RECONSTRUCTION OF INFERENCE: FROM INDIAN PERSPECTIVE*

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A. Brief Sketch of *Navya-Nyāya* Logic:

The *Nyāya* School of philosophical discourses is based on the texts known as *Nyāya-Sutras*, introduced by Maharşi Goutama in and around 2nd century CE. The system of *Navya-Nyāya* has its origin in the discourses of Gangeśa Upadhyaya and was developed during the 13th to 17th centuries by Indian logicians like Vardhamāna Upādhyāya, Jayadeva, Vasudevā Sārvabhouma, Viśvanātha and Raghunātha Shiromani, Mathurānātha Tarkavāgiśa, Jagadiśa Tarkālankāra, Gadādhara Bhattāchārya, and many others. Annama Bhaţţa developed a consistent *Nyāya-Vaiśeşika* system by combining the ancient and new schools of *Nyāya* system along with the *Vaiśeşika* school of thought. The *Navya-Nyāya* school of philosophy admits four *pramāṇas* of which *anumāna* is one of those. *Pramāṇa* stands for *pramān-karaṇam* and it follows that valid inferences lead to true cognition which is called *anumiti*.

Constituents of *Anumāna*:

An *anumiti* is the product of several causal inferential conditions which are combinedly designated as *anumāna* (inferential process). If we consider the internal structure, of the cognitive states, constituting *anumāna*, we find three basic elements, viz,

. *Pakṣa* (p) -the subject of inferential cognition.

.*Sādhya* (s) - The property which is admitted in the *pakṣa*.

.*Hetu* (h) -The inferential mark or reason on the basis of whose pervasion with *sādhya*, the latter is inferred in the *pakṣa*. The form of an *anumāna* is 'p has s because of h', i.e., s is inferred to be present in p, on the basis of h. It is by

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virtue of the inferential relation of pervasion which h has in respect of s, that we can infer the presence of s in p.

The Relation of *Vyāpti*:

The relation of pervasion can be explained in the following way: If a thing x related to another thing y in such a way that wherever and whenever x is present, y is also present then x is pervaded by y. In that case, x can function as the *hetu* or inferential mark for y. For example, if we know that smoke is related to fire in such a way that wherever and whenever smoke is present, fire is also present, then smoke can be said to be pervaded by fire. In that case smoke can operate as the *hetu* or the inferential mark for fire.

Mechanism of *Anumāna*:

The cognitive process of *anumāna* can be explained with the help of the stock example of *Navya-Nyāya*, viz., 'The hill has fire because of smoke'. The agent goes near a hill and perceives smoke, which is connected with the hill at the root (*avicchinnamūla*), in the hill. This perception reminds him of the truth that smoke has the relation of pervasion (*vyāpti*) with fire, and this remembrance leads to the perception of the hill possessing such smoke as is pervaded by fire. From these three cognitions, he concludes that the hill has fire. Thus, the *anumiti* that hill has fire is causally preceded by three prior cognitions, viz.

a. *Pakṣadharmatājñana* -The perception of smoke in the hill (the h is in p).
b. *Vyāptijñāna* - The recollection to the effect that smoke stands in the relation of pervasion with fire (the h has pervasion with s).
c. *Parāmarśa* - The perception that smoke as pervaded by fire characterizes the hill.

The second recollective cognition depends on a previous non-recollective cognition of the same relation, which does not form a part in the actual inferential process. These three causally interrelated cognitions centre on the *hetu* in the following way:

a. Cognition- 1 - the *hetu* which was perceived to be present in the *pakṣa*.

b. Cognition - 2 - is remembered to be pervaded by the *sādhya*.
c. Cognition- 3 - which leads to the perception of the *hetu* as characterized by the relation of pervasion with the *sādhya*, to be present in the *pakṣa*.

We can explain this inferential process in the following way:

Stage 1: Agent A perceives *hetu* in the *pakṣa*. This is a perceptual process.

Stage 2: Agent A recollects his previous perceptual knowledge that smoke is pervaded by fire, i.e., wherever there is smoke, there is fire.

Stage 3: Agent A perceives that smoke, which is pervaded by fire, is present in hill.

Stage 4: Agent A infers that fire is present in hill.

