

Buddhism and science

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Generalities

Mathematics and zeroism

Is mathematics valid knowledge?

Are mathematical calculations exact?

Is there aesthetics in formal math?

Interim summary

Zeroism makes math easy

Zeroism makes math better

Science and *paticca samuppāda*

Another cultural intrusion: “laws of nature”

A better science

śīla

Summary

General

Mathematics

Science

śīla

Practical recommendations

Generalities

Mathematics and
zeroism

Science and
*paticca
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Summary

Does Buddhism connect to science?

Buddhism and
science

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Generalities

Mathematics and
zeroism

Science and
paticca
samuppāda

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Summary

- ▶ Is Buddhist philosophy relevant to the teaching AND practice of modern sciences?

Does Buddhism connect to science?

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- ▶ Especially

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- ▶ Especially
 - ▶ mathematics,

Does Buddhism connect to science?

- ▶ Is Buddhist philosophy relevant to the teaching AND practice of modern sciences?
- ▶ Especially
 - ▶ mathematics,
 - ▶ physics

There must be a connection

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Summary

- ▶ There **must** be a connection

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 - ▶ *anumāna* (inference)

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- ▶ since Buddhism not based on faith,
- ▶ and accepts only two valid means of knowledge:
 - ▶ *pratyakṣa* (empirical) and
 - ▶ *anumāna* (inference)
- ▶ as does science (in principle)

Demonstration needed

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Summary

- ▶ Important to **demonstrate** that connection between Buddhism and science

Demonstration needed

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- ▶ since today science is regarded as valid knowledge

Demonstration needed

- ▶ Important to **demonstrate** that connection between Buddhism and science
- ▶ since today science is regarded as valid knowledge
- ▶ and anything different is rejected as invalid

Cultural factors in science

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Cultural factors

A difference may arise between Buddhism and science due to Western cultural influences in present-day mathematics and science

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Summary

Cultural factors

A difference may arise between Buddhism and science due to Western cultural influences in present-day mathematics and science

- ▶ Remedy is to eliminate those cultural influences to make mathematics universal

Cultural factors

A difference may arise between Buddhism and science due to Western cultural influences in present-day mathematics and science

- ▶ Remedy is to eliminate those cultural influences to make mathematics universal
- ▶ and existing science objective.

Focus areas

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Summary

- ▶ I will focus on two key concepts.

Focus areas

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Summary

- ▶ I will focus on two key concepts.
 - ▶ *śūnyavāda* and mathematics

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 - ▶ *śūnyavāda* and mathematics
 - ▶ *paticca samuppāda* (conditioned coorigination), and physics

Terminology

Zeroism

- ▶ will use the term ZEROISM in place of *śūnyavāda* since

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Summary

Terminology

Zeroism

- ▶ will use the term ZEROISM in place of *śūnyavāda* since
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 - ▶ useful even to those (such as Muslims) who may not accept Buddhism, and

- ▶ will use the term ZEROISM in place of *śūnyavāda* since
- ▶ the interest is in the practical value of the *śūnyavāda* philosophy
 - ▶ useful even to those (such as Muslims) who may not accept Buddhism, and
- ▶ to avoid pointless controversy over the exact philosophical meaning of “*śūnyavāda*”.

Terminology

contd.

- ▶ Zeroism is how I interpret *śūnyavāda*.

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Summary

Terminology

contd.

- ▶ Zeroism is how I interpret *śūnyavāda*.
- ▶ If someone does not agree with this interpretation that is fine, the practical value of zeroism is still there.

Is mathematics valid knowledge?

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Summary

- ▶ Consider $2+2=4$.

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Summary

- ▶ Consider $2+2=4$.
- ▶ Is it valid knowledge?

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- ▶ Is it valid knowledge?
- ▶ Typical response: 2 chairs and 2 chairs make 4 chairs.

Is mathematics valid knowledge?

- ▶ Consider $2+2=4$.
- ▶ Is it valid knowledge?
- ▶ Typical response: 2 chairs and 2 chairs make 4 chairs.
- ▶ That is *pratyakṣa pramāṇa* (empirical proof).

