The Immaterial Paradise, Motivating Paradoxes, Puzzles, and R,

Part I

Selmer Bringsjord

Intro to (Formal) Logic (and AI) = IFLAI1

1/12/23

AI in The News …

A New Area of A.I. Booms, Even Amid the Tech Gloom

An investment frenzy over "generative artificial intelligence" has gripped Silicon Valley, as tools that generate text, images and sounds in response to short prompts seize the imagination.

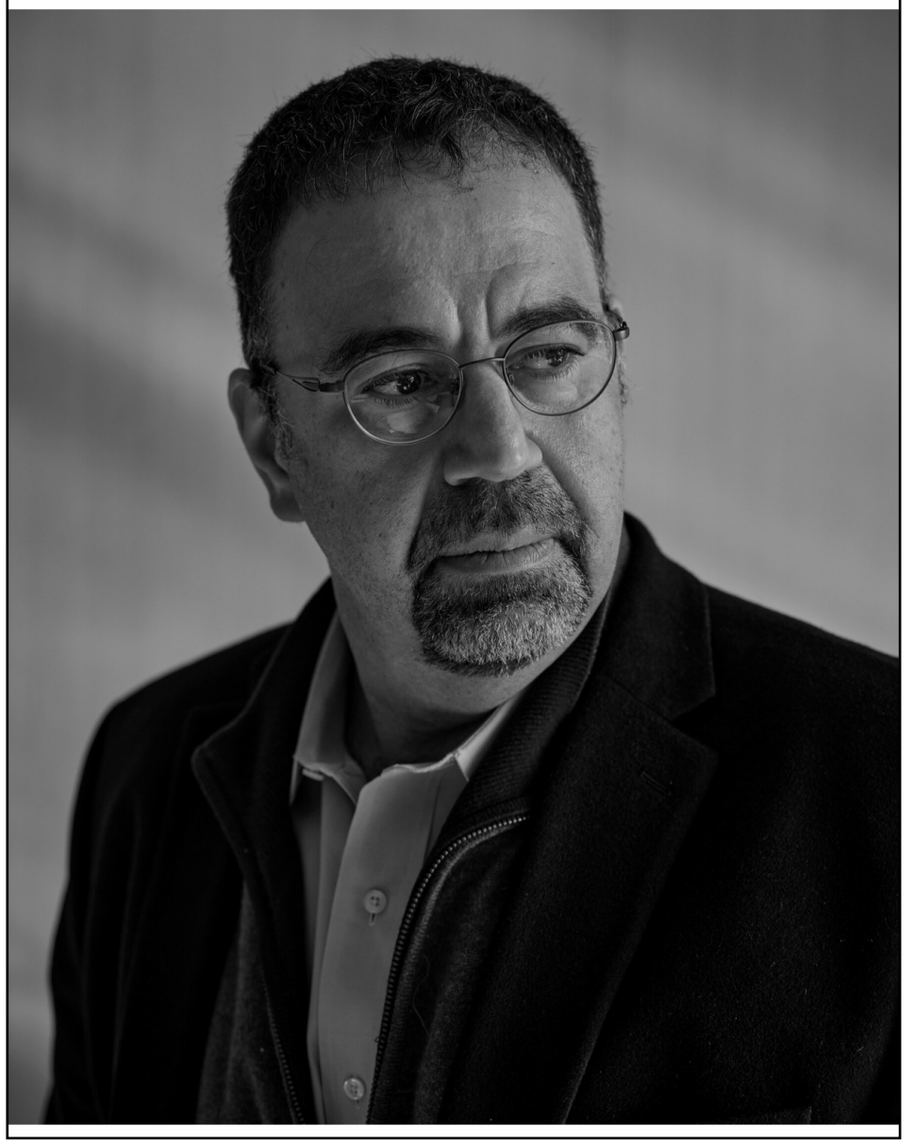
Sam Altman, a founder and chairman of OpenAI, a lab that is popularizing generative artificial intelligence. The company is now in talks on a tender offer. Mike Cohen for The New York Times