Legitimacy of *Hetu*:

An *anumiti* is valid and true, only when it is done on the bases of a legitimate *hetu* and the truth of *parāmarśa.* There are five legitimacy conditions of a *hetu*. These are:

Pakṣasatta -Existence of the *hetu* in the *pakṣa*.

Sapakṣasatta- Existence of the *hetu* in similar instances of *pakṣa*.

Vipakṣasatta - Non- existence of the *hetu* in dissimilar instances.

Avādhitatva - Uncontradicted.

Asatpratipakṣatta - Absence of counter *hetu*.

Classification of Inference:

Naiyāyikas have classified inference from several standpoints. From the standpoint of purpose, Navya-Naiyāyikas have classified inference under two heads, viz., (a) *Svārthanumāna* (inference for oneself) and (b) *Parārthānumāna* (inference for others). While the former is short and does not require formal statements, the second is elaborate and stated explicitly in formal statements. *Svārthānumāna* can be stated as following:

1. *Pratijñā*-The hill has fire.
2. *Hetu* - Because the hill has smoke.
3. *Udāharaṇa*-Wherever there is smoke, there is fire, as in the kitchen.

In this way, we can get a syllogism consisting of three members or propositions, if we want to formulate it. Hence such inference is called *Triavayavīnyāya*, i.e., three membered syllogism. *Parārthāthānumāna*, on the

other hand, has five formulated members or propositions, and hence is called '*Pañcāvayavīnyāya*, i.e., five-membered syllogism. These five members are:

1. *Pratijñā* - The hill has fire.
2. *Hetu* - Because the hill has smoke.
3. *Udāharaṇa* - Wherever there is smoke, there is fire, for example, a kitchen.
4. *Upanaya* -The hill has smoke.
5. *Nigamana* - Hence, the hill has fire.

In this type of inference, *pratijñā* sets forth the conclusion to be established. The *hetu* states the reason for the conclusion. *Udāharaṇa* depicts the pervasion of the *hetu* with *sādhya*, supported by an example. The *upanaya* is the application of the universal proposition to a particular case. The *nigamana* is the conclusion drawn from the preceding propositions.

There are other classifications of inference in the older *Nyāya* system and we are not going into those. There are other important but indirect factors of the inferential process, but we may skip them for the brevity of our present discussion. In the above lines, I hope I could give a very brief, yet clear description of the *Navya-Nyāya* view about the logical mechanism of inferential process, wherefrom the inferential knowledge takes its origin, which is, however an epistemological achievement. Thus, in *Navya-Nyāya*, logic and epistemology go hand in hand.

B. Comparison between Traditional Aristotelian Logic and *Navya-Nyāya* Logic:

At the very outset, I want to draw attention to the following two points:

1. In India, philosophy has been a comprehensive study and it does not admit of branching into metaphysics, logic, epistemology etc., as done in western philosophy. In the west, logic and epistemology are treated as two separate but closely related branches of philosophy. While logic deals with the inferential process, the inferential knowledge becomes the subject matter of epistemology. In Indian philosophy, however, the theory of inference includes both process and resulting knowledge and

constitutes the theory of *Pramāṇa*, which can be explained as logic and epistemology in the same bracket.

2. In the western formal logic, validity is conceived as independent of truth. An inference can be valid without giving true conclusion and vice versa. Even when a semantical concept of validity is used in formal logic, it is not concerned with the actual truth or falsity of the premises or conclusion. It only restricts that in a valid argument, true premises cannot yield false conclusion.

The *Navya-Nyāya* theory, on the other hand, rests on a theory of validity, which claims that validity without truth is an impossibility. In other words, a valid inference is sure to yield a true conclusion. Thus *Navya-Nyāya* theory of logic provides an infrastructure of inferential processes where valid inferences are source of true knowledge and thus is adequate for epistemology. Under these perspectives, we can start to compare the traditional Aristotelian logic and the *Navya-Nyāya* logic. We can observe that though they share some common features, yet they also differ in important respects.