A key cultural factor

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Summary

- ▶ *pratyakṣa pramāṇa* accepted in Buddhism
- ▶ and in **all** systems of Indian philosophy
- ▶ and also in science.
- ▶ But **rejected** in present-day math as taught in our schools and universities

A key cultural factor

- ▶ *pratyakṣa pramāṇa* accepted in Buddhism
- ▶ and in **all** systems of Indian philosophy
- ▶ and also in science.
- ▶ But **rejected** in present-day math as taught in our schools and universities
- ▶ (also known as formal math).

Formal math

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- ▶ It **demands** deductive proof of $2+2=4$ from some axioms,
- ▶ such as Peano's axioms or axioms of set theory.
- ▶ This makes the proof very complicated.
- ▶ E.g. To prove $1+1=2$, Whitehead and Russell need 378 pages!

•56'101. $\vdash: R \in \check{\Delta} \equiv . D'R, (\check{C}'R \in 1)$

Dem.

$\vdash . \bullet 55'16 . \bullet 11'11'341 . \supset$

$\vdash: (\exists x, y) . R = x \downarrow y \equiv: (\exists x, y) . D'R = t'x . (\check{C}'R = t'y :$

[•11'54] $\equiv: (\exists x) . D'R = t'x : (\exists y) . (\check{C}'R = t'y :$

[•52'1] $\equiv: D'R, (\check{C}'R \in 1)$

(1)

$\vdash . (1) . \bullet 56'1 . \supset \vdash . \text{Prop}$

•56'102. $\vdash: \check{\Delta} = \check{D}'\epsilon 1 \cap \check{C}'\epsilon 1$

Dem.

$\vdash . \bullet 56'101 . \bullet 37'106 . \supset$

$\vdash: R \in \check{\Delta} \equiv . R \in \check{D}'\epsilon 1 . R \in \check{C}'\epsilon 1 .$

[•22'33] $\equiv . R \in \check{D}'\epsilon 1 \cap \check{C}'\epsilon 1 : \supset \vdash . \text{Prop}$

•56'103. $\vdash: R \in \check{\Delta} . \supset . \check{q}'! R$

Dem.

$\vdash . \bullet 56'101 . \supset \vdash: R \in \check{\Delta} . \supset . D'R \in 1 .$

[•52'16] $\supset . \check{q}'! D'R .$

[•33'24] $\supset . \check{q}'! R : \supset \vdash . \text{Prop}$

•56'104. $\vdash: R \in 0 . \equiv . R = \check{\Lambda}$ [(•56'03)]

•56'11. $\vdash: R \in 2 . \equiv . (\exists x, y) . x \neq y . R = x \downarrow y$ [(•20'3 . (•56'02)]

•56'111. $\vdash: R \in 2 . \equiv . D'R, (\check{C}'R \in 1) . D'R \cap (\check{C}'R = \check{\Lambda})$

Dem.

$\vdash . \bullet 51'231 . \bullet 55'16 . \supset$

$\vdash: x \neq y . R = x \downarrow y \equiv . t'x \cap t'y = \check{\Lambda} . D'R = t'x . (\check{C}'R = t'y .$

[•13'193] $\equiv . D'R \cap (\check{C}'R = \check{\Lambda}) . D'R = t'x . (\check{C}'R = t'y$ (1)

$\vdash . (1) . \bullet 56'11 . \bullet 11'11'341 . \supset$

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[•11'45] $\equiv: D'R \cap (\check{C}'R = \check{\Lambda}) : (\exists x, y) . D'R = t'x . (\check{C}'R = t'y :$

[•11'54] $\equiv: D'R \cap (\check{C}'R = \check{\Lambda}) : (\exists x) . D'R = t'x : (\exists y) . (\check{C}'R = t'y :$

[•52'1] $\equiv: D'R \cap (\check{C}'R = \check{\Lambda}) . D'R, (\check{C}'R \in 1) : \supset \vdash . \text{Prop}$

•56'112. $\vdash: R \in 2 . \equiv . D'R, (\check{C}'R \in 1) . C'R \in 2$

Dem.

