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ALTERNATIVE MODELS OF SCIENTIFIC RATIONALITY: THEORISATION IN CLASSICAL INDIAN SCIENCES

The roots of scientific[1] epistemology have generally been recognized in the Greeks, Aristotle and Euclid,[2]—the former representing an empiricist trend whereas the latter representing a rationalist trend. Very little is known about classical Indian scientific epistemologies which are generally considered at least two centuries earlier than Aristotle. Inspired by the Aristotelian and Euclidean models of scientific rationality, various new models have flourished in contemporary Western thought, the prominent ones being the logical-empiricist-inductivist model (Reichenbach), the hypothetico-deductivist-falsificationist model (Popper), conventionalist-

[1] Aristotle, *Posterior Analytics*, W.D. Ross (ed. & tr.), *The Works of Aristotle*, Vol. I, Oxford University Press, 1963.

[2] Euclid, *The Elements*, Great Books of the Western World, Vol. 11, London, Encyclopaedia Britannica, Inc., 1952.

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rationalist model (Pioncaré, Duhem), dialectical-historicist model (Kuhn), and rationalist-historicist model (Lakatos, Feyerabend).[3] While the researches in and debates about these models are still going on,[4] it may be profitable to examine the models of scientific rationality that are presupposed in the most prominent classical Indian sciences such as *Yoga*,[5] *Vyākaraṇa*,[6] *Jyotiṣa Siddhānt*,[7] and *Ayurvijñān*.[8] All these sciences have enjoyed an uninterrupted continuity ever since their origin although their evolution has suffered generally after 1200 A.D. (save Yoga) due to cultural-historical vicissitudes.

Contemporary Greco-European models of scientific rationality have generally not been able to rise above the metatheoretical or epistemological general concepts discovered by the Greeks, the only exception being the concept of *experiment*.[9] These general concepts are either Aristotelian or Euclidean and may be enumerated briefly as induction by intuition or enumeration, deduction, observation, validity, *archai* or axioms or common notions, postulate, hypothesis, definition, theorem, proof, and theory. Most of the contemporary scientific epistemologies employ these fundamental concepts and generate their specific models by putting some or all of these concepts in an order, stressing some concepts as central and others as not so central in scientific theorising. For this reason, the limitations of Greek scientific epistemology are also the limitations of contemporary epistemologies and even the most prestigious amongst these have not recorded any radical breakthrough, any real innovation in apprehending the scientific enterprise at large and scientific rationality and objectivity specifically. Contrary to this, classical Indian

[3] See for a discussion on some of these, V. Shekhawat, *Diogenes*, N. 128 (1984), pp. 77-102.

[4] I. Lakatos, "History of Science and Its Rational Reconstructions", in C. Howson (ed.), *Method and Appraisal in the Physical Sciences*, Cambridge University Press, 1976.

[5] H. Aranya, *Pātanjal Yoga Darśan*, Delhi, Motilal Banarsidas, 1974.

[6] Panini, *Aṣṭādhyāyī*, M.P. Misra (ed.), Varanasi, Chowkhamba Vidya Bhawan, 1967.

[7] M.P. Srivastava (comm.), *Sūrya Siddhānta*, Allahabad, Ratnakumari Swadhyaya Samsthan, 1982.

[8] *Charak Samhitā*, Jamnagar, Gulabkunwarba Ayurvedic Society, 1949.

[9] Galileo Galilei, *Two New Sciences*, Great Books of the Western World, Vol. 28, London, Ency. Brit., Inc., 1952.

sciences go much beyond Aristotle and Euclid and present a picture of science that cannot be interpreted in terms of the general concepts mentioned above. Yet these sciences have not only survived and progressed but also enjoyed great reputation for at least two and a half millennia and represent a form of knowledge that pretends, if not claims, very high ideals of truth. Thus, for example, while Aristotelian intuition remains confined to prolonged observation and enrichment of experience, *Yoga* develops a praxiology for its cultivation and intensification; while Euclidean axioms are the truths that are self-evident common notions, postulates of *Jyotiṣa Siddhānt* are super-intuited truths; while the justification for Aristotelian universal concepts or statements is sense experience alone, in *Yoga* and *Āyurvijñān* such concepts and statements are justified, in addition to sense experience, on the basis of some ground theory or metaphysics which is a comprehensive world-view or a theory of reality in entirety arrived at by and large by intuitive and rational methods saving at the same time what is experienced by senses.

If we examine the methods of theory construction and theory appraisal in these sciences, we find that they use intuitive, ratiocinative or informal-logical, as well as empirical methods. However, amongst these the representative science which is predominantly intuitionist in its methodology is Yoga, the representative science which is predominantly empiricist in its methodology is Vyākaraṇa, and the representative science that is predominantly informal logicist in its method is Āyurvijñāna. In fact, the scientific epistemology of *Charak Samhitā*,[10] which is the basis of the therapeutic science of disease and medicine, is the most complex and it represents a model of rationality which may be considered complete in certain respects. In the present paper, we propose to formulate the main tenets of some models of rationality as envisaged in these various classical Indian sciences and examine some of their features.

