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THE FOUNDATIONS OF STATISTICS

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Introduction

0.1 I am particularly grateful to Professor F. Gonseth and Professor A. Linder, the organizers of the Zürich Symposium which was held in the Swiss Federal Institute of Technology in Zürich in April 1953, for having invited me to open the discussion on the foundations of statistics. In my opening observations I had referred to certain ideas in the Indian-Jaina theory of *syādvāda* [1] which aroused much interest; and I was requested to give a fuller account of Jaina views at the time of preparing the text of my communication. I am doing this in Part 1 of the present paper.

0.2 There was also a brisk discussion on some of the views which I had placed before the symposium. It was suggested that I should take into consideration these comments and amplify to some extent my own arguments in writing out my communication. I intend to give my own views in Part 2 of the present paper broadly on the basis of the observations made by me at the Zürich symposium with, however, certain additions and amplifications to deal with some of the comments made by the other speakers.

0.3 I wish to offer my sincere thanks to Professor Linder for looking through the manuscript of the paper and for making valuable comments and suggestions.

[1] Usually described as « The dialectic of the sevenfold categories of knowledge ». In the present paper I have given references to books in the English language and not to original sanskrit texts because these are not likely to be readily available in Europe. The English books (to which I have referred) give very full bibliographical references to original texts.

Part 1. The Indian-Jaina dialectic of syādvāda in relation to probability

1. *Brief history of syādvāda*

1.1 There are certain ideas in Indian-Jaina logic called *syādvāda* which seem to have close relevance to the concepts of probability, and which can, therefore supply a convenient background to my own observations on the foundations of statistics. It is always difficult to be sure about the exact meaning of logical and philosophical phrases which were current 1500 or 2500 years ago: and it is not claimed (and I also agree that it would not be correct to claim) that the concept of probability in its present form was recognized in *syādvāda* but the phrases used in *syādvāda* seem to have a special significance in connexion with the logic of statistical inference.

1.2. I shall first give a brief historical account of *syādvāda*. Jaina religion and philosophy came into prominence from the time of its great leader Mahāvira (599-527 B. C.) who was a contemporary of Buddha, the founder of the Buddhist religion. The earliest reference to *syādvāda* occurs in the writings of Bhadrabāhu who is believed to have given the following explanation of *syādvāda*: syāt = « may be », and *vāda* = « assertion », or the assertion of possibilities [1].

« The *syādvāda* is set forth as follows: (1) May be, it is; (2) may be, it is not; (3) may be, it is and it is not; (4) may be, it is indescribable; (5) may be, it is and yet is indescribable; (6) may be, it is not and it is also indescribable; (7) may be, it is and it is not and it is also indescribable [2]. »

1.3. There were two authors of the name Bhadrabāhu, the senior belonging to the period 433-357 B. C., and the junior to about 375 A. D., and it is not definitely known whether the above explanation was given by the senior or the junior Bhadrabāhu;

[1] Satis Chandra VIDYABHUSANA, *A History of Indian Logic* (Calcutta University 1921), pp. 167. (This book will be referred to as *HIL*.)

[2] *HIL*, pp. 167-168.

but the above exposition is usually ascribed to the senior Bhadrabāhu of the 4th century B. C. [1]. There is indisputable mention of *syādvāda* in the *Nyāyāvatāra* of Siddhasena Divākara [2] (about 480-550 A. D.). A little later Samantabhadra (about 600 A. D.) gives a full exposition of the seven parts of *Syād-vāda* or *Sapta-bhaṅgī-naya* in his *Āptamīmāṁsā* [3]. It is clear that *syādvāda* was well developed by the sixth century A. D., and received a great deal of attention in the mediaeval period of Indian logic; the *syādvāda-mañjarī* of Malliṣeṇa (1292 A. D.), for example, is a separate treatise on the same theory [4]. There are, of course, still later works such as Vimala Dāsa's *Saptabhaṅgītaraṅgiṇī* and a large number of mediaeval and modern commentaries. I am, therefore, dealing with a well-known theme which is considered to be the most original contribution of Jaina logic to Indian thought [5].