$\vdash . \bullet 56'111 . \bullet 54'43 . \supset$

$\vdash: R \in 2 . \equiv . D'R, (\check{C}'R \in 1) . D'R \cup (\check{C}'R \in 2) .$

[•33'16] $\equiv . D'R, (\check{C}'R \in 1) . C'R \in 2 : \supset \vdash . \text{Prop}$

•56'113. $\vdash: 2_r = \check{2} \cap \check{C}'\epsilon 2$

Dem.

$\vdash . \bullet 56'112'101 . \supset \vdash: R \in 2_r \equiv . R \in \check{2} . C'R \in 2 .$

[•37'106 . •33'122] $\equiv . R \in \check{2} . R \in \check{C}'\epsilon 2 .$

[•22'33] $\equiv . R \in \check{2} \cap \check{C}'\epsilon 2 : \supset \vdash . \text{Prop}$

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- ▶ symbols used in formal math lack any natural meaning.
- ▶ We could have $1+1=0$ (exclusive “or”) or $1+1=1$ (inclusive “or”).

Metaphysics of infinity

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Summary

- ▶ So, we must first specify that the symbols 2, +, = relate to INTEGERS.

Metaphysics of infinity

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Summary

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- ▶ But integers are infinitely many: so we must specify the whole infinity of integers.

- ▶ So, we must first specify that the symbols 2, +, = relate to INTEGERS.
- ▶ But integers are infinitely many: so we must specify the whole infinity of integers.
- ▶ Thus, formal math brings in a metaphysics of infinity even at the elementary level of $2+2=4$.

Warnings

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 - ▶ that even most professors of mathematics in India do not understand it.
 - ▶ Are often unable to define “set” in axiomatic set theory.

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 - ▶ that even most professors of mathematics in India do not understand it.
 - ▶ Are often unable to define “set” in axiomatic set theory.
- ▶ Anecdote: Western math as paradise with a sandy foundation.

Wrong belief of formal math

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Summary

- ▶ Thus formal math based on **wrong belief**

Wrong belief of formal math

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Summary

- ▶ Thus formal math based on **wrong belief**
- ▶ that a complicated metaphysics of infinity

Wrong belief of formal math

- ▶ Thus formal math based on **wrong belief**
- ▶ that a complicated metaphysics of infinity
- ▶ is a surer and more “universal” basis of knowledge than *pratyakṣa pramāṇa*.

Why reject the empirical?

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Summary

- ▶ Why does formal math reject empirical proofs (*pratyakṣa pramāṇa*)?

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Why reject the empirical?

- ▶ Why does formal math reject empirical proofs (*pratyakṣa pramāṇa*)?
- ▶ Because **formal math claims certitude**.
- ▶ Empirical proof (*pratyakṣa pramāṇa*) is fallible.

Why reject the empirical?

- ▶ Why does formal math reject empirical proofs (*pratyakṣa pramāṇa*)?
- ▶ Because **formal math claims certitude**.
- ▶ Empirical proof (*pratyakṣa pramāṇa*) is fallible.
- ▶ Classic example in Indian philosophy is mistaking a rope for a snake.

Deductive proof is also fallible

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 - ▶ Logic is not unique or universal (e.g. Buddhist *catuṣkoṭi*).

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- ▶ The theorems of formal math are not valid knowledge because
 - ▶ Theorems are **relative** truths (and the truth of metaphysical hypotheses cannot be determined).
 - ▶ Logic is not unique or universal (e.g. Buddhist *catuṣkoṭi*).
 - ▶ There may be errors in deductive proof like bugs in a computer program.

Argument from relative truth

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Summary

Relative truths

A deductively proved theorem is NOT valid knowledge for the hypotheses may be invalid.