Jan 7 2023

By Erin Griffith and Cade Metz

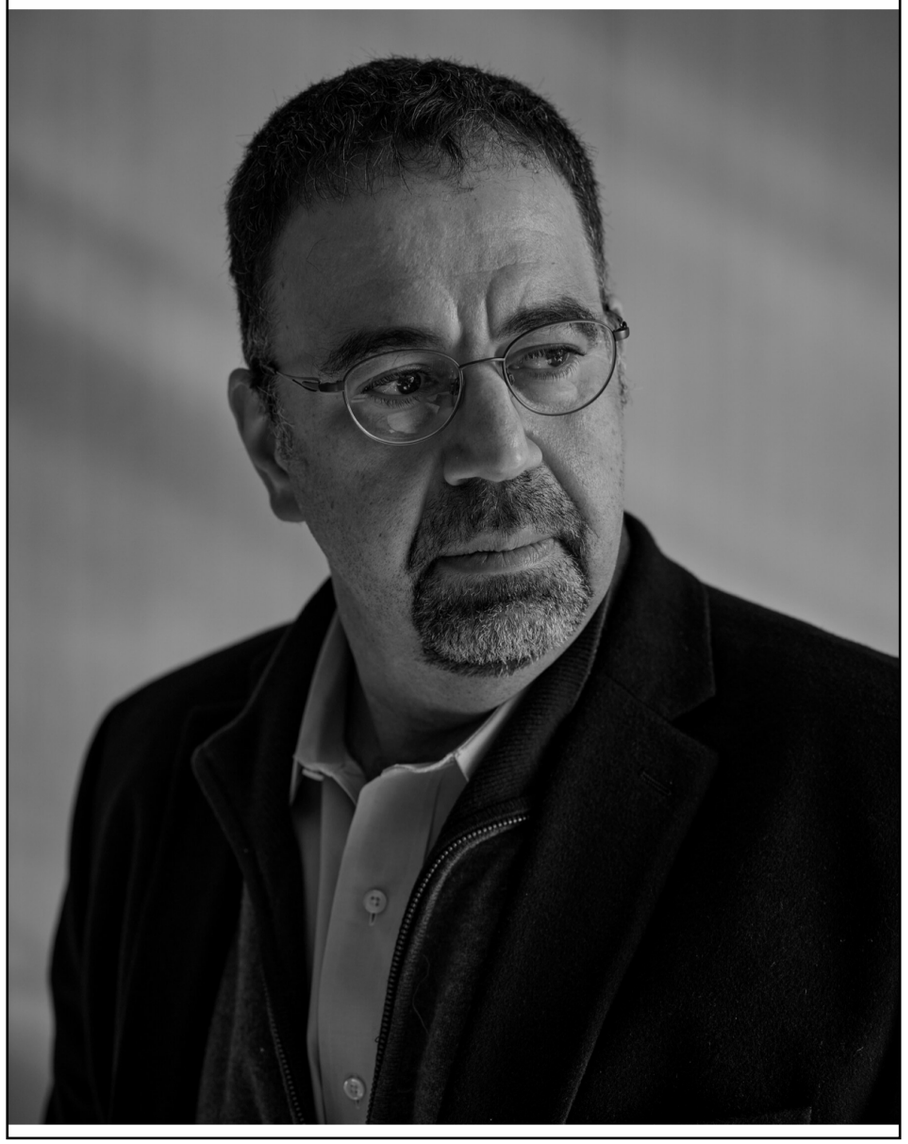
Economists Pin More Blame on Tech for Rising Inequality

Recent research underlines the central role that automation has played in widening disparities.



Economists Pin More Blame on Tech for Rising Inequality

Recent research underlines the central role that automation has played in widening disparities.