2. *Dialectic of seven-fold predication*

2.1. I shall next refer to the actual text in Sanskrit of the dialectic of sevenfold predication *(saptabhaṅgīnaya)*:

(1) *syādasti* [6]	= may be, it is.
(2) *syātnāsti*	= may be, it is not.
(3) *syādasti* [6] *nāsti* [7] *ca*	= may be, it is, it is not.
(4) *syādavaktavyaḥ* [8]	= may be, it is indeterminate.

[1] *HIL*, p. 167.

[2] *HIL*, p. 181 : « It is the perfect knowledge of things taken from all possible standpoints. Thus a thing may be, may not be, both may or may not be, etc. according as we take it from one or the other standpoint. »

[3] *HIL*, pp. 182-184.

[4] Jadunath SINHA, *History of Indian Philosophy* (Central Book Agency, Calcutta, 1952). Vol. II, p. 179. (This book will be referred to as J. SINHA, *HIP*).

[5] Satkari MOOKERJEE : *The Jaina Philosophy of Non-Absolutism* (Bhāratī Jaina Parisat, Calcutta, 1944), p. 191 (This book will be referred to as *JPN*).

[6] The two words *syāt* (may be) and *asti* (it is) are compounded (by rules of pronunciation) in one compound phrase *syādasti*.

[7] *nāsti* = not-is or it is not.

[8] The compound-phrase consists of two words *syāt* (may be) and *avaktavyaḥ* (or inexpressible, or indeterminate).

(5) *syādasti ca*[1] *avaktavyaśca*[2] = may be, it is and also indeterminate.

(6) *syātnāsti ca avaktavyaśca* = may be, it is not and also indeterminate.

(7) *syādasti nāsti ca avaktavyaśca* = may be, it is and it is not and also indeterminate.

2.2. The word *syāt* has been translated as « may be » but this does not bring out the full implications. The Sanskrit word in mentioning one possibility has also some indirect allusion to other possibilities. The Sanskrit word *asti* may be rendered as « it is », « it exists », or « it is existent »; and *nāsti* is the negation, i. e. « it is not », « it does not exist », or « it is non-existent ». The third category predicates the possibility of both *asti* and *nāsti*; of both « it is » and « it is not ». The first three categories conform thus to the categories of classical logic and do not present any difficulty.

2.3. The fourth category is *avaktavya* which I have translated as « indeterminate ». Other authors have used the words « indescribable »[3], or « inexpressible » or « indefinite ». For example, Satkari Mookerjee explains « The inexpressible may be called indefinite »... (*JPN*, p. 115.) I prefer « indeterminate » because this is nearer the interpretation which I have in mind.

2.4. It will be useful if at this stage I give an illustration. Consider the tossing of a coin; and suppose it turns up « head ». We may then say (1) « it is head » (now). This also implies, (2) « it is not-head » (on some other occasion). The third category follows without difficulty, (3) « it is, and it is not » which is a synthetic predication based on both (1) and (2). The fourth category predicates that the position is still (4) indeterminate.

2.5. This, however, does not exhaust the possibilities of predication or modes of knowledge. For example, if we know that it is a coin which has « head » on one side and « not-head » or « tail »

[1] *ca* = and or also.

[2] By rules of pronunciation the two words *avaktavyah* and *ca* are compounded into *avaktavyaśca*.

[3] For example, Satis Chandra VIDYABHUSANA in *HIL* and other works.

on the other side, and we also know that it must turn up either « head » or « tail », we may then predicate that (5) there exists one type of indeterminateness which is capable of being resolved in terms of the first four categories. On the other hand we may know that the subject of discourse is not a coin but something else to which the category of indetermination in the above sense cannot apply, we may then use the sixth mode of predication and assert that (6) there does not exist that type of indeterminateness which is capable of being resolved in terms of the first four categories. Finally, there is the seventh mode of knowledge where we may be able to predicate that sometimes the possibility of resolution of indetermination exists (as in the fifth mode) and sometimes this possibility does not exist (as in the sixth mode).

2.6. According to *syādvāda*, the above seven categories are necessary and are also sufficient so that they exhaust the possibilities of knowledge. There is a minority view which holds that there are further possibilities of (8) *vaktavyaśca avaktavyaśca*, a kind of duplicated indeterminateness together with successive categories of the fifth, sixth, and seventh types in an infinite regression but the accepted opinion is that the hypothetical eighth category is identical with the fourth so that there is no need of more than seven categories.