Argument from relative truth

Relative truths

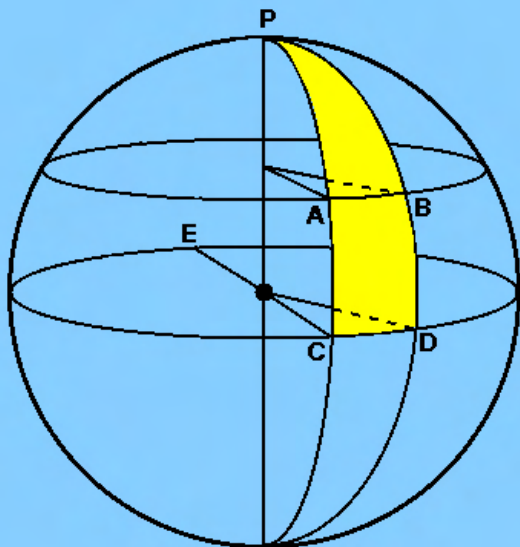
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- ▶ E.g. 1. Wolf's paws

Relative truths

A deductively proved theorem is NOT valid knowledge for the hypotheses may be invalid.

- ▶ E.g. 1. Wolf's paws
- ▶ E.g. 2. "Pythagorean theorem" not valid knowledge for right-angled triangles drawn on the curved surface of the earth to determine latitude and longitude.



Argument from relative truths

accepted also by formalists

- ▶ Formalists accept that mathematical theorems are only true **relative** to the hypotheses.

Argument from relative truths

accepted also by formalists

- ▶ Formalists accept that mathematical theorems are only true **relative** to the hypotheses.
- ▶ Since the hypotheses of formal math are metaphysical, their validity can **never** be ascertained.

Argument from relative truths

accepted also by formalists

- ▶ Formalists accept that mathematical theorems are only true **relative** to the hypotheses.
- ▶ Since the hypotheses of formal math are metaphysical, their validity can **never** be ascertained.

Bertrand Russell

“In [formal] mathematics we never know whether what we are saying is true”

Argument from logic

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Summary

- ▶ A deductively proved theorem is not valid knowledge,

Argument from logic

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Summary

- ▶ A deductively proved theorem is not valid knowledge,
- ▶ for logic is not universal.

Argument from logic

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Summary

- ▶ A deductively proved theorem is not valid knowledge,
- ▶ for logic is not universal.
- ▶ With a different logic

Argument from logic

- ▶ A deductively proved theorem is not valid knowledge,
- ▶ for logic is not universal.
- ▶ With a different logic
- ▶ different theorems may be proved relative to the same hypotheses.

Argument from logic

contd.

- ▶ Aquinas, Kant, Russell etc. were ignorant of the multiplicity of logics

Argument from logic

contd.

- ▶ Aquinas, Kant, Russell etc. were ignorant of the multiplicity of logics
- ▶ as found in Indian tradition from pre-Buddhist times.

Argument from logic

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- ▶ Aquinas, Kant, Russell etc. were ignorant of the multiplicity of logics
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- ▶ *catuṣkoṭi* differs from the 2-valued logic used in formal mathematical proofs.

Argument from logic

contd.

- ▶ Aquinas, Kant, Russell etc. were ignorant of the multiplicity of logics
- ▶ as found in Indian tradition from pre-Buddhist times.
- ▶ *catuṣkoṭi* differs from the 2-valued logic used in formal mathematical proofs.
- ▶ as does the Jaina logic of *syādavāda*.

No certitude in deduction

- ▶ Theorems vary with logic

No certitude in deduction

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- ▶ Hence, **no certitude** in the theorems of formal mathematics

No certitude in deduction

- ▶ Theorems vary with logic
- ▶ Hence, **no certitude** in the theorems of formal mathematics
- ▶ due to uncertainty about logic.

Which logic?

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Summary

- ▶ Aquinas and schoolmen said logic bound God.

Which logic?

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- ▶ But **which** logic binds God?

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- ▶ If logic selected on cultural grounds, mathematical theorems are relative cultural truths.

Which logic?

- ▶ Aquinas and schoolmen said logic bound God.
- ▶ But **which** logic binds God?
- ▶ If logic selected on cultural grounds, mathematical theorems are relative cultural truths.
- ▶ If logic selected on empirical grounds, deductive proofs are **more fallible** than empirical proofs.