1. The process of theorisation of knowledge is generally agreed to have two components: methods of theory construction or theory

[10] V. Shekhawat, "Model of Scientific Rationality in Charak Samhita", paper presented at the International Seminar on *Development of Theory in Humanities*, American Studies Research Centre, Hyderabad, 1988.

generation and methods of theory appraisal or testing. In so far as theory construction is concerned, one can proceed predominantly intuitively, predominantly informally-logically, or predominantly empirically. By intuitive method of theory construction we mean that one *intuits* basic *concepts, relations*, and *truths* without drawing explicitly from experience and without providing rational grounds for them. These are generally accepted as "assumptions", "hypotheses", or "intuitions" and their legitimacy is defended on grounds of success in theoretic explanation in so far as criticism and defence are concerned although one who intuits them generally claims them true, not merely *possibly* true. By informal-logical method of theory construction we mean that each and every assertion is made on the basis of some reasons: reasons may be common notions or inferences drawing from sense-experience or simply informal arguments.[11] And by empirical method of theory construction we mean that each and every assertion of the theory is a generalisation from experience. Both the intuitive and the empirical methods of theory construction must eventually take recourse to some rational methods for establishing some relations and refuting others.

In respect of theory appraisal, the only methods available are rational and empirical methods for howsoever sound and reliable the intuition of a person, his intuitive assertion that certain theory is true or correct cannot provide it incontrovertible legitimacy although it can spur one to seek more thoroughly its rational and/or empirical justification. Generally, any theory as a whole must map experience to a high degree of accuracy if it claims to be true although it may involve certain principles that can be justified only on rational grounds. Thus, even though a theory may be faultless upon rational appraisal, gaps in its conformity with experience will not be tolerated, whereas gaps in rational systematisation may be tolerated if its accuracy with respect to

[11] There cannot be a better example of "informal" logical method of theory construction than the geometry of Euclid. It proceeds with *common notions* or *axioms* and not intuitions. Common notions are *rational simples* and for that reason do not need any reasons. Even the definitions cannot be said to be intuited but are more like *simple rational descriptions* of the essence of the object of reason. Thus, the entire geometrical theory of Euclid is free from intuition as well as experience and is strictly informal-logical in character.

empirical appraisal is of a high degree. In their simple forms, thus, theories may involve one or two of the above methods of theory generation along with rational and/or empirical methods of theory appraisal; whereas in their complex form, theories may employ all the available methods of theory construction and appraisal.

By "empirical" we shall mean sense-experience alone and what is called inner-sense or "internal-experience" will be considered as belonging to intuition. Thus, a certain "dream-experience" may be called an intuition or, for example, a patient telling the doctor that he "feels better" may be called the intuition of the patient. Similarly, if one claims, for instance, that one's memory, concentration, and rational ability have increased as a result of, say, yogic practice, then it will be called an intuitive claim yet to be justified on empirical grounds (by actual performance of increased memory etc.). Also, "introspective experience" such as of one's own thought process, or conceptual associations, or imagination or immediate experience of pain, etc., shall be called intuition. All such intuitions when natural, may be true or false, but when cultivated systematically—shortly to be clarified in the context of Yoga—are generally admitted to be always true.[12]

Apart from the above distinction of methods of theory generation and appraisal, every *scientific* enterprise as a process of theorisation of knowledge presupposes certain methodological rules of *objectivity* and *rationality*. That is to say, certain guidelines and standards exist within the enterprise for ensuring that methods of knowledge-gathering, construction, and appraisal are *objective* and *rational*.

Ordinarily, the standards of scientific rationality ensure that our reasoning is free from fallacies on the one hand and does not involve contradiction on the other hand; and that convincing reasons and evidences can be adduced for not only what is being held but also for the adequacy of methods of obtaining such knowledge, that is, reasons why only such methods would be adequate and not other methods. And ordinarily the criteria of

[12] It is this cultivated intuition which is always true knowledge, that has been accepted as testimony, or *Śabda pramāna* in some of the classical Indian epistemologies. *Śabda*, however, has only third place in the epistemological order, first being perception, and second being inference.

scientific objectivity imply impartiality to facts, that no fact is more privileged than others, that facts obtained by careful observation are free of individual inclinations and fancies, and that agreement in the community generally obtains about what the facts are. There are no *fixed* standards and rules of rationality and objectivity in the scientific enterprise yet the norms of the community are such that only the rational and the objective in the above senses of the terms gets credence ultimately. These are, however, common-sense, ordinary and restricted senses of the terms where both rationality and objectivity remain *relativised* within the community. Some classical Indian sciences would, however, be impossible if these standards and criteria were not extended so as to explain the growth or purification of rationality and objectivity themselves and thus to point out the *absolute* limits these may attain. For these pressing reasons, a Grand Scientific Epistemology was developed which went beyond the *naive* methods of knowledge-gathering and theory generation and appraisal and one aim of the present paper is to make this explicit.