2.7. I should like to emphasize that the fourth category is a synthesis of three basic modes of « it is » (assertion), « it is not » (negation), and inexpressible, or indefinite, or « indeterminate » (which itself is resolvable into either « it is » or « it is not »), and supplies the logical foundations of the modern concept of probability. Consider the throw of a coin. It has the possibility of head (it is) or not-head (it is not); sometimes head and sometimes not-head; and the combination of both possibilities of « it is » and « it is not » in an yet indefinite or indeterminate form. The fifth category of knowledge in Jaina logic predicates the existence of indetermination (which we may perhaps interpret, in modern language, as the assertion of the existence of a probability field). The sixth category denies the existence of a probability field; while the seventh category covers the whole range of possibilities mentioned in the other six categories.

3. *Relativism*

3.1. It would be of interest to consider some further aspects of Jaina logic. The points to be stressed are that Jaina thought is non-absolutist (that is, it is relativist) and realist. Siddhasena Divākara (480-550 A. D.) in *Nyāyāvatāra* (which is accepted as the earliest Jaina work on pure logic at present available) gave an exposition of *syādvāda* (knowledge of the all-sided method) of which the authentic text is as described below:

« *Syādvāda*, which literally signifies assertion of possibilities, seeks to ascertain the meaning of things from all possible standpoints. Things are neither existent nor non-existent absolutely... *Syād* which signifies « may be » denotes all these seven possibilities, that is, a thing may be looked at from one of the above seven points of view, there being no eighth alternative [1]. »

3.2. It has been pointed out that:

« All objects are multiform *(anekānta)* according to him (i. e. the Jaina). From their many-sided nature it follows that all judgments are relative. They are true under certain conditions. They are conditional or hypothetical. No judgments are absolutely true. The word « perhaps » must be added to all judgments to indicate their conditional character. This is *Syādvāda* or the doctrine of relativity of judgments [2]. »

« The Jainas emphasize manifold nature of real things which are endowed with infinite qualities, modes, and relations to the other things [3]. They have identity-in-difference. The Vedantists emphasize pure identity and deny plurality. The Jainas emphasize manifoldness of inter-related reals and deny pure identity. They are anti-Absolutists. They are advocates of relative pluralism [4]. »

[1] *Nyāyāvatāra* edited by Satis Chandra VIDYABHUSANA. (Indian Research Society, Calcutta, 1909), pp. 29-30.

[2] J. SINHA, *HIP*, vol. II, 1952, pp. 205-206.

[3] It is worth noting that the Jaina view in this respect has much similarity to A. N. WHITEHEAD'S « inexhaustibility of nature ». Also cf. V. I. LENIN: « Materialism and Empiriocriticism. »

[4] J. SINHA, *HIP*, vol. II, 1952, p. 208.

3.3. It has been also pointed out that:

« Thus the Jainas hold that no affirmation, or judgment, is absolute in nature, each is true in its own limited sense only, and for each one of them any of the above seven alternatives (technically called *saptabhaṅgī*) holds good. (See *syādvādamañjarī* with Hemachandra's commentary p. 166 etc). The Jainas say that other Indian systems each from its own point of view asserts itself to be the absolute and the only point of view. They do not perceive that the nature of reality is such that the truth of any assertion is merely conditional, and holds good only in certain conditions, circumstances, or senses *(upādhi)*. It is thus impossible to make any affirmation which is universally and absolutely valid. For a contrary or contradictory affirmation will always be found to hold good of any judgment in some sense or other. As all reality is partly permanent and partly exposed to change in the form of losing and gaining old and new qualities, and is thus relatively permanent and changeful, so all our affirmations regarding truth are also only relatively valid and invalid. Being, non-being and indefinite, the three categories of logic, are all equally available in some sense or other in all their permutations for any and every kind of judgment. There is no universal and absolute position or negation, and all judgments are valid only conditionally [1] ».

4. *Realism*

4.1. Jaina logic is essentially realistic : « The Jaina philosopher maintains that existents are possessed of an infinite number of attributes and characteristics which can be discovered by experience alone. ... He refuses to put a premium on internal intuition. The mind, even with its active contributions, which the Jaina does not seek to deny, is believed by him to be an instrument of discovery and not a creator of facts. » (*JPN*, p. 1.)

[1] S. DASGUPTA, *History of Indian Philosophy*, vol. I, pp. 180-181 (Cambridge University Press, 1922).