Argument from bugs

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Summary

- ▶ In practice, deductive proofs may contain hard-to-spot errors

Argument from bugs

- ▶ In practice, deductive proofs may contain hard-to-spot errors
- ▶ just as observation may contain errors.

Argument from bugs

- ▶ In practice, deductive proofs may contain hard-to-spot errors
- ▶ just as observation may contain errors.
- ▶ E.g. 1: “Euclid’s” *Elements* has invalid deductive proof of “Pythagorean theorem” wrongly accepted as valid for 8 centuries.

No deductive proofs in *Elements*

- ▶ I have explained this numerous times in the last 15 years, but it may be quicker to cite authority.

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Russell

The first 8 propositions of the *Elements* contain numerous errors. It is a scandal that Euclid is still taught to boys in England.

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Russell

The first 8 propositions of the *Elements* contain numerous errors. It is a scandal that Euclid is still taught to boys in England.

- ▶ The proof of the “Pythagorean theorem” in the *Elements* depends on the empirical proof of the 4th proposition.

Interim summary

My position

- ▶ We cannot rely on *pratyakṣa pramāṇa* alone (as in Lokayata),

Interim summary

My position

- ▶ We cannot rely on *pratyakṣa pramāṇa* alone (as in Lokayata),
- ▶ nor *anumāna* alone (as in Western formal math)

Interim summary

My position

- ▶ We cannot rely on *pratyakṣa pramāṇa* alone (as in Lokayata),
- ▶ nor *anumāna* alone (as in Western formal math)
- ▶ but should use both *pratyakṣa pramāṇa* and *anumāna* as in Indian mathematical tradition, Buddhism, and science.

Mathematics about calculation

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Summary

- ▶ Mathematics (*Gaṇita*) is about useful calculation not proof alone (of whatever kind)

Mathematics about calculation

- ▶ Mathematics (*Gaṇita*) is about useful calculation not proof alone (of whatever kind)
- ▶ Calculation necessarily involves approximation or inexactitude.

Mathematics about calculation

- ▶ Mathematics (*Gaṇita*) is about useful calculation not proof alone (of whatever kind)
- ▶ Calculation necessarily involves approximation or inexactitude.
- ▶ E.g. “Pythagorean theorem”

“Pythagorean theorem”

Needs square roots

- ▶ Usually stated in Western tradition as $c^2 = a^2 + b^2$.

“Pythagorean theorem”

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- ▶ Manava *śulba sūtra* 10.10 explicitly states “Pythagorean proposition” using square roots.

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- ▶ Hence *śulba sūtra*-s declares $\sqrt{2}$ as *saviśesa* (with remainder) and *anitya* (non-eternal).

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- ▶ Approximation to what?
- ▶ With zeroism we can point empirically to the diagonal of a unit square and say “this is the exact square root of 2”

Western metaphysics of infinity

Related to theology of eternity

- ▶ No such empirical referent available with formalism.

Buddhism and
science

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- ▶ That metaphysics of infinity related to the Western theology of eternity, as clear since the 5th c. creationist controversy between Proclus vs Philoponus.
- ▶ Indian *gaṇita* used non-Archimedean arithmetic which can still be used in place of \mathbb{R} .

Zeroism and inexactitude

Buddhism and
science

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Summary

- ▶ On Buddhist thought not only $\sqrt{2}$, but the whole world is *anitya*.

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- ▶ **Zeroism needed for dealing with inexactness.**

Inexactitude even with integer arithmetic

Buddhism and
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Summary

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Inexactitude even with integer arithmetic

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Inexactitude even with integer arithmetic

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- ▶ When we speak of 2 dogs, the two dogs are never identical,
- ▶ but we naturally neglect or zero the difference between the two dogs as irrelevant to the context.

Back to $2+2=4$

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- ▶ That is, we shift from a model of **integers** to a model of **fractions** to describe the situation.

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Mathematics and soul

Buddhism and
science

C. K. Raju

Generalities

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Summary

- ▶ Plato believed mathematics, like music, arouses the soul.