2. Of the four sciences mentioned at the beginning, Yoga and Vyākaraṇa are two of the three *basic* sciences (the third being *Nyāya*[13]—a science dealing with principles of reasoning and theorising); and *Āyurveda* and Jyotiṣa are two of the many *applied* and *natural* sciences. A deep preoccupation with the basic sciences in classical India indicates how greatly they were valued, considered as they were the presuppositions or necessary conditions for the possibility of *all* other sciences. Indian preoccupation with Vyākaraṇa and Yoga began very early—perhaps a millennia before Christ—and perhaps these were the earliest to acquire systematic theoretic structures. That may be one reason why their methodologies are simple in comparison to the other two: not employing simultaneously many methodological components and therefore not acquiring that complexity, sophistication and comprehensiveness which is noticed in Āyurveda and Jyotiṣa-Siddhānta.

Following predominantly intuitionist methods of theory generation and informal-logical methods of theory appraisal, Yoga, as science of self or *ātma vidyā*, consists primarily of two com-

[13] Gautam, *Nyāya Sūtra*, Arya Muni (Tr.), Rohtak, Jhajjar Gurukula, Haryana Sahitya Samsthan, 1980.

ponents: a person theory and a praxis theory. The theories presuppose *Sāmkhya*[14] ground-metaphysic or world-view and appropriate many concepts from it remaining by and large consistent with it.[15] The person theory consists primarily of three sub-theories: *Vrtti*-theory,[16] *kleśa*-theory,[17] and *samapath*-theory,[18] whereas the praxis theory[19] may be analysed into two parts, namely, principles presupposed in human yogic-conduct and systematisation of praxis for purposes and aims of the science itself (namely discovery of one's true nature). The person theory is a first-order "psychological" theory consistent with the zero-order Sāmkhya metaphysic or ground-theory. Following the fundamental *Vaiśeṣika*[20] insight or intuition that in order to construct a theory in some domain, we should ask what are the substances, attributes and actions in the domain and what are their specific and general natures as well as relations, the first-order person theory can be analysed similarly. Thus the substance of the theory under investigation is *chitta* or "psyche", the attributes or qualities dependent on the substance are the *kleśas*, and the actions dependent on it are the *vrttis*. *Chitta, kleśas*, and *vrttis* are all *intuitively* posited. In terms of the Ayurvedic model of science,[21] one can say that *chitta, kleśas* and *vrttis* are the causes (*kāraṇa*) of the science, the effects (*kārya*) to be brought about are suspension of *vrttis* (*vrtti nirodha*) and elimination of *kleśas* (*kleśa hāna*), and the purpose (*prayojana*) is emancipation of *apavarga* or *kaivalya* or complete elimination of suffering (*atyanta dukha nivrtti*).

The *chitta* is the substantial basis or the "psychic" substratum of the person considered primarily from psychological point of view. It is the inner complex which is the seat of all of man's mental activities. If we want to effect a depth analysis of man's "life of

[14] Panchasikha, *Sāmkhya Sūtra*, R. Bhattacharya (Tr.), Varanasi, Bhartiya Vidya Prakasan, 1964.

[15] This feature, of seeking consistency with a ground metaphysic, is an important feature of classical Indian scientific epistemology and is quite explicit in at least three sciences, namely Yoga, Āyurveda, and Dharmaśāstra.

[16] Patanjali, *Yoga Sūtra, op. cit.*, sutra 1-5 to 1-12.

[17] *op. cit.*, sutra 2-3 to 2-14.

[18] *op. cit.*, sutra 1-17 to 1-20 and 2-41 to 2-51.

[19] *op. cit.*, sutra 2-1, 2; 2-26 to 2-55; 3-1 to 3-8.

[20] Kanad, *Vaiśeṣika Sūtra*, S.N. Misra (Tr.), Varanasi, Chowkhamba Samskrta Samsthan, 1980.

[21] See V. Shekhawat, *Ind. Jr. Hist. Sc.*, 21 (2), 1986, pp. 99-112.

consciousness", we must discover that seat in which it inheres and that is *chitta*. Consistently with Samkhya ground-metaphysic, *chitta* is conceived as *subtle* form of matter (*prakrti*) primarily which, as simple, unconscious, and active entity, is a *conjunct* of simple, inactive and conscious knower-experiencer (*puruṣa*). It is also qualified or characterised as of three-fold nature or "triple-stranded" so that, ever dynamic and vibrant, it is a sight of constant conflict (*guṇa virodha*) and modifications (*bhāva*).

The above mark only the general characteristics of *chitta*. Its specific characteristic consists in being a seat of *kleśas* which are *structured in* the person seen as *a chitta*. These are seen as deep deformities within the psyche which are fundamentally the root of all other abnormalities and sufferings. The *kleśa*-theory actually arises from a causal analysis of suffering so that *kleśas* are seen as deepest *causes* of all forms of suffering, having been strengthened birth after birth for immeasurable time. *Kleśas* as most fundamental causes are false understanding (*avidyā*), egosense (*asmitā*), enchantments (*rāga*), disenchantments (*dveṣa*), and instinct for life or fear of death (*abhiniveśa*).[22] There is no other way to know these *kleśas* except by intuition and according to the theory these are also responsible for the formation of *karma* and *samskāras*.[23] According to the principle of *karma*, each and every human action fructifies sooner or later—those which cannot fructify in this life will become dormant and fructify in a later life when adequate conditions obtain. And according to the principle of *samskāra*, our conduct leaves imprints on our psyche which are the sum and substance of our habits and inclinations and which are also carried along or "inherited" from one life to another.