« Logic has to work upon the data of experience and is as much an instrument as experience is. » (*JPN*, p. 5). ... « Pure logic, prior to and independent of experience, is a blind guide to the determination of truth. Logic is to rationalize and systematize what experience offers. » (*JPN*, p. 78.)

« A thing is existent, is non-existent and is both existent and non-existent, but always subject to limitations imposed by objective differences of substance, time, space and attributes *(dravya-kṣetra-kāla-bhāvāpekṣayā)* [1]. The differences in predication are not due to our subjective contemplation from different angles of vision, but are founded upon objectively real attributes. They are facts irrespective of the consideration whether we contemplate them or not. » (*JPN*, p. 107.)

4.2. « The Jaina does not see any reason why things should be particulars alone. Things are, according to the Jaina, both universals and particulars together ... A real is a particular which possesses a generic attribute. » *(JPN*, p. 2.) ... « in conformity with the plain verdict of experience, the nature of reals is admitted to be made up of both the elements — universal and the particular and to be cognised as such by perceptual knowledge. » ... (*JPN*, p. 3.)

« Things are neither exclusively particulars, nor are they exclusively universals, but they are a concrete realization of both. The two elements can be distinguished by reflective thought, but cannot be rent asunder. So our experience of one particular individual is not confined to that individual alone, but extends to unperceived individuals also in so far as the latter typify the universal as a part of their constitution. Individuals, even when they belong to a class, will vary from one another. ... Repetition of experience only helps us to take stock of the universal in its true character, but once the latter is known, it does not stand in need of verification or confirmation by further observation [2]. » (*JPN*, p. 6.)

[1] *dravya* = substance ; *kṣetra* = space ; *kāla* = time ; *bhāva* = attribute.

[2] I may draw attention to the similarity of these ideas to the concept of an « individual element » in relation to the « population » in modern statistical theory.

4.3. The Jaina emphasizes the multiple nature of reality and accepts the standpoint of non-absolutism : « He asserts that neither unity nor diversity sums up the nature of a real, but both taken together do it. Unity is not exclusive of diversity or vice versa. The difficulty that is confronted is not grounded upon objective reality, but arises from a subjective aberration, which consists in the imagination of inconsistency between unity and diversity. But unity is associated with diversity and diversity is never found apart from unity, which is its very foundation. » (*JPN*, p. 58.)

« The central thesis of the Jaina is that there is not only diversity of reals, but each real is equally diversified. Diversification as induced by relations has been explained. The conclusion is legitimate that each real is possessed of an infinite number of modes at every moment. The number of reals is infinite and consequently their relations with one another are infinite. ... all things are related in one way or the other and ... relations induce relational qualities in the relata, which accordingly become infinitely diversified at each moment and throughout their career. ... Things are neither momentary [1] nor uniform [2] » ... (*JPN*, p. 70.) According to the Jaina « a real changes every moment and at the same time continues. The continuity never breaks down. » (*JPN*, p. 70.)

« A real is that which not only originates, but is also liable to cease and at the same time capable of persisting. Existence, cessation, and persistence are the fundamental characteristics of all that is real ... This concept of reality is the only one which can avoid the conclusion that the world of plurality, which is the world of experience, is an illusion. » (*JPN*, p. 72.)

4.4. The relativism of the Jaina philosopher is to be sharply contrasted with some of the other Indian systems of philosophy.

[1] There is one well-known school of Buddhist philosophy which holds that reality consists of an infinite sequence of « atomistic » or completely independent « moments » which have no connexion with one another.

[2] On the other hand, the monistic philosophy of the Vedāntist holds that the Absolute transcends all change.

« The Vedāntist starts with the premise that reality is one universal existence; the Buddhist fluxist [1] believes in atomic particulars, each absolutely different from the rest and having nothing underlying them to bind them together. The Naiyāyika [2] believes both to be combined in an individual, though he maintains that the two characters are different and distinct. ... The Jaina differs from them all and maintains that the universal and the particular are only distinguishable traits in a real, which is at once identical with and different from both. » (*JPN*, p. 13.)

It is, however, necessary to notice that:

« There is a difference — and intrinsic difference at that — between a manifested and an unmanifested real ... They are identical and different both — identical in so far as it is the same substance and different in so far as it undergoes a change of characteristic. This is the Jaina position of non-absolutism. » (*JPN*, p. 39.)

