readers

No minority group, however, should be left without help. The formation of special collections in the stack room is one form of help to a single minority in a particular library. But to meet the needs of several minorities, the catalogue can be pressed into service. A separate guide-card giving the interest of each minority may be inserted in the

alphabetical part of the catalogue. Behind the guide-card for a particular minority may be inserted a duplicate set of the main entry cards of all the documents of interest to that minority. These duplicate main entry cards should be arranged in the classified sequence. This is only an aside. We shall now resume our main line of thought.

8 SEARCH FOR THE HIDDEN ROOTS OF CLASSIFICATION

8.1 Syntax of Facets

My wish is that in our search for hidden roots of classification, we should not stop with the postulates and principles at the near-seminal level. These form only a first approximation. What pleased me most was the announcement that this Seminar intended to dive deeper still, to find the very tip of the tap-root in the intellect, so to speak. In analytico-synthetic classification, one of the vital steps is the determination of the helpful sequence of the facets of a subject. This means the Syntax of Facets. This in its turn means a harmonious sequence of the facets, that gives satisfaction to the human mind. Webster quotes the following passage to show the power of a good syntax:

"His mind moved in a rich erudite and complex *Syntax*
That turned all opposition into admiration".

The syntax of facets in classification based on the postulates and principles gives satisfaction to the majority of readers.

8.2   Quest for the Reason for Satisfaction

What is the reason for the Syntax of Facets given by the postulates and principles being satisfactory to most people? The reason should be searched in the minds of the readers. This will lead us to the roots of classification hidden far deep in the intellect-in-action. In this behalf, I made a suggestion in my talk at the Washington Conference (1958) on "Retrieval of Scientific Information, that to help in the establishment of a fairly long-lived helpful scheme for classification, a team of epistemologists, psychologists, linguists, reference librarians, classificationists, and statisticians should investigate the way in which the human intellect works today – that is, the Syntax of Facets that will give the greatest satisfaction to the greatest number of readers. Probably, the time was not then ripe for it. For, I found scepticism in some. If I remember right, one even called it a "tall-order". I am glad that the theme has been seized in 1966 by the organisers of the Symposium on the Foundation of Syntactic Relations in Classification in the University of Maryland.

8.3   Absolute Syntax

By 'Absolute Syntax' is meant the sequence in which the facet ideas of a subject arrange themselves in the minds of the majority of persons. Linguistic Syntax is the Syntax of Words - that is, the sequence in which the words stand arranged in a sentence or in the name of a subject in a natural language. The Linguistic Syntax may vary with the language; often it does.

The result in Step 5 in the steps in classifying a document corresponds to Absolute Syntax – that is, Syntax of Facets. In it, the

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kernel terms in the name of a subject stand rearranged according to the Syntactic Principles governing the sequence of the facets denoted by the respective kernel terms. On the other hand, the result in Step 3 corresponds to Linguistic Syntax. In it, the kernel terms stand arranged in the same sequence as the one in which these terms are found in the name of the subject in the natural language used. Here is an example.

Consider the Subject

"The Heart of the Frog".

This is Step 0. the full title in Step 1 will be

"The Heart of the Frog (as studied in) Zoology".

In Step 2, where only the kernel terms are retained, we shall have

"Heart. Frog. Zoology".

This sequence is according to the Linguistic Syntax of the English language.

According to the Linguistic Syntax of the Tamil language, the kernel terms will stand arranged in Step 2 as follows: "

Zoology. Frog. Heart".

In step 5, the kernel terms will stand arranged as:

"Zoology. Frog. Heart".

This represents the Syntax of Facets.

It happens that the Linguistic Syntax of the English language differs from the Syntax of Facets; while the Linguistic Syntax of the Tamil language agrees with the Syntax of Facets.

There may be languages in which the Linguistic Syntax may give respectively
"Zoology. Heart. Frog
Frog. Heart. Zoology
Frog. Zoology. Heart
Heart. Zoology. Frog" – respectively.

The number of variations of Linguistic Syntax from the Syntax of Facets will increase with the number of the kernel terms in the name of the subject – which is the same as the number of the facets in it.

8.4 Absolute Syntax and Facet Syntax

In general, the number of Linguistic Syntaxes for the name of a subject, in the different natural languages all taken together, can become as great as factorial n, where n is the number of kernel terms in the name of the subject. But, there is only one Syntax of Facets for the subject. For this reason, it is conjectured that the Syntax of Facets is the same as the Absolute Syntax. This implies that the Absolute Syntax is the one conforming to the Postulates and Principles guiding the design of an Analytico-Synthetic Classification.

8.5 Problem for Investigation

The problem for investigation is, "Is there an Absolute Syntax governing the sequence of the facets of a subject, inherent in the human

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intellect-in-action as it is today?" This investigation should be made by a team of specialists in Epistemology, Psychology, Linguistics, Reference Service, Design of Classification, and Statistical Analysis, mentioned in Sec 8.2.

8.6 Removal of Encrustation

It is not expected that the Absolute Syntax will be inherent in the minds of one and all the adults, without any exception. For, from childhood onwards the Linguistic Syntax of the mother tongue makes an incessant impact on the mind of a person. It is too much to expect that the encrustation formed by this incessant impact would not have become too hard and opaque for the inherent Absolute Syntax to become operative. On the other hand, I only expect the Absolute Syntax will be operative with the majority of persons.

8.7 Frequency Study

While investigating the problem, the Team of Specialists would use the same assortment of subjects. They should examine a reliable random sample of persons drawn from each of most of the natural languages. Probably, it will be helpful to have three sets of random samples – one for children, one for adolescents, and one for adults. The investigation may have to be done in five stages.

In the first instance, without any suggestion whatever being made by the Team, the sequence of facets naturally preferred in the various facets by the different persons should be found out and recorded.

Thereafter, an attempt should be made to break gently the encrustation of the Linguistic Syntax in the minds of the people. The degree of success in this work will throw the people into several groups.

At the third stage, the sequence of facets in the subjects, preferred by each of the groups, should then be found out and recorded.

The work in the fourth stage will fall largely to the share of the Statisticians. They will have to construct the necessary and possible frequency tables and curves, and the correlation tables and curves and surfaces; and they should also furnish all the necessary statistical constants emerging from the study of the problem.

In the fifth stage, it may be possible to find out, from the results tabulated by the Statisticians, whether there is an Absolute Syntax, and if so, what it is; and in particular, it can be verified whether the Syntax of Facets based on the Postulates and Principles for an Analytico-Synthetic Classification is the same as or at least a good approximation to the Absolute Syntax.

8.8   Help to Classificationist

The final findings of such a team of specialists will enable the classificationists to build schemes for classification on fairly firm foundations. At present, a good deal of professional energy and time get dissipated in discussing problems in classification guided solely by conjectures and conflicting opinions based on insufficient data. This wastage should be avoided. I wish that the deliberations of this Seminar leads to the solution of this problem along objective and scientific lines by Teams of Specialists, probing into the hidden roots of classification. The results will be of help in the study of absolute linguistics also. This piece of tiny research deserves to be provided for by a Foundation.

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