Resemblances between Aristotelian and *Navya-Nyāya* Logic:

1. Both the *Navya-Nyāya* and the Aristotelian syllogism contain three terms, and these terms correspond almost one-to-one. For example, the *pakṣa*, *sādhya* and *hetu* of *Navya-Nyāya*, correspond both in function and occurrences to minor, major and middle terms respectively, of Aristotelian syllogism.
2. Though a *Navya-Nyāya parārthānumāna* has five members, it can be shown to be uniform to Aristotelian syllogism, for as we find the *nigamana* is just repetition of *pratijñā*, and *hetu* and *upanaya* are two different modes of presenting the same truth, viz., the *hetu* is in *pakṣa*. Let us explain this point with a concrete example:

Aristotelian Syllogism	***Navya-Nyāya* Syllogism**
Major premiss: All M is P	*Pratijñā*: The hill has fire
Minor premiss: All S is M	*Hetu*: Because the hill has smoke

CONCLUSION: All S is P.

Udaharaṇa: Wherever there is smoke, there is fire, e.g., kitchen.
Upanaya: The hill has smoke.
Nigamana: The hill has fire.

3. The *Navya-Nyāya* focuses on the relation of *vyāpti* or pervasion of *hetu* with *sādhya* as the ground of inference. In Aristotelian logic also, the inferential relation between the middle term and the major term construes the ground of inference. Thus, in both systems of logic, the inferential relation between the middle term and major term is the pivot of the inferential process.

Difference between the Two Systems:

There are some differences between these two systems of logic. We may observe the main points of differences in the following way:

- In *Navya-Nyāya* logic, inference is conceived as mediate inference only, there does not appear to be any theory of immediate inference like the processes of Conversion, Obversion etc., of Aristotelian logic.
- The distinction between formal truth and material truth so commonly made in western Aristotelian logic is not made in Indian logic, especially *Navya-Nyāya*. The reason is, inferences which are formally valid but not materially true, are not conducive to *pramā*, and Indian *Pramāṇa* system does not admit anything short of *pramā.*
- As inference is a mode of knowledge, the theory of inference is essentially a theory of epistemic notions. But since it involves the logical process of *anumāna*, it is also a theory of logic. Thus, Indian theory of inference is a logico-epistemological theory. However, the Aristotelian logic is a strictly logical theory.
- In Indian logic, there does not appear to be any theory of propositional logic, i.e., a theory of inference in which unanalyzed propositions are used as units of analysis, instead of terms. Thus Bochenski is right when he says, ‘Indian logic seems to be almost entirely lacking in

propositional logic.' Aristotelian logic, on the other hand, is essentially propositional.

- In *Navya-Nyāya* logic, the terms or the constituents are non-linguistic metaphysical entities, but in traditional Aristotelian logic, terms in syllogism are just linguistic entities. For example, when one says, 'The hill has smoke', he is talking about the physical entities like hill and smoke. In Aristotelian syllogism, on the other hand, when one says, 'All men are mortal', both 'men' and 'mortal' are linguistic terms, and questions are raised regarding their distribution and occurrences.
- In *Navya-Nyāya* logic, the apparently subject-predicate statements are actually relational statements. When we say, 'The hill has fire', it is analyzed as 'The fire is in the relation of conjunction with the hill'. But, in Aristotelian logic, the propositions are categorical and non-relational in categorical syllogism, which occupies the central position.
- ·The *Navya-Nyāya* theory of inference is both deductive and inductive, while Aristotelian syllogism is strictly deductive. The third proposition of a five-membered *Navya-Nyāya* syllogism, i.e., the *udāharaṇa* indicates that the universal major premise is an induction generalised from instances already observed. Thus, it transpires that both deduction and induction are integral parts of *Navya -Nyāya* syllogism.

From the above discussions we can conclude that there is a close relationship between Indian *Navya-Nyāya* logic and Western Aristotelian logic.

C. Reconstruction of *Navya-Nyāya* Logic into Modern Symbolic Logic:

In this part of the paper, I would briefly mention the attempts made by eminent scholars like Stainsl Schayer to work out a reformulation of *Navya - Nyāya* syllogism into First order Predicate logic , so that the Indian heritage of logical thoughts becomes easily accessible to the western scholars proficient in mathematical logic. Once they can understand the intricacies and depth of Indian logic, Indian logic would get wide popularity among the scholars.