« A real is not entirely expressible in all its aspects and modes. But it is not inexpressible altogether. A real being a multiple entity is expressible and inexpressible both in reference to different aspects; it is expressible in so far as it partakes of a universal and is inexpressible so far as it is a unique individual [3]. » ... (*JPN*, p. 113).

« The unique individuality of a real is not accessible to conceptual thought and, hence, to language, but it is reached by an analysis of the nature of reality as it is apprehended in perception. ... we have tried to prove, following the guidance of the Jaina philosophers, that the nature of reals, on analysis, has been found to exhibit the following traits, viz., existence, non-existence and inexpressibility. » (*JPN*, p. 127.)

[1] The phrase « fluxist » requires a little explanation. The Buddhist school of philosophy (to which reference has been made in footnote [1]) is known as *kṣaṅa-vāda* which means literally the theory or philosophy of « moments ». It has been translated by S. Mookerjee as « fluxist » which, however, does not seem to be entirely happy.

[2] Another well-known school of Indian philosophy.

[3] It may be noted that a single or unique individual as such (that is without any relation to a « population » or « universe ») has no meaning in modern statistical or probability theory.

5. *Relational aspects*

5.1. Relational aspects have received special notice in Jaina logic.

« Everything is related with every other thing, and this relation involves the emergence of a relational quality. The qualities cannot be known *a priori*, though a good number of them can be deduced from certain fundamental characteristics. » (*JPN*, p. 3.) ... « A real is only a part of a system knitted together by a network of relations, from which it cannot be divorced. » (*JPN*, p. 109.) « Every real is thus hedged round by a network of relations and attributes, which we propose to call its system or context or universe of discourse, which demarcates it from others. » (*JPN*, p. 114.)

« It is idle to raise questions of chronological status as to whether the unity is prior to the elements or the elements are prior to the unity. In the concrete real at any rate they are coordinate. This unity of being and non-being, or rather of self-being and negation of other-being, is beyond the reach of logical concepts, and, hence, of linguistic symbols, which are but the vehicles of such concepts. The Jaina in recognition of this inalienable character of reals declares them to be inexpressible. The inexpressible may be called indefinite from the standpoint of formal logic. But this is not the whole character of a real. It is also expressible and logically definable as existent, as non-existent [1]. » (*JPN*, p. 115.)

« The Jaina conception of relation may be summed up as follows. Relations are objective verities which are as much given to intuition and to thought as the terms are. A relation has no objective status outside the terms. It is the result of an internal change in the nature of the terms. It is *sui generis* in that it cannot be placed under the head of identity or of difference, both of which are contained as traits in its being. » (*JPN*, p. 211.)

5.2. The Jaina view of relatedness of the things is very naturally extended to the discussion of causality.

[1] The Jaina view insists on the inadequacy of formal logic by introducing the concept of indefiniteness or indetermination or uncertainty as an inalienable character of reals ; but also emphasizes the possibility of defining reals in terms of existent or non-existent taken together.

« ... neither synchronism nor succession is believed by the Jaina to be the essential characteristic of causal relation. Causality is a relation of determination. The effect is that whose coming into being is necessarily determined by the being of another. . The determinant is called the cause and the determinatum is called the effect. The determinant may be synchronous with the determined or may be separated by an interval ... » (*JPN*, p. 212.)

« What is the organ of the knowledge of causality? The Jaina answers that it is perception of the concomitance in agreement and difference. ... The Jaina takes the observation of concomitance in agreement and in difference to be one observation. ... The Jaina posits a twofold cause for the perception of universal relation — an internal and an external condition. The internal condition is found in the developed state of our mind and the external condition is the repeated observation of the sequence of the two events. » (*JPN*, p. 217.)

... « Such concepts as causality, substance, attribute and the like, are no doubt the ways in which the mind works up the data of experience, but this does not mean with the Jaina that they are true of the mind only and not of the extra-mental reality which they purport to understand. The Jaina would take them to be the instruments of discovery of the nature of reality, internal and external, which render the same kind of service as the sense-organs do. » (*JPN*, p. 217.)