The *vrtti*-theory stresses the fundamental activity that occurs on the basis of *chitta*. Just as no quality can exist without some basis, no action or activity can take place without some basis, and *vrttis* are just these fundamental actions or activities *in* the *chitta* which make all other complex activities possible. Just as *kleśas* may be considered the necessary conditions of the "instinct for undergoing experience" (*bhoga*), the *vrttis* may be considered the necessary

[22] *Yoga Sūtra*, sutra 2-5 to 2-9.
[23] *op. cit.*, sutra 2-12 to 2-15.

conditions of the "instinct for activity" (*pravrtti*). The significant discovery made by the *vrtti*-theory is that the epistemological activity lies at the root of all our activities and if one can develop the ability of "suspending it at will" (*nirodha*), the instinct for activity can be overcome and self-control attained. Thus, *knowledge is a process* and fundamentally lies at the roots of human action,—spurring it, directing it, "possibilizing" it. The *vrtti*-theory arises from an analysis of simple human activities,—such as listening, seeing, thinking, remembering, so that the *vrttis* are seen as the simples or the fundamental building blocks, not causes, of all our complex forms of activity or *krivā*. Of course, the *chitta*, being a subtle formation of *prkrti*, is naturally vibrant and active; what is sought to be understood by the *vrtti*-theory is how this natural activity *modifies* into a systematic activity called the *vrttis*. The five simple *vrttis* are:[24] the basic knowledge-processes (*pramāṇa*), the illusion process (*viparyay*), the process of internal stimulation due to concepts (*vikalpa*), the repetitive process of cognitionlessness (*nidrā*), and the process of provisional retainment of ideas and experiences (*smrti*).[25] A thorough understanding of these *vrttis* and detailed working out of *vrtti*-theory lies at *the foundation of psychology of knowledge. The pramāṇas* as basic knowledge processes for instance include perception, inference etc. which are discussed in detail in the Samkhya ground-theory; and similarly a thorough understanding of illusion process is central to psychology of knowledge as well as epistemology (in *all* ground-theories of classical Indian thought). The *vrttis* as simple foundations of all activity are also intuited as no reasons are advanced in the theory as to why these alone are to be accepted as fundamental.

The *samāpatti*-theory is the most complex of the three sub-theories as it presumes the two earlier theories briefly mentioned above. This theory seeks to understand the transformation or structural change that takes place in the *chitta* when protracted

[24] *op. cit.*, sutra 1-7 to 1-12.

[25] *Smrti* differs from *samskāra* in being "provisional" in the sense that it is retained for comparatively shorter duration in a given life; the *samskāras* are deeper and are carried or "inherited" from one life to another. *Smrti* means one knows that one *had* retained, *samskāra* means one has retained but does not know that one *has*.

efforts are made for *vrtti nirodha*. The *samāpattis* are sort of "psychic states" of the *chitta* through which it successively passes upon Yoga practice. These are psychic stages of the "revolution in consciousness" leading to elimination of "structural defects" and consequent purification of the *chitta*. The *chitta* is here conceived as a crystal (*maṇi*) in which defects such as *klesas* have permeated during perennial undergoing of experience (*bhoga*) by means of *vrttis* life after life and where *vrttis* themselves have to be qualified by *kleśas* (*kliṣṭa vrtti*). In this state of impurity of the *chitta*, the compound self "knows" itself as of the "form of *vrttis*" (*vrtti sārūpya*) although *originally* it is independent of *vrttis* and only pure consciousness (*puruṣa*). *Samāpatti* means "end" or "conclusion of some act" so that as the yoga practicant acquires a higher and higher degree of purity, the *samāpattis* identify various stages (or milestones) of purification. The stages are intuitively apprehended in terms of predominant psychic "forms" (*rupa*) of the *chitta* and are characterised as inner quibbling (*vitark rūpa*), thinking systematically (*vichāra rūpa*), joyfulness (*ānanda rūpa*) and self-identification (*asmitā rūpa*).[26] A dual classification of these stages is also affected by referring to inner cognitive activity (*pratyaya*) and deeper *samskāras*. Thus, they are all classified as marking a state of "self-absorption with the seed remaining" (*sabīja samādhi*) from which the state of *nirbīja samādhi* is different where the *samskaras* as seeds (basically *kleśas*) are eliminated.[27] The former are further classified as "with cognition" (*samprajñāta*) as well as with *samskaras* and "without cognition" (*virāma pratyaya* or *asamprajñāta*) but with *samskāras*.[28] What the theory suggests is that the process of purification is a gradual process and there are various degrees of "self-absorption" which are experienced as the *chitta* gradually purifies upon protracted practice.