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- ▶ “Mathematics” derives from mathesis or learning.

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- ▶ Plato said [Meno] “all learning is recollection” of the knowledge acquired by the soul in past lives.
- ▶ Proclus: “mathematics arouses the soul from its slumber since birth”
- ▶ Hence, Plato [Republic] prescribed the teaching of music and mathematics for the upliftment of the soul.

Church and mathematics

Buddhism and
science

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Church and mathematics

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- ▶ However, the church cursed that notion of soul in the 6th c. and banned mathematics.
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- ▶ Hence Aquinas' Divine Reason differs from Proclus' divine reason.

Euclid and Jesus



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Multiversity



Citizens International

The Eleven Pictures of Time

*The Physics, Philosophy, and
Politics of Time Beliefs*



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Formal math soul-less

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- ▶ Remedy: switch back to normal math from formal math.

Four noble truths in mathematics

Buddhism and
science

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- ▶ There is much *dukkha* today among math students.

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Summary

Four noble truths in mathematics

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- ▶ as a necessary part of the reality of the world.

Zeroism makes math easy

Buddhism and
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Summary

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- ▶ 8 groups in 5 universities in 3 countries
- ▶ “Calculus without Limits”
- ▶ as it developed in India with Āryabhaṭa.

Central University of Tibetan Studies
Sarag, Nepal
Workshop on "Calculus without Limits"
22nd - 28th September, 2009
By Prof. David Hestenes, USTC





نشست علمی "ریاضیات از منظری دیگر"، پروفیسور سی.کی. راجو
مرکز مطالعات و همکاری‌های علمی بین‌المللی، تهران، ۱۳۹۱





Other courses

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Generalities

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- ▶ “String geometry” for class 8 students, etc.

- ▶ *Cultural Foundations of Mathematics*, Pearson Longman, 2007.

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- ▶ Most practical applications of math today done by using calculus on a computers.
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- ▶ Zeroism provides greater clarity in this process.

Students can do harder problems

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- ▶ the time period of the simple pendulum and how it varies with amplitude.

- ▶ A better math leads to a better science.

Laws of nature

- ▶ Aquinas proposed the dogma that God rules the world with **eternal laws of nature**.

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Aquinas, *Summa Theologica* 1st part of the 2nd part, 91,1

the whole . . . universe is governed by Divine Reason. Wherefore the very Idea of the government of things in God the Ruler of the universe, has the nature of a law. And since the Divine Reason's conception of things is not subject to time but is eternal, according to Proverbs 8:23, therefore it is that this kind of law must be called eternal.

Generalities

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Summary

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- ▶ as does Buddhism and Jainism

Laws of nature and related propaganda

Buddhism and
science

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Summary

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- ▶ in Western propaganda, Islam faulted as unscientific on the ground that Islamic theology (al Ghazali) rejected the belief in laws of nature.(CKR: “Islam and science”.)
- ▶ Buddhism could be similarly attacked, since this dogma contrary to *paticca samuppāda*.

Differential equations

Buddhism and
science

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Summary

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- ▶ With **all** these equations the future/past states of the cosmos are decided by its present state.

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- ▶ Should be possible to make science compatible with everyday observation without intrusion of theology (i.e., without using term “free will”).

Reformulate science

Buddhism and
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Summary

- ▶ Q. Is it possible to reformulate science to make it compatible with mundane observation?

Reformulate science

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- ▶ A. Yes.

Reformulate science

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- ▶ Q. Is it possible to reformulate science to make it compatible with mundane observation?
- ▶ A. Yes.
- ▶ This also makes science compatible with *paticca samuppāda*
- ▶ so that human actions can eliminate *dukkha*.
- ▶ Easier to understand this reformulation in a historical perspective.

A better calculus

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Summary

- ▶ Differential equations use the calculus.

A better calculus

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- ▶ using “non-Archimedean” arithmetic.
- ▶ Ref: *Cultural Foundations of Mathematics*.

- ▶ Or see my MIT talk “Calculus: the real story”.