... « The different categories, viz., the selves, matter, time, space and so on, are deductions from experimental data. They have been posited since general concepts presuppose their existence and since without these principles the data of experience cannot be organized into a system. These categories in spite of their general and comprehensive character are not only not inconsistent with the existence of individual entities, but on the contrary they are entirely based on the objective data. Without the individual existents these categories would be reduced to unmeaning class concepts. The affirmation of categories as objective principles is thus proof of the existence of individual reals, which are included within the ambit of these categories. Without the individuals forming their contents the categories would be empty and barren,

and the individuals without the categories would be reduced to a welter of chaos. The Jaina is a believer in plurality no doubt, but that plurality is not an unrelated chaos. The plurality is a system inasmuch as each individual is cemented with the rest by definite bonds of relationship. » (*JPN*, pp. 299-300.)

« From the analytic point of view *(paryāyārthikanaya)* the world is an infinite plurality with their infinite variations and modes. But the analytic view does not give us the whole nature of reality as it is. It is a partial picture that we derive of the world by means of such approach. The whole gamut of reality, however, reveals its universal unitive nature *as one existence* when it is envisaged from the synthetic angle of vision *(dravyārthikanaya)*. » (*JPN*, p. 301.)

« It seems legitimate to conclude that the universe is one existence which manifests itself, as substance *(dravya)* as it unifies the modes and attributes. The selfsame existence again reveals itself as Space in so far as it provides accommodation for the infinite plurality of existence within itself *(kṣetra)*. It is the same existence which manifests itself as Time (w. f. *kāla*) in so far as it changes into aspects, as precedent and consequent, as earlier and latter, as present, past and future modes. It is the same existence that evolves as phases and modes, attributes and states. The substance, time, space, attribute and relation are thus evolved from the same existence. The different categories, thus viewed as functional variations of one principle, are no longer in a position of antagonism of indifferent isolation. (*Aṣṭasāhasrī*, p. 113.)

The world of reals is thus not only plurality but a unity also. It is one universe that the Jaina metaphysics gives us. But the oneness is not secured at the sacrifice of the many, nor are the many left in unsocial indifference. » (*JPN*, pp. 301-302.)

5.3. It has been observed that « Jaina philosophy is ... entitled to be called the paragon of realism. If experience be the ultimate source of knowledge of reality and its behaviour, we cannot repudiate the plurality of things. The admission of plurality necessitates the recognition of the dual nature of reals as constituted of ' being ' and ' non-being ' as fundamental elements. One real will be distinguished from another real and this distinction, unless it is

dismissed as error of judgment, presupposes that each possesses a different identity, in other words that being of one is not the being of the other. This truth is propounded by the Jaina in that things are real, so far as they have a self-identity of their own unshared by others *(svarūpasattā)*, and they are unreal in respect of a different self-identity *(pararūpasattā)*. ... The logic of Jaina is empirical logic, which stands in irreconcilable opposition to pure logic [1]. » (*JPN*, p. 181.)

5.4. J. Sinha (*HIP.*, vol. II, p. 180) gives the following summary of Jaina philosophy : « The world is self-existent and eternal. All objects of the world are multiform *(anekānta)* and endued with infinite qualities and relations *(anantadharmaka)*. This is relative pluralism. The reality can be considered from different points of views or *nayas*. The *nayas* are the standpoints. ... All judgments are relative and probable. No judgments are absolute. This is *syādvāda*. There are seven ways of predication. This is called *saptabhangīnaya* [2]. »

It is not strange that Jainas believe that « the different systems of philosophy are only partial views of reality. Jainism is the complete view of reality. » (J. Sinha, *HIP*, vol. II, p. 180.)

6. *Some general observations*

6.1. I have given actual quotations from books on Jaina philosophy to convey the thoughts in their original form (of course, in English translation) without the bias of any subjective interpretations. I should now like to make some brief observations of my own on the connexion between Indian-Jaina views and the foundations of statistical theory. I have already pointed out that the fourth category of *syādvāda*, namely, *avaktavya* or the « indeterminate » is a synthesis of three earlier categories of (1) assertion (« it is »), (2) negation (« it is not »), and (3) assertion and negation in succession. The fourth category of *syādvāda*, therefore, seems to me to be in essence the qualitative (but *not* quantitative) aspect of the modern concept of probability. Used in a purely

[1] Pure logic in the sense of formal logic.
[2] J. Sinha, *HIP*, vol. II, p. 180.

