

Logic in Early Classical India: From Analogy to Deduction

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HISTORICAL ORIENTATION

Rough periodization of the history of logic in classical India

- Early period: 3rd century BCE to 6th century CE
- Middle period: 7th to 11th century CE
- Late period: 12th to 17th century CE

OUTLINE

- Preliminary remarks:
 - Reasoning and logic
 - Distinguishing good from bad reasoning
 - * Five perspectives
 - Language vs notation
- The origins of the canonical Indian syllogism from analogy to deduction
3rd century BCE to 6th century CE (early period)
 - argumentation and its emergence
 - canonical analogical argument and its emergence
 - canonical deductive argument (syllogism) and its emergence
 - culmination of the first period
- Conclusion

REASONING AND LOGIC

INFERENCE VS ARGUMENT

- Humans reason:
 - that is, taking some things to be true, they conclude therefrom that other things are also true.
 - *inference* done in thought;
 - *argument* done in speech.
 - They are two sides of the same coin.

REASONING AND LOGIC

HUMAN ACTIVITY VS REFLECTIONS ON IT

- reasoning vs reflecting on reasoning

The activity of reasoning, on the one hand, and the activity of reflecting on which reasoning is good and which is not, on the other, are distinct, though naturally they are intimately related.

- the first without the second

The fact that humans reason is no guarantee that those who do reflect on which reasoning is good and which is bad.

- similarly with language and grammar.

REASONING AND LOGIC
HUMAN ACTIVITY vs REFLECTIONS ON IT

EXAMPLES

- Language vs grammar
 - Classical China: Chinese
ěr-yā (爾雅) (3rd BCE)
 - Classical Greece: Greek
technē grammatikē (Dionysius Thrax 2nd BCE)
 - Classical India: Sanskrit
Aṣṭādhyāyī (Pāṇini 5th BCE)
- mathematics vs logic
 - Classical Greece:
Euclid's *Elements* vs Aristotle's syllogistic
First order predicate logic vs Aristotle's syllogistic
(Muller 1972)

GOOD vs BAD ARGUMENTS PERSPECTIVES

FIRST TWO:

- In reasoning, one takes certain things to be true and concludes that something, typically something else, is true.
- What sorts of things does one take to be true or false?
Some kinds of thoughts and the sentences expressing them.
- Two perspectives:
 - **epistemic** perspective:
Under what conditions does taking of certain thoughts to be true permit one to take some other thought to be true?
 - **linguistic** perspective:
Under what conditions does the taking of certain sentences to be true permit one to take some other sentence to be true?

GOOD vs BAD ARGUMENTS
PERSPECTIVES

THIRD:

- Arguments are typically used to persuade others.
- **dialectic** perspective:
Under what conditions does the acceptance by someone of some facts require him or her to accept some other fact?

GOOD vs BAD ARGUMENTS
PERSPECTIVES

FOURTH:

- Neither thoughts nor sentences are intrinsically true. They are true by dint of states of affairs in the world.
- **ontic** perspective:
Which states of affairs require other states of affairs?

GOOD vs BAD ARGUMENTS PERSPECTIVES

LINGUISTIC PERSPECTIVE again:

- linguistic form:
The only viable notion of the form of an argument or an inference is its linguistic form.
- classifying linguistic forms:
The most evident option, then, is to try to identify forms of expressions and then to distinguish them into those which are good and those which are bad.
- generality:
To gain generality requires *semantic ascent*.

SEMANTIC ASCENT

Semantic ascent is what occurs when one replaces statements or questions about the world with statements or questions about expressions used in the statements or questions about the world.

- (1.1) This man is Devadatta.
- (1.2) This man's name is 'Devadatta'.
- (2.1) Man is a rational animal.
- (2.2.1) The word 'man' means a rational animal.
- (2.2.2) The word 'man' means the same thing as the expression 'rational animal'.
- (3.1) Devadatta is wise.
- (3.2) The sentence 'Devadatta is wise' is true.