The praxis-theory consists of two parts: the first part attempts to systematise the principles governing human praxis which are again presented intuitively; and the second part consists of the systematisation of praxis itself in terms of certain operations of the psychosomatic system whose repeated implementation would lead

[26] *op. cit.*, sutra 1-17 to 1-20; 2-41 to 2-44.
[27] *op. cit.* sutra, 2-51.
[28] *op. cit.*, sutra 2-46; 2-17, 18, 19.

to desired purification. The second part also is largely intuitive since no reasons are advanced as to why these operations will lead to a desired goal and not to some alternative operations. The operations are both mental and physical and essentially play a therapeutic role of "curing" the *chitta* of its defects. The praxiology, thus, consists of techniques of natural cure including the general principles of conduct since "error in conduct", caused as it is by *kleśas*, is the intermediate cause of human suffering. The principles of conduct are classified into two sets: those considering the individual in relation to others, and those considering the individual as essentially a singular, lone entity. The former are called *yamas* and involve principles of not doing violence, speaking the truth etc.; the latter are called *niyamas* and involve the principles of cleanliness, non-hankering, study etc.[29] The operations may again be grouped into physical and mental: the physical operations are posturing (*āsana*), breath control (*prāṇāyāma*), and control of sense activity (both cognitive and affective) (*pratyāhāra*); the mental operations are introspective retaining (*dhāraṇā*), attention or concentration (*dhyāna*), and self-absorption (*samādhi*).[30] All these operations have to be performed repeatedly and regularly which will result in gradual purification of the *chitta* passing through the *samapatti* stages.

Now, it may be asked, what sort of a model of rationality does this science presume? Indeed, is there any *rationality* at all in it? Although the person theory is generated exclusively intuitively, its "rationality" is defensible on two grounds. Firstly, the theory is informally consistent with the Sāmkhya metaphysic which is itself appraised by informal-logical methods as well as empirically. (There exists a reasoning for every assertion in this ground theory). Secondly, following the model of medicine, the validity of the theory is to be appraised by its efficacy in yielding desired results of the praxis prescribed within the theory. Thus, although generated intuitively, the theory is defensible on logical as well as practical grounds. There is even a claim that empirical physiological changes (*bhūtendriva pariṇāma*)[31] occur in the practicant, though these may

[29] *op. cit.*, sutra 2-30 to 2-45.
[30] *op. cit.*, sutra 2-46 to 2-55 and 3-1,2,3.
[31] *op. cit.*, sutra 3-13.

not be so decisive in the appraisal of the theory for the external perceptible changes of the body can give no indication of the deep internal changes of colossal magnitude.

The theory goes beyond the naive methods of observation and empirical knowledge-gathering and presents a novel and non-naive method of doing science. It suggests *knowing* the object not through sense-experience and logical methods but by confronting its "essence" in an *immediate experience* obtained by performing the complex operation called *samyana*, being a combination of internal retaining or *dhāraṇā*, concentration of *dhyāna* and self-absorption or *samādhi*.[32] It is claimed that by this method of operation on the object, one knows its essence (*dharma*), characteristics (*lakśaṇa*), and state (*ayasthā*) purely intuitively (*prajñā āloka*).[33] The validity of such intuitively obtained knowledge may then be appraised by logical and/or empirical methods as the science itself suggests in its own case.

3. The science of human life-span or *Ayu Vijñāna*, which has also been called the science of medicine or *auṣadha vijñāna*, aims primarily at the understanding of human *nature*, its *normal* state (of health), causes that lead to denormalisation of this state and arising of disease (*vyādhi*), and ways and means of curing such diseases. It is the most complex of all the above sciences and, perhaps for that reason, its methodology is also quite complex. Thus, in theory generation it employs intuitionist, informal-logical as well as empirical methods demanding in addition that its theory be consistent with a ground theory of reality whose consistency itself has been rationally and empirically established. The primary components of the science are the *dhātu*-theory, the *rasa*-theory, the *doṣa*-theory, and the pathological theory effecting a causal analysis of disease and providing criteria of normal state of health. With these theories as basis, the science further develops a symptomatology; effects analysis of the concept of therapy from diverse angles; classifies diseases in respect of curability, mode of origination etc.; classifies human nature into definite types developing at the same time a systematic methodology of diagnosis and treatment; and develops a scientific epistemology for purposes

[32] *op. cit.*, sutra 3-4.
[33] *op. cit.*, sutra 3-5.

of constructing and appraising scientific theories as also for applying them in practice (in the present case, therapeutic practice).

The science actually proceeds with considerations of a ground theory of reality or a ground metaphysics which is actually a synthesis of Sāmkhya and Vaiseṣika theories of reality. The two theories are considered complementary and not antagonistic and, strictly speaking, Vaiseṣika structure is considered as fundamental in which Sāmkhyan elements are assimilated. Thus, following the basic Vaiseṣika insight or intuition, it is held that while attempting to apprehend the world of experience in terms of theoretic construction—whether in general or for a specific domain (such as therapy)—one ought to proceed with locating the complex of substances (*drvya samgrah*), the complex of qualities (*guṇa samgrah*), and the complex of actions (*karma samgrah*) in their specific (*viśeṣa*), general (*sāmānya*) and relational (*samayāy*) modes in the domain under consideration.[34] The burden of the theory is to investigate the causes (*kāraṇa*) and the effects (*kārya*) as also the practical implementation (*prayojana*) that is implied. The specific theory of the domain must be consistent with the ground theory of reality and progress in the theory would result in greater and greater consistency. Thus, in the therapeutic theory, the *drvyas* are "*dhātu*", "*doṣa*" and "*rasa*"; their *guṇas* are "*śabdādi*" and "*guru-ādi*";[35] and the *karmas* are "*varnanādi*".[36] The elaborate structure of the theory consists in finding the specific and general modes of the above as also various kinds of necessary and contingent relations between them.