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- ▶ That gives details and other instances where Europeans did not understand imported Indian mathematics.

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- ▶ (the ratio of the circumference of a circle to its diameter)
- ▶ This method was later developed by the $\bar{\text{A}}\text{ryabha}\check{\text{t}}a$ school in Kerala to compute π using infinite series.

Descartes' difficulty

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- ▶ If one sums only a finite number of terms of that series one arrives at an inexact value (called *āsanna* or near value by Āryabhaṭa).
- ▶ But summing all infinite terms of an infinite series is physically impossible.

Descartes' difficulty

contd.

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Descartes' difficulty

contd.

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- ▶ Hence, Descartes said (*Geometry*)
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- ▶ European failure to understand Indian calculus led to bad science.
- ▶ Newton's physics hence failed

Newton's "laws"

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- ▶ hence in his notes [Yahuda collection, Jerusalem National Library] he cancelled *hypothesi* and wrote *lex* (law).

Newton's "laws"

Seeking perfection

- ▶ Newton thought those eternal laws were written in the "perfect" language of mathematics.

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- ▶ He thought this could be defined "perfectly" by making time (t) metaphysical
- ▶ (as is still taught in university calculus by saying that calculus needs metaphysical "real" numbers, so that time must be like the real line).

Making time metaphysical

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Summary

- ▶ On Newton's theory of "fluxions"

Making time metaphysical

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Summary

- ▶ On Newton's theory of "fluxions"
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Newton

Absolute, true and mathematical time flows on without regard to anything external.

Failure of Newton's "laws"

contd.

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Failure of Newton's "laws"

contd.

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- ▶ Because Newton made time metaphysical (= known to God) he did not define a way to measure it physically.

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- ▶ Ref: *Time: Towards a Consistent Theory*.

Relativity and FDEs

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Summary

- ▶ Correcting Newton's conceptual error led to the theory of relativity

Relativity and FDEs

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- ▶ A little noticed consequence of relativity: physics to be reformulated using functional differential equations (FDEs).

- ▶ With ordinary or partial differential equations

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Summary

- ▶ With ordinary or partial differential equations
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- ▶ present state decides past and future states.
- ▶ FDEs = coupled ordinary and partial differential equations
- ▶ With **retarded** FDEs past decides future (but not the other way round).
- ▶ With **mixed-type** FDEs (my model) belief in “laws of nature” is abandoned: past does NOT wholly decide future.

Retarded gravitation

Improving Newtonian gravitation

- ▶ If we correct Newtonian gravity with retarded FDEs

Retarded gravitation

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- ▶ Ref: Functional Differential Equations. 4: Retarded Gravity.

- ▶ Changing science to use mixed-type FDEs does NOT involve any new hypothesis:

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Summary

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- ▶ al Ghazali and sufis meant something similar by speaking of continous creation by Allah, conditioned by past habits, but not determined by it.
- ▶ Similar belief about creativity among Neoplatonists and Gnostics.

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Summary

Quantum mechanics and *catuṣkoṭi*

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Summary

- ▶ The use of mixed-type functional differential equations leads to a **structure of time**.

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- ▶ The corresponding temporal logic is a quasi truth-functional logic (Ref: *Time: Towards a Consistent Theory*, FDEs6)
- ▶ This logic equivalent to *catuṣkoṭi*.
- ▶ Relevant also to quantum computing.

- ▶ How usual notions of *śīla* connect to *paticca samuppāda*

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- ▶ in the sense of mixed-type FDE's

- ▶ How usual notions of *śīla* connect to *paticca samuppāda*
- ▶ in the sense of mixed-type FDE's
- ▶ explained in “The harmony principle”.

Summary

general

- ▶ Religious dogmas have crept into mathematics and science:

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Summary

Summary

general

- ▶ Religious dogmas have crept into mathematics and science:
- ▶ the belief in the certitude and exactitude of mathematics are dogmas

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Summary

Summary

general

- ▶ Religious dogmas have crept into mathematics and science:
- ▶ the belief in the certitude and exactitude of mathematics are dogmas
- ▶ as is the belief in eternal laws of nature.