GOOD vs BAD ARGUMENTS PERSPECTIVES

FIFTH:

- **notational** or **symbolic** perspective:

Just as one devises a notation for positive integers (e.g., Indic numerals) corresponding to the counting numerals of natural language, so one devises notation for arguments formulated in natural language.

- The idea of doing so goes back to Gottfried Leibniz (1646–1716).
- It ultimately results in the emergence of mathematical logic, exhibited, for example, in first order predicate logic.

NOTATIONAL vs LINGUISTIC PERSPECTIVE

LANGUAGE vs NOTATION:

Classical Quantificational Logic lacks all of the following features of natural language:

- a copula
- verbs vs adjectives vs prepositions
- subject vs complement vs modifier
- coordinator vs subordinator

NB:

- using analogy in applying technical terms from logic to expressions of natural language: *contraposition*, *deduction*, and others.
- Such usage is routine, as for example the use of the word *wind* in the expression *solar wind*.

ORIGINS OF THE CANONICAL INDIAN SYLLOGISM

PRE CLASSICAL PERIOD:

The precursors to the emergence of Indian logic are two activities:

- public events
in which promulgators of religious views hostile to traditional Vedic practice (e.g., Buddhists and Jains) prosyletized and disputed with followers of other religious views and
- śastraic literature
in which are found the formulations of bodies of knowledge pertaining to agriculture, architecture, astronomy, grammar, law, medicine and politics.

EMERGENCE of an AWARENESS of ARGUMENTATION

TWO BUDDHIST TEXTS (3rd century BCE):

- *Questions of King Milinda (Milinda-pañha)*

The monk Nagasena teaches Buddhist doctrine to King Milinda.

Most of the text is expository and uses many figures of speech, especially analogy.

There are some arguments.

- *Points of controversy (Kathā-vatthu)*, attributed to Moggaliputta Tissa.

It is a compendium of arguments designed to refute some 200 propositions.

EMERGENCE of an AWARENESS of ARGUMENTATION

Points of controversy

Sthaviravādin: Is the soul known truly and ultimately?

Pudgalavādin: Yes.

Sthaviravādin: Is the soul known truly and ultimately just like any ultimate fact?

Pudgalavādin: No.

Sthaviravādin: Acknowledge your refutation,

If the soul is known truly and ultimately, then indeed, good sir, you should also say that the soul is known truly and ultimately just like any ultimate fact.

What you say here is wrong: namely, that we ought to say (a) that the soul is known truly and ultimately; but we ought not to say (b) that the soul is known truly and ultimately just like any ultimate fact.

If the latter statement (b) cannot be admitted, then indeed the former statement (a) should not be admitted.

It is wrong to affirm the former statement (a) and to deny the latter (b).

EMERGENCE of an AWARENESS of ARGUMENTATION

LINGUISTIC FORM:

Sthaviravādin: Is A B?

Pudgalavādin: Yes.

Sthaviravādin: Is C D?

Pudgalavādin: No.

Sthaviravādin: Acknowledge your refutation,

If A is B, then C is D.

What you say here is wrong: namely, that

A is B but that C is not D.

If C is not D, then A is not B.

It is wrong that A is B and C is not D.

EMERGENCE of an AWARENESS of ARGUMENTATION

REMARKS:

- This form is repeatedly instantiated throughout Book 1, Chapter 1.
- The author presumes it is self evident that:
 1. it is wrong to hold inconsistent propositions;
 2. sentences corresponding to instances of the following set of propositional schemata are inconsistent:
 α , $\neg\beta$, $\alpha \rightarrow \beta$;
 3. sentences corresponding to instances of the following propositional schema are regarded as true:
if $\alpha \rightarrow \beta$, then $\neg\beta \rightarrow \neg\alpha$.