In the *dhātu*-theory[37] it is held that man is a *combination* of eight *dhātus* namely sap (*rasa*), flesh (*mānsa*), blood (*lohita*), fat (*meda*), marrow (*majjā*), bones (*asthi*), semen (*śukra*), and consciousness (*chetanā dhātu*) which are ultimately reducible to the basic elements of the ground theory, namely the five elements (*khādini*) and the pure self (*ātmā*). These *dhatus* have ten fundamental pairs of qualities (*guṇah*) each having an opposite, such as heavy-light

[34] See V. Shekhawat, "The Art of Theory Construction on Charak Samhita", *Ind. Jr. Hist. Sc.*, 21(2), 1986, pp. 99-112.
[35] *op. cit.*, Appendix II, p. 109.
[36] *op. cit.*, p. 109.
[37] Charak Samhita, *op. cit.*, p. 1089, sutra 59.

(*guru-laghu*), cold-hot (*śīta-uṣṇa*), etc. The *śarīradhātu* increases by the use of foods of like qualities and decreases by the use of foods of unlike qualities. The increase and decrease of *dhatus* with time (*vrddhi-hrāsa-gamanam*) is called *vaiṣamyagamana*. This disproportion of *dhātus* (*dhātu vaiṣamya*) leads to a state of ill health (*kleśa*). According to the theory there is a constant conversion of the prior *dhatu* into the latter, e.g. *rasa* into *lohita, lohita* into *mānsa* and so on, so that *śukra* is a distilled form of ultimate visible substance, from which arises the invisible *chetanā dhātu*. Maintenance of a dynamic equilibrium or proportion of the *dhātus* is essential to a normal natural state (of health).

The *doṣas*-theory[38] intuitively posits *vāta*, *pitta*, and *kapha* as three *śarīra doṣas* and *raja* and *tama* as the two psychological *doṣas* (*mānaṣa doṣa*) which are also subtle *drvyas* in the body not accessible to direct observation. The qualities of the *doṣas* are also the same as above, namely heavy-light etc. The *doṣas* acquire two states: normal or natural (*prakrtibhūta*) and abnormal (*kupita*). Although these have definite seats—the colon is the seat of *vata*, the lower stomach (*āmāśaya*) is the seat of *pitta*, and the chest is the seat of *kapha*—actually they move in the entire body (*sarva śarīra charāh*). They cause good or bad effects according to whether they are normal or abnormal: when normal, they are responsible for the building of the body, health and happiness; when provoked, for disease (*vikāra*). The seasonal change of *doṣas* occurs naturally (*Kālakrta gatih*) in the six weathers as the accumulation (*chava*), provocation (*prakopa*), and sedation (*praśama*) of *vata, pitta*, and *kapha* respectively. There are 80 fundamental *vāta*-diseases, 40 fundamental *pitta*-diseases, and 20 fundamental *kapha*-diseases whose combinations may lead to complex, innumerable diseases.

The *rasas*-theory[39] gives the complex of juices-as-tasted (*rasa samgraba*). The *rasa* is the object of taste (*rasanā arthah*); its substantial basis (*drvya*) is water and earth (*ksiti*) and they are differentiated (*viśeṣe*) by ether, fire, and air elements. There are six fundamental *rasas*, namely, sweet (*svadu*), acid (*amla*), salt (*lawaṇa*), sour (*katuka*), pungent (*tikta*), and astringent (*kaṣāya*)

[38] *op. cit.*, p. 13, sūtra 59-61.
[39] *op. cit.*, p. 14, sutra 64-66.

and their qualities are again heavy-light etc. The *rasas*, when they enter the body, act by virtue of being substances (*drvya prabhāvatah*) or by virtue of their *guṇas* (*guṇa prabhāvatah*). The variation in *rasa* combinations can be of 63 types such as 15 combinations of 2 *rasas* each, 20 combinations of three *rasas* each, and so on. The *rasas* act directly on *dhātus* and *doṣas*: the *dhātus* are increased or decreased by them and the *doṣas* are provoked or subdued. Thus *vāta* is subdued by the *svādu-amla-lavaṇa* combination, etc., which equations can be represented as follows by using first letters as representative symbols:

i) $\bar{V} \searrow S - A - L$; $\bar{P} \searrow \acute{K} - S - T$; $\bar{K} \searrow \acute{K} - K - T$
ii) $\bar{V} \nwarrow K - T - \acute{K}$; $\bar{P} \nwarrow K - A - L$; $\bar{K} \nwarrow S - A - L$