qualitative sense, the fourth category of predication in Jaina logic corresponds precisely to the meaning of probability which covers the possibility of (a) something existing, (b) something not-existing, and (c) sometimes existing and sometimes not-existing. The difference between Jaina « *avaktavya* » and « probability » lies in the fact that the latter (that is, the concept of probability) has definite quantitative implications, namely, the recognition of numerical frequencies of occurrence of (1) « it is », or of (2) « it is not »; and hence in the recognition of *relative* numerical frequencies of the first two categories (of « it is » and « it is not ») in a synthetic form. It is the explicit recognition of (and emphasis on) the concept of numerical frequency ratios which distinguishes modern statistical theory from the Jaina theory of *syādvāda*. At the same time it is of interest to note that 1500 or 2500 years ago *syādvāda* seems to have given the logical background of statistical theory in a qualitative form [1].

6.2. Secondly, I should like to draw attention to the Jaina view that « a real is a particular which possesses a generic attribute ». This is very close to the concept of an individual in relation to the population to which it belongs. The Jaina view in fact denies the possibility of making any predication about a single and unique individual which would be also true in modern statistical theory.

[1] I think it is also proper to note the occasional occurrence of certain intriguing phrases in the mediaeval period of Indian logic. As an example, I am giving below what I myself heard about 20 years ago from the late Dr. Sir Brajendra Nath SEAL (the great Indian savant and the author of the « History of Positive Sciences of the Hindus » and other works who died in 1938. Dr. Seal told me that in a mediaeval Indian treatise there is a discussion about the practice of giving alms to Brahmins; and the question is raised whether the recipients of the gifts are always deserving persons. It is stated in reply that the practice of giving alms can be supported because « only ten out of hundred recipients are undeserving ». I do not know whether the above phrase is to be interpreted as a simple statement about the number or proportion of recipients who were found to be undeserving or whether the phrase has any implications of a statistical or probabilistic nature. Dr. Seal's view was that the above phrase had some probabilistic significance but only in a latent or implied (but not explicit or developed) form. As the subject of mediaeval Indian logic is not my special field of study I have not had the opportunity of making more detailed enquiries. I am, however, mentioning this point because it may be worth while making some further researches in this matter.

6.3. The third point to be noted is the emphasis given in Jaina philosophy on the relatedness of things and on the multiform aspects of reals which appear to be similar (again in a purely qualitative sense) to the basic ideas underlying the concepts of association, correlation, and concomitant variation in modern statistics.

6.4. The Jaina views of « existence, persistence, and cessation » as the fundamental characteristics of all that is real necessarily leads to a view of reality as something relatively permanent and yet relatively changing which has a flavour of statistical reasoning. « A real changes every moment and at the same time continues » is a view which is somewhat sympathetic to the underlying idea of stochastic processes.

6.5. Fifthly, a most important feature of Jaina logic is its insistence on the impossibility of absolutely certain predication and its emphasis on non-absolutist and relativist predication. In *syādvāda*, the qualification « *syāt* », that is, « may be » or « perhaps » must be attached to every predication without any exception. All predication, according to *syādvāda*, thus has a margin of uncertainty which is somewhat similar to the concept of « uncertain inference » in modern statistical theory. The Jaina view, however, is essentially qualitative in this matter (while the great characteristic of modern statistical theory is its insistence on the possibility and significance of determining the margin of uncertainty in a meaningful way). The rejection of absolutely certain predication naturally leads Jaina philosophy continually to emphasize the inadequacy of « pure » or « formal » logic, and hence to stress the need of making inferences on the basis of data supplied by experience.

6.6. I should also like to point out that the Jaina view of causality as « a relation of determination » based on the observation of « concomitance in agreement and in difference » has dual reference to an internal condition « in the developed state of our mind » (which would seem to correspond to the state of organized knowledge in any given context) and also to an external condition based on « the repeated observation of the sequence of the two events » which is suggestive of a statistical approach.

6.7. Finally, I should draw attention to the realist and pluralist views of Jaina philosophy and the continuing emphasis on the multiform and infinitely diversified aspects of reality which amounts to the acceptance of an « open » view of the universe with scope for unending change and discovery. For reasons explained above, it seems to me that the ancient Indian-Jaina philosophy has certain interesting resemblances to the probabilistic and statistical view of reality in modern times.

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