EMERGENCE of a CANONICAL ANALOGICAL ARGUMENT

- Texts attributed to Nāgārjuna (2nd century CE):
 - *Basic verses on the middle way* (*Mūla-madhyamaka-kārikā*)
 - *Exclusion of disputes* (*Vigraha-vyāvartanī*)
 - *Tract on pulverization* (*Vaidalya-prakaraṇa*).
- A text attributed to Āryadeva (3rd century CE), *Treatise in one hundred verses* (百論 : *Śataka-sāstra*).

EMERGENCE of a CANONICAL ANALOGICAL ARGUMENT

REMARKS:

- These texts comprise arguments with objections and replies to the objections.
- Many of the arguments are arguments by analogy, some are deductive, usually enthymemes, whose omitted premisses are often false.
- Analogical arguments found in these texts either have the following form or can easily be recast into it.

FORM OF ANALOGICAL ARGUMENT THROUGH SIMILARITY

proposition (pratijñā): p has S

reason (hetu): because of p having H,

example (dṛṣṭānta): as d has H and d has S.
(where $d \neq p$)

FORM OF ANALOGICAL ARGUMENT THROUGH DISSIMILARITY

proposition (pratijñā): p has S

reason (hetu): because of p having H,

example (dṛṣṭānta): as d has neither H nor S.

EMERGENCE of a CANONICAL ANALOGICAL ARGUMENT

TWO TEXTS:

- *Caraka's collection* (*Caraka-saṃhitā*)

It is attributed to Agniveśa (2nd CE).

It is a medical text in which is inserted a section on logic.

- *Commentary on logic* (*Nyāya-bhāṣya*).

It is attributed to Vātsyāyana (5th CE).

It is a commentary on the *Aphorisms on logic* (*Nyāya-sūtra*), attributed to Gautama (2nd CE).

EMERGENCE of a CANONICAL ANALOGICAL ARGUMENT

EXAMPLE from *Caraka's collection* (*Caraka-saṃhitā*) CS 3.8.31:

CANONICAL ANALOGICAL ARGUMENT

PROPOSITION: the soul is eternal
(*pratiññā*)

GROUND: because of being uncreated,
(*hetu*)

CORROBORATION: like space;
(*dr̥ṣṭānta*)

APPLICATION: **as (yathā)** space is uncreated and it is eternal,
(*upanaya*) **so (tathā)** is the soul uncreated;

CONCLUSION: therefore, the soul is eternal
(*nigamana*)

EMERGENCE of a CANONICAL ANALOGICAL ARGUMENT

EXAMPLE from *Commentary on logic (Nyāya-bhāṣya)* NSB 1.1.33–39

CANONICAL ANALOGICAL ARGUMENT THROUGH SIMILARITY

PROPOSITION: sound is non-eternal
(*pratijñā*)

GROUND: because of having the property of arising;
(*hetu*)

CORROBORATION: a substance, such as a pot, having the property of
(*udāharaṇa*) arising, is non-eternal;

APPLICATION: and **likewise** (**tathā**), sound has the property of arising;
(*upanaya*)

CONCLUSION: therefore, sound is non-eternal because of having
(*nigamana*) the property of arising.

EMERGENCE of a CANONICAL ANALOGICAL ARGUMENT

EXAMPLE from *Commentary on logic (Nyāya-bhāṣya)* NSB 1.1.33–39

CANONICAL ANALOGICAL ARGUMENT THROUGH DISSIMILARITY

PROPOSITION: sound is non-eternal
(*pratijñā*)

GROUND: because of having the property of arising;
(*hetu*)

CORROBORATION: a substance, such as the self, not having the property
(*udāharāṇa*) of arising, is eternal;

APPLICATION: and **obversely** (*tathā*), sound does not have the property
(*upanaya*) of arising;

CONCLUSION: therefore, sound is non-eternal because of having the
(*nigamana*) property of arising.