The casual-theory of disease[40] analyses the immediate causes of disease as discordance of *dhātus* and *doṣas* (*dhātu doṣa vaiṣamyā*). But these are not the only causes. Perennial change, for example, is another initiator (*preraka*) of diseases. A deeper analysis in the light of the ground theory reveals that there are deeper causes of disease which are also the causes of all suffering including disease. Thus, the root causes (*hetu samgrah*) of all diseases are: wrong contact (*mithyā yoga*), non-contact (*ayoga*), and excessive contact (*ati yoga*) of time (*kāla*), reason (*buddhi*) and senses objects (*indrivārthānām*). This is called inordinate conjunction (*asātmya indrivārtha samyoga*) which leads to improper actions under misunderstanding (*prajrnāparādha*). Such diseases can be endogenous (*nijasva*) or exogenous (*āgantu*) and bodily or mental (*sārira-manasāh*). The endogenous diseases first arise due to deeper causes and then lead to *dhātu-doṣa-vaiṣamya* whereas the exogenous diseases are caused by *dhātu-doṣa-vaiṣamya* itself. This causal analysis implies further division of diseases into curable by medicine (*auṣadha sādhya*) and incurable by medicine (*asādhya*) which further necessitates the division of therapy itself into medicinal therapy (*bheṣaja prayoga*) based on *dhātu-doṣa-rasa* reasoning (*yukti vyapāśray*) and non-medicinal therapy based on deeper analysis of *karma* (*daiva vyapāśray*). And further, the same

[40] *op. cit.*, p. 331, sutra 57; p. 12, sutra 54; p. 331, sutra 5.

causal analysis at a deeper level suggests an ultimate therapy of disciplining the mind (*mano nigrah*) which eliminates even the possibility of all suffering and disease.

The general scientific epistemology[41] considers both accessibility to *absolute* truth as well as to *relative* truth: the former can be attained by the sort of methods suggested by the science of Yoga, whereas the latter can be attained by normal dialectical, argumentative, investigative methods. It may be said that the absolutist methods are the methods of non-naive epistemology while the relativist methods are that of a naive epistemology. Thus a grand theory of knowledge involves: (i) methods of cognising the fundamental constituents of all-that-there-is (*tattya smrti upāya*); (ii) methods of communication within the community (*sambhāṣa vidhi*); (iii) methods of dialectic and inner working-out (*vāda mārga*); (iv) methods of theory appraisal (*parikśā vidhi*); (v) methods of verification and practical application (*siddhi upāya*) of the science; and (vi) critical reflection on the entire nature of the enterprise under consideration (*kārya parikśā*). Of these steps, steps (i) to (iv) constitute non-naive epistemology and steps (ii) to (vi) constitute naive-epistemology,—the former involving intuitive and informal-logical methods only, and the latter involving informal-logical and empirical methods only.

The application of the theory in actual practice in examination of the patient and diagnostic analysis of disease as well as administration of appropriate *rasa* combinations and observance of their subsequent effect in cure is also the empirical verification of the therapeutic theory. Since diversely many variables of the doctor-patient situation are involved, this verification cannot be strictly "deductive" but has to be "inductive" and statistical. Thus, for example, failure in cure may not be an evidence for falsification of the theory but may be because the case is medicinally incurable, or because the diagnostic hypothesis was only partially true/false, or because the prescriptions were not strictly adhered to. A statistically large number of successes, therefore, would be sufficient clue to the truth of the theory (including the success in predicting the case as incurable).

[41] V. Shekhawat, "Standards of Scientific Investigation", *Ind. Jr. Hist. Sc.*, 19(3), 1984, pp. 224-52.

The model of rationality suggested here is the most complex of all the above discussed models. It is also maturer since epistemological considerations are considered necessary for the actual performance of theory generation and theory appraisal so that the scientists of the domain are fully aware of what is going on and what are the goals. It is an open question whether epistemological issues ought to be part of the science of a specific domain, but their presence here leaves the impression that Indian science of therapy has attained a high degree of perfection and completeness. The science suggests an *ultimate* rationality or *ideal* rationality where human reason attains a pure, truth-bearing state (*satyā buddhi*) which is different from ordinary, dialectical rationality requiring only sharpening of reason (*praśasta buddhi*),—both being equally significant in the pursuit of scientific knowledge. Thus, for example, the *doṣa*-theory is arrived at by intuitive methods but is at the same time consistent with the ground metaphysics as it also fits into the general model of theorisation (*doṣas* are the *drvyas* of the therapeutic domain). Similarly, the causal theory of disease is also largely intuitive—and consistent with the ground theory explaining disease as a specific form of suffering. The *dhatu* and *rasa*-theories, on the other hand, are arrived at empirically where, in the latter, an empirical linkage with the *doṣas* is sought by empirical methods. Theory appraisal in this science is both logical as well as empirical—the validity of general therapeutics theory derives partly from its consistency with ground metaphysics and partly from therapeutic success (*chikitsā siddhi*). The theory, however, claims only a statistically high *degree* of validity (not absolute validity) since failures in curing some cases could not *necessarily* imply falsity of the theory. Thus, partly because of depth of analysis and partly because of a sophisticated epistemic strategy, the theory appears irrefutable.