Moreover the amalgamation of Western and Indian logical thoughts would surely lead to a great advancement of logic. As Klaus Glashoff indicates, there have been two revolutionary developments in the recent history of western logic during the period from about 19th century to 20th century. These may be specified as:

a. Beginning in the middle of the 19th century, traditional Aristotelian logic has been completely abandoned in favour of mathematical logic (classical logic) as invented by Frege and Russell.

b. From about the middle of the 20th century onwards, classical logic split into numerous different logical systems with different goals, each of them representing different generalisations, restrictions or even incompatible alternatives to Frege and Russell's classical logic. As on today, there are many existing varieties of logic. These are Classical predicate logic, Higher order logic, Deontic logic, Many-valued logic, Modal logic, Tense logic, Relevant logic, Paraconsistent logic, Free logic, Non-monotonous logic, Institutionistic logic, Epistemic logic, Partial logic, Fuzzy logic, Quantum logic, Erotectic logic, to name a few. All these systems are designed for different Special applications in the fields of Mathematics, Philosophy, Linguistics, and Computer Science and so on.

We may start our observation of the task of reformulation, with Stainslaw Schayer who wanted to do away with Aristotelian logic as a means of interpreting Indian logic. He proposed a new calculus to modernize the *Navya-Nyāya* format of inference. We can explain his proposal with the help of an example, where, (a) = on this mountain

1. *Pratijṇā* Ψ (a) There is fire on a
2. *Hetu* φ (a) There is smoke on a
3. *Udāharaṇa*=statement of pervasion (x) (φx ⊃Ψx) For every locus x: if there is smoke in x, then there is fire in x.

4. *Upanaya*= statement of the *hetu*'s Presence in *pakṣa* φ (a) ⊃ Ψ (a)
This rule also applies to x=a (for the *pakṣa*.

5. *Nigamana*= statement of *sādhya* Ψ (a) Because the rule applies to x=a and

The statement Ψ (a) is true.

Glashoff points out that items 3 and 4 of this new calculus is problematic since the *Navya- Nyāya* text may not fit the this formula. However, regardib=ng item3, we may point out that, we can use '⊃' (horse-shoe) in the symbolic representation of the relation of pervasion. In that case, we can formulate the crux of the *Navya-Nyāya* format of argument in the format of the First order predicate logic in the following way:

1. (x) (xR1h ⊃ xR2s)
2. pR1h
3. pR2s

We can explain this format in the following way:The first statement states the relation of pervasion between *hetu* and *sādhya*, as it states that, 'Wherever h is present (in the relation R1), s is also present (in the relation R2)'. R1 and R2 are different relations since different relations determine these occurrences. Thus the relation of pervasion x corresponds to that of material implication and something like paradox of material implication arises in the theory of pervasion also. The second statement indicates that the *hetu* is in *pakṣa* in the relation of R1, and thus is a statement of *pakṣadharmatājñāna*. Finally, the third statement expresses the conclusion that *sādhya* is in the *pakṣa*, in the relation R2. However, in this form, the *Navya-Nyāya* schema of inference also corresponds to traditional Aristotelian syllogism of the form:

All men are mortal
Socrates is a man
∴Socrates is mortal. (BARBARA)
Which, in the First-order predicate logic would be formulated as:
1. (x) (Hx ⊃ Mx)
2.Hs /∴Ms

3.Hs ⊃ Ms (1)UI

4. Ms (3),(2) MP

In (3) we use the applicative rule and in (4) the implicative rule of inference.

We can also show that a negative form of *Navya- Nyāya* inference can be formulated in the schema of First order predicate logic in the following way:

1. (x) (xR1h ⊃ xR2s)

2. ~ (pR2s)

3. (pR1 h) (1), (2) , MT.

Which corresponds to Aristotelian syllogism of the form:

1. All philosophers are happy.

2. Tom is not happy.

3. Tom is not a philosopher. (CAMESTRES)

Thus we can reformulate the basic structure of *Navya-Nyāya* schema of inference into Aristotelian syllogism as well as the First order predicate logic. We may conclude our deliberation with the humble observation that, our attempts at formulating the *Navya-Nyāya* structure of inference into modern symbolic logic is only at the commencement period. There are many more nuances and subtleties of the theory, which may be a difficult task to reconstruct into the language of modern mathematical logic. It has been claimed by many scholars that use of symbolic logic, which is free from restrictions of various languages, is conducive to a truly universal understanding of different philosophical traditions. Accordingly, this paper is a brief attempt at a universal understanding of *Navya-Nyāya* philosophy, which is the epitome of Indian logical skill.

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