EMERGENCE OF THE CANONICAL DEDUCTIVE ARGUMENT

TWO BUDDHIST TEXTS:

- *Treatise on the essence of expedient means* (方便心論 : *Upaya-hṛdaya*)

It was composed before the 5th century CE.

- *Treatise on how things are* (如實論 : *Tarka-śāstra*)

It was composed in the 5th century CE.

EMERGENCE OF THE CANONICAL DEDUCTIVE ARGUMENT

EARLIEST KNOWN EXAMPLE OF THE CANONICAL ARGUMENT IN A DEDUCTIVE FORM

- *Treatise on the essence of expedient means* (方便心論 : *Upaya-hṛdaya*) (T 1632 28a4–6) regards this as a fallacious argument

A DEDUCTIVE ARGUMENT

PROPOSITION: (<i>pratiññā</i>)	the self is eternal
GROUND: (<i>hetu</i>)	because it is not perceptible by the senses;
CORROBORATION: (<i>dr̥ṣṭānta</i>)	space, not being perceptible by the senses, is eternal; everything which is not perceptible by senses is eternal; 一切不根所覺者盡皆是常
APPLICATION: (<i>upanaya</i>)	the self is not perceptible by senses;
CONCLUSION: (<i>nigamana</i>)	how can the self be non-eternal?

EMERGENCE OF THE CANONICAL DEDUCTIVE ARGUMENT

REMARKS:

1. universal statement added

While a statement making clear the analogy is retained, a statement has been added making clear the universal connection which one property, the reason (*hetu*), bears to the property to be established (*sādhya*).

2. deductive core

The canonical argument clearly has a deductive core.

EMERGENCE OF THE CANONICAL DEDUCTIVE ARGUMENT

Treatise on how things are 如實論 (*Tarka-śāstra*)

- Its author rejects analogical arguments as indecisive.
- The author advocates the adoption of a form of argument which is deductive.
- Earliest extant text to adopt the *threefold criterion* (*tri-rūpa*) as a way of distinguishing good arguments from bad ones.

EMERGENCE OF THE CANONICAL DEDUCTIVE ARGUMENT

EXAMPLE from *Treatise on how things are* (如實論 : *Tarka-śāstra*) (T 1633 30c5-7)

CANONICAL ANALOGICAL ARGUMENT

PROPOSITION: sound is eternal
(*pratijñā*)

GROUND: because of being incorporeal,
(*hetu*)

CORROBORATION: space is incorporeal and eternal;
(*dr̥ṣṭānta*)

APPLICATION: sound too is incorporeal,
(*upanaya*)

CONCLUSION: therefore, sound is eternal
(*nigamana*)

EMERGENCE OF THE CANONICAL DEDUCTIVE ARGUMENT

CORRECT DEDUCTIVE ARGUMENT

EXAMPLE from *Treatise on how things are* (如實論 : *Tarka-sāstra*) (T 1633 30c5–7)

CANONICAL DEDUCTIVE ARGUMENT

PROPOSITION: sound is not eternal
(*pratijñā*)

GROUND: because of arising immediately due to the
(*hetu*) arising of an effort,

CORROBORATION: **if** a thing is eternal, then it does not arise
(*dṛṣṭānta*) due to an effort;
若有物依因緣生即是無常
for example, space is eternal and does not
arise due an effort.

APPLICATION: sound is not this way (不如是),
(*upanaya*)

CONCLUSION: therefore, sound is not eternal.
(*nigamana*)

REMARKS:

- Like the argument found in *Treatise on the essence of expedient means* (方便心論 : *Upaya-hṛdaya*), the argument here has a statement of analogy and a statement of the universal connection which one property, the reason (*hetu*), bears to the property to be established (*sādhya*).
- However, here the universal statement is first and the statement referring to the analogical case is second.
- Moreover, the universal statement is given in a contrapositive form.