4. The four models of scientific rationality discussed above suggest not only alternatives to the currently discussed models mentioned at the beginning of this essay, but they also provide us an insight into the nature of classical Indian sciences and how in them the knowledge-gathering enterprise was viewed. Thus, except in the situation where a great mass of empirical data is sought to be systematised (such as in grammar), theorisation is highly

dependent on intuitive methods. The ground theories of reality, from which support is sought by "first order" theories of specific domains, themselves rely on intuitive apprehension of categories on intuitive "metaphysical" analysis, their informal-logical systematisation occurring subsequently in the form of defence and criticism. It may even be held that informal-logical methods developed largely as methods of systematic and rational presentation of the apprehended truths and their defence—their role in the discovery of truths being minimal. Intuitive methods of theorisation specifically stress deep "metaphysical" analysis of specific domains of reality be it the apprehension of time or of word or of mental apparatus or of life-span. This stress springs from the belief that ratiocinative and/or empirical methods alone are not sufficient for apprehension of deeper truths which is possible only by cultivation of intuition and expansion of consciousness—the latter belief gets support from the science of Yoga itself which has been systematised as a basic science precisely for such needs.

Although ratiocinative methods have developed primarily for purposes of systematisation and defence of theories and not for discovery of principles, they are indispensable for persuasive theorisation. For this reason, there is repeated stress on critical examination (*parīkśā*), on providing reasons and/or causes (*hetumat*), on providing rationale or proof (*upapatti*). The evidence for this concern can be found in some of the ground theories of reality where original texts in the form of *sutras* have been preserved along with their detailed commentaries (such as Vaiseṣika Sutra and Sāmkhya Sutra): one may claim, upon reading these works, that no assertion has been made there without providing some reason(s). It appears that this concern for ratiocination began with Sāmkhya theory in a systematic form (which is considered the oldest) and developed and spread to all the other sciences—appearing in a sophisticated form "finally" in the Nyāya Sutra.

Classical Indian thought has been charged with lack of empiricist concern partly because of certain intellectual developments around the 10th century A.D. when an illusionist interpretation of some Upanisadic trends of thought was advanced. This is, however, an unfortunate development and it cannot be easily explained if we

notice a persistent commitment to the world of experience (*loka*) in both ground theories of reality as well as basic sciences.[42] But here again we may notice that although experience played a critical role in appraisal and acceptance of theories, it was never a source of discovery, and since sense-experience was not developed as a method of discovery, it could not evolve into a concept of "experiment" and qualitative measurement where sense-experience is deepened and expanded by means of instruments (particularly in post-Renaissance Greco-European science). Since only ordinary sense-experience was sought to be explained, such as the naked-eye experience in astronomy, and since only such experience was a critical datum for appraisal of theories, theorisation itself remained confined to informal-logical, simple arithmetical and geometrical methods of ratiocination.

The central feature of all these models of rationality being a stress on intuitive methods of theory generation as well as a stress on consistency with some ground theory of reality, it is evident that most of the classical Indian sciences evolved by their own internal logic, remaining more or less completely untouched and uninfluenced by contemporary Greek[43] and Chinese sciences[44] —the only other two cultures that displayed significant intellectual creativity for a prolonged period. The cultivation of

[42] This can be partly understood by a study of intellectual history of India which begins with an Age of Discovery around 1500 BC-1000 BC when Vedic and Upanisadic creativity spread, develops into an age of Consolidation and systematisation during 1000 BC to 400 BC when *Samhitas* were written in diverse areas of knowledge, crystallises further into an Age of Theorisation during ca. 400 BC - 400 AD when logical, critically appraised theories were built and written in *sutrā* form. From 400 AD to 1000 AD is, however, the Age of Debates when Buddhist and Upanisadic thoughts debated over principles and evolved by means of criticism. This age was followed by an Age of Crisis, from 1000 AD to 1900 marked by intellectual confusion, loss of political freedom, interaction with Arabic and European cultures and loss of creativity. It is this last age in which illusionist, occultist and mystical tendencies were embraced. However, because of intercalation with foreign thought in this age, one can notice a tendency for assimilation and synthesis and criticism of this thought which points to a possible dawning of a new phase of creativity and onset of an Age of Synthesis.

[43] G. Sarton, *A History of Science*, vol. I & II, Cambridge, Harvard University Press, 1959.

[44] J. Needham, *Science and Civilization in China*, Vol. 1 to 5, Cambridge University Press, 1956.

intuition as a method of theory generation is surprisingly missing in the entire Greek thought although ordinary intuition as "hypothesis" or speculative conjecture may be seen. The stress in Greek science is primarily on "rationally obvious" or self-evident common notions which ought to become the *archai* of all science. In Chinese thought, on the other hand, one may notice cultivation of intuition, in Taoism for example, and evolution of ratiocinative techniques also, but a concern for systematic theorisation as well as evolution of critical epistemology is, by and large, absent. Whatever the influences and interactions between these cultures in the "classical" period (500 BC - 500 AD), the above models of rationality of classical Indian sciences can certainly play a significant role in the development of modern science which is gradually becoming transcultural in character.

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