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Summary

Summary

general

- ▶ Religious dogmas have crept into mathematics and science:
- ▶ the belief in the certitude and exactitude of mathematics are dogmas
- ▶ as is the belief in eternal laws of nature.
- ▶ Any comparison of science with religion must take this into account.

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Summary

Summary: general

contd.

- ▶ For an objective comparison of Buddhism and science, we must first reformulate both mathematics and science to eliminate those dogmas.

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Summary

Summary: general

contd.

- ▶ For an objective comparison of Buddhism and science, we must first reformulate both mathematics and science to eliminate those dogmas.
- ▶ This has been done. But needs to be widely understood.

Summary: general

contd.

- ▶ For an objective comparison of Buddhism and science, we must first reformulate both mathematics and science to eliminate those dogmas.
- ▶ This has been done. But needs to be widely understood.
- ▶ The changed mathematics and science need to be brought into educational practice.

Summary: mathematics

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Summary: mathematics

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Summary: mathematics

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- ▶ This *dukkha* will cease if we teach mathematics with zeroism, as demonstrated.
- ▶ But this way needs to be known, it should be taught more widely and brought into mainstream education.

Summary: mathematics

contd.

- ▶ Zeroism changes the philosophy of mathematics:

Summary: mathematics

contd.

- ▶ Zeroism changes the philosophy of mathematics:
- ▶ by accepting fallibility and inexactitude

Summary: mathematics

contd.

- ▶ Zeroism changes the philosophy of mathematics:
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- ▶ (neither certain nor non-certain, neither exact nor inexact).

Summary: mathematics

contd.

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Summary: mathematics

contd.

- ▶ Zeroism changes the philosophy of mathematics:
- ▶ by accepting fallibility and inexactitude
- ▶ (neither certain nor non-certain, neither exact nor inexact).
- ▶ This agrees with actual mathematical practice and
- ▶ makes mathematics “work better” for all practical applications.

Summary: science

- ▶ The dogma about “laws of nature” is **contrary** to the everyday observation that we create a bit of the future.

Summary: science

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Summary: science

- ▶ The dogma about “laws of nature” is **contrary** to the everyday observation that we create a bit of the future.
- ▶ We can make science compatible with observation by using mixed-type FDEs to reformulate science.
- ▶ This also makes science compatible with *paticca samuppāda*: the future is conditioned by the past, but not determined by it.

Summary: science

contd.

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Summary: science

contd.

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Summary: science

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Summary: science

contd.

- ▶ On this model, time must have a microphysical structure;
- ▶ the corresponding temporal logic is
- ▶ a quantum logic on the one hand
- ▶ and similar to *catuṣkoṭi*.
- ▶ Relevant to future technology of quantum computing.

- ▶ This reformulated science provides a physical basis for *śīla*.

- ▶ This reformulated science provides a physical basis for *śīla*.
- ▶ A better cosmos is possible, and it is our responsibility to create it.

Summary: changing education

- ▶ One concrete step towards a better world is to change education by decolonising it.

Summary: changing education

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Summary

- ▶ One concrete step towards a better world is to change education by decolonising it.
- ▶ Let us start teaching mathematics based on zeroism

Summary: changing education

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Summary: changing education

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Summary: changing education

- ▶ One concrete step towards a better world is to change education by decolonising it.
- ▶ Let us start teaching mathematics based on zeroism
 - ▶ calculus without limits
 - ▶ string geometry
 - ▶ statistics for social science (and ethical business)
 - ▶ computing with floating-point numbers
- ▶ at least in “Buddhist” institutions such as Nalanda, Sanchi, and similar institutions in Taiwan and Thailand.

Summary: changing education

contd.

- ▶ At least introduce a common course

Summary: changing education

contd.

- ▶ At least introduce a common course
- ▶ on “Buddhism, science and technology”

Summary: changing education

contd.

- ▶ At least introduce a common course
- ▶ on “Buddhism, science and technology”
- ▶ to be later expanded to teaching science with *paticca samuppāda*.