EMERGENCE OF THE CANONICAL DEDUCTIVE ARGUMENT

THREEFOLD CRITERION (*tri-rūpa statement*) in *Rú shí lùn* (*Tarka-śāstra*)
(T1633 30c18–26)

The reason you set forth is not definite because it is seen to be pervaded by both eternality and non-eternality. The reason I set forth has the three marks. (1) **The (reason) is a property (法) of the subject of the argument** (*pakṣa* : 根本), (2) **it is included (攝) within what is similar** and (3) **it is excluded (離) from what is different**. Therefore, the reason I set forth succeeds in not deviating, your reason does not. Therefore, your objection is confused.

汝立因不決定常無常遍顯故。我立因三種相 (1) 是根本法。 (2) 同類所攝 (3) 異類相離。是故立因成就不動。汝因不。是故汝難顛倒。

CULMINATION OF THE FIRST PERIOD

DIGNĀGA (6th century CE)

1. Dignāga explicitly recognizes that inference, the cognitive process whereby one increases one's knowledge, and argument, the device of persuasion, are but two sides of a single coin.
2. Dignāga further refines the form of the canonical deductive argument.
3. Dignāga uses the particle *eva* (*only*) to refine the statement of the second and third criteria of the threefold criteria. (Katsura pc.)
4. Dignāga formulates the wheel of reason (*hetu-cakra*).

CULMINATION OF THE FIRST PERIOD

DIGNĀGA (6th century CE)

CANONICAL ARGUMENT FOR DIGNĀGA

THESIS: (<i>pratijñā</i>)	sound is non-eternal
GROUND: (<i>hetu</i>)	because of resulting from effort;
SIMILARITY CORROBORATION: (<i>sādharmya-dṛṣṭānta</i>)	that which (<i>yat tat</i>) is immediately connected with an effort is observed be non-eternal, like a pot;
DISSIMILARITY CORROBORATION: (<i>vaidharmya-dṛṣṭānta</i>)	that which (<i>yat tat</i>) is eternal is observed not to be immediately connected with an effort, like space.

REMARKS:

1. Dignāga eliminates from the form of the canonical deductive argument the application (*upanaya*) statement and the conclusion (*nigamana*) statement, both of which are logically superfluous.
2. Dignāga retains in the example (*dṛṣṭānta*) statement a statement of the universal connection which one property, the reason (*hetu*), bears to the property to be established (*sādhya*).
3. Dignāga retains reference to an analogous case, but now expressed by a noun phrase denoting an instance of the universal statement.
4. Dignāga adds a second universal statement, which is the contrapositive of the other statement, together with a phrase referring to an instance of the universal instance.

CULMINATION OF THE FIRST PERIOD

DIGNĀGA (6th century CE)

SOME FURTHER REMARKS:

1. The word *dr̥ṣṭa* (*observed*) occurs in the universal statement of the corroboration statement.

It does not occur within the relative clause; it has scope over the entire clause.

The word itself is liable to a factive construal, as does the English verb *to observe* and *to notice*. (Cp. In English, the verb *to know* is factive, the verb *to believe* is not.)

2. The requirement to have a noun phrase naming a corroborating instance in the corroboration statement does not alter the deductive validity of the canonical argument. It does, however, exclude unpersuasive arguments.

CONCLUSION

1. The early forms of the canonical argument are analogical.
2. A deductive version of the canonical argument first appears in *Treatise on the essence of expedient means* (方便心論 : *Upaya-hṛdaya*), but the argument given is rejected.
3. A deductive version of the canonical argument appears in *Treatise on how things are* (如實論 : *Tarka-śāstra*) and arguments are given to show the superiority of the deductive form of the argument over the analogical form.
4. *Treatise on how things are* (如實論 : *Tarka-śāstra*) states the *three-fold criterion* (*tri-rūpa-hetu*) as the criterion which distinguishes good arguments from bad ones.
5. Dignāga adopts a deductive version of the canonical argument, putting it in a more concise and perspicuous form.