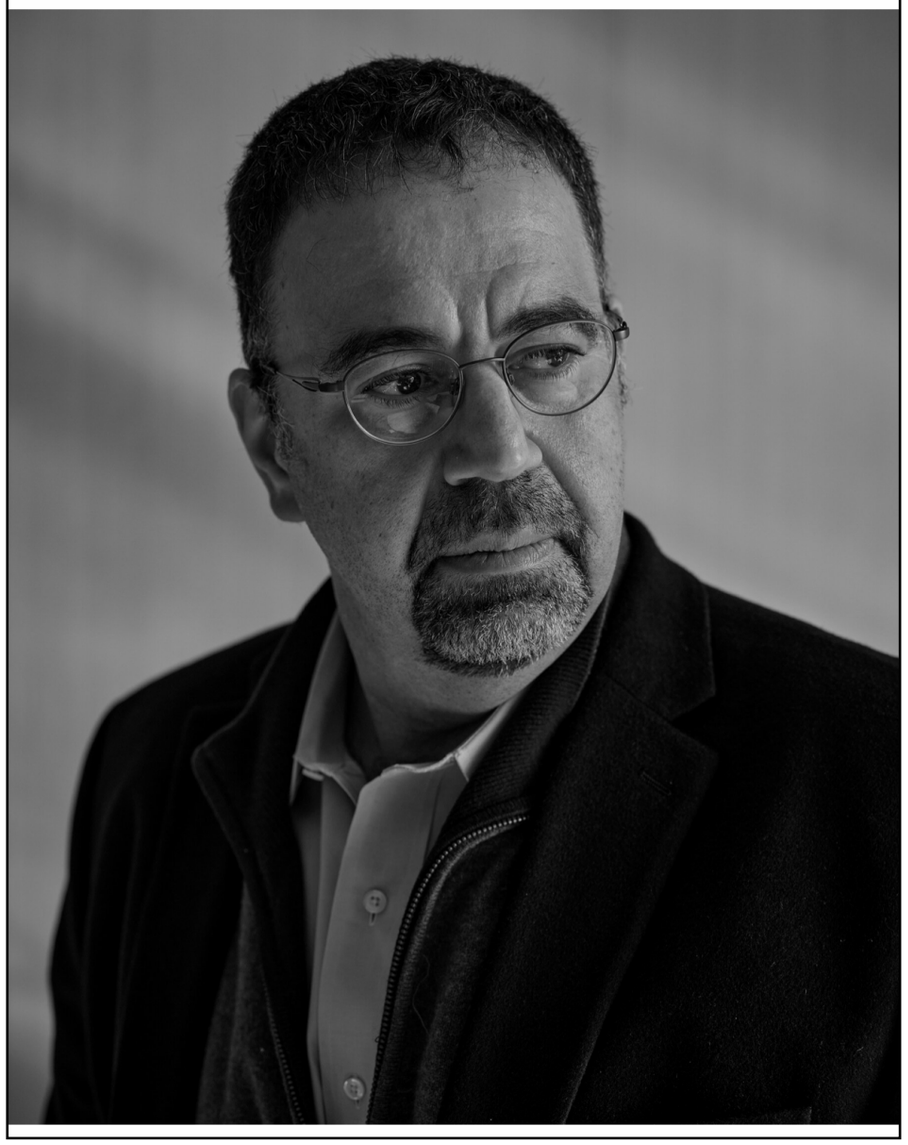
At least half the rising gap in wages among American workers in the last 40 years comes from the automation of tasks once done by people, says Daron Acemoglu, an economist at M.I.T. Cody O'Loughlin for The New York Times

By Steve Lohr

Published Jan. 11, 2022 Updated Jan. 12, 2022

Economists Pin More Blame on Tech for Rising Inequality

Recent research underlines the central role that automation has played in widening disparities.



At least half the rising gap in wages among American workers in the last 40 years comes from the automation of tasks once done by people, says Daron Acemoglu, an economist at M.I.T. Cody O'Loughlin for The New York Times

By Steve Lohr

Published Jan. 11, 2022 Updated Jan. 12, 2022

Mr. Acemoglu, like some other economists, has altered his view of technology over time. In economic theory, technology is almost a magic ingredient that both increases the size of the economic pie and makes nations richer. He recalled working on a textbook more than a decade ago that included the standard theory. Shortly after, while doing further research, he had second thoughts.

“It’s too restrictive a way of thinking,” he said. “I should have been more open-minded.”

Mr. Acemoglu is no enemy of technology. Its innovations, he notes, are needed to address society’s biggest challenges, like climate change, and to deliver economic growth and rising living standards. His wife, Asuman Ozdaglar, is the head of the electrical engineering and computer science department at M.I.T.

forum/AI & economics

Rage against the machine

WHAT ARE OUR PROSPECTS AS ADVANCES IN AI CHANGE THE LABOUR EQUATION?

SELMER BRINGSJORD AND **JOE JOHNSON**

SEE TROUBLE AHEAD

http://kryten.mm.rpi.edu/SB_JJ_Rage_Against_Machine_offprint.pdf

Logistics …

(Reading the syllabus is essential :).)

What *is* Logic?

What *is* Logic?

- The key to becoming rational.

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.
- One of two fundamental approaches to studying minds, and replicating/simulating minds in machines…

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.
- One of two fundamental approaches to studying minds, and replicating/simulating minds in machines…
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?…

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.
- One of two fundamental approaches to studying minds, and replicating/simulating minds in machines…
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?…

What *is* Logic?

- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.
- One of two fundamental approaches to studying minds, and replicating/simulating minds in machines…
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?…
- …

What *is* Logic?

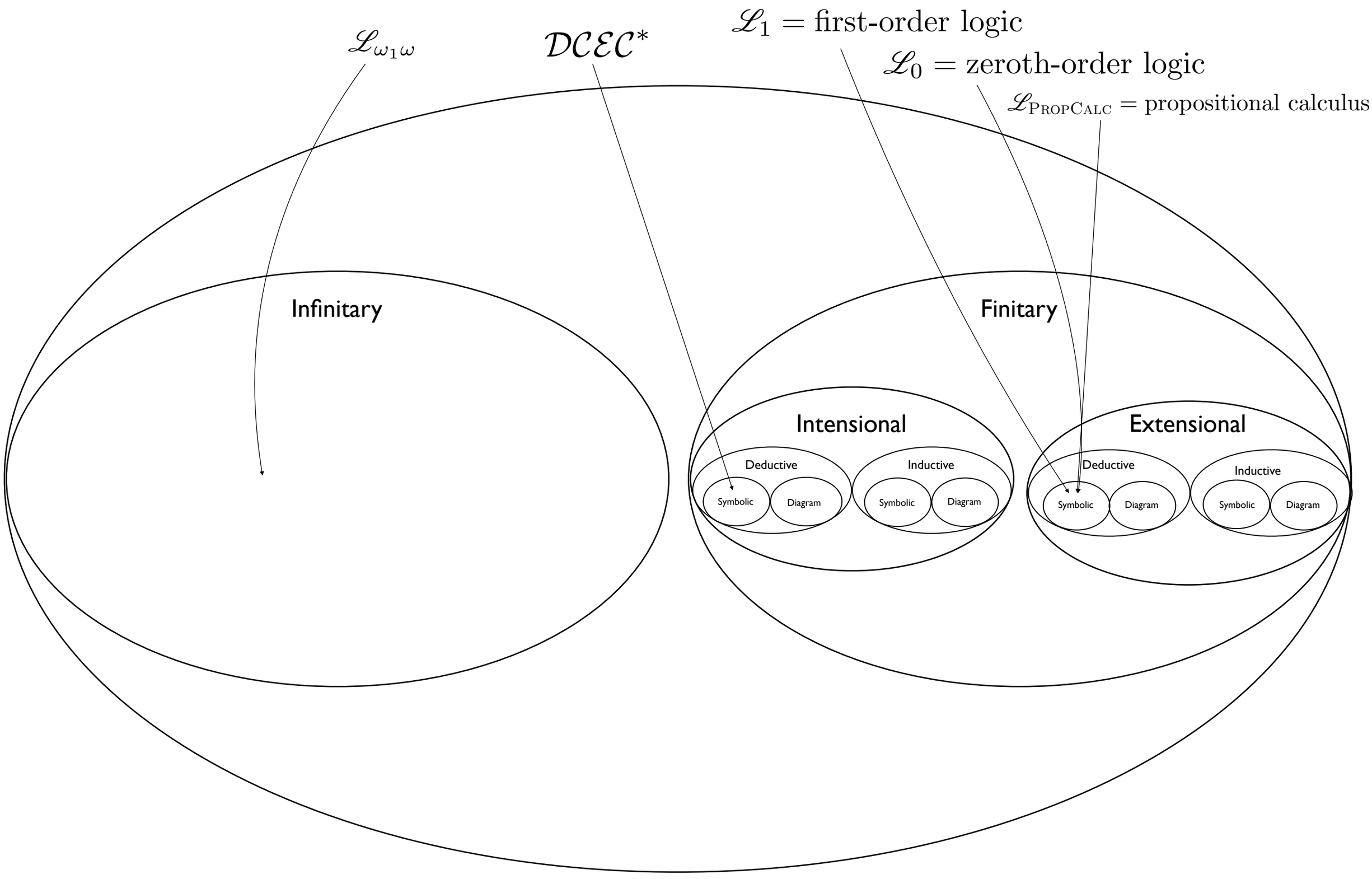
- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and n
  and you); and mindless machines (like Deep Blue & \
- A key to riches.
- The key to divining the meaning of life (and other su
- The better way to program computers; and fundam
  computers.
- One of two fundamental approaches to studying mi
  machines…
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?…
- …

What *is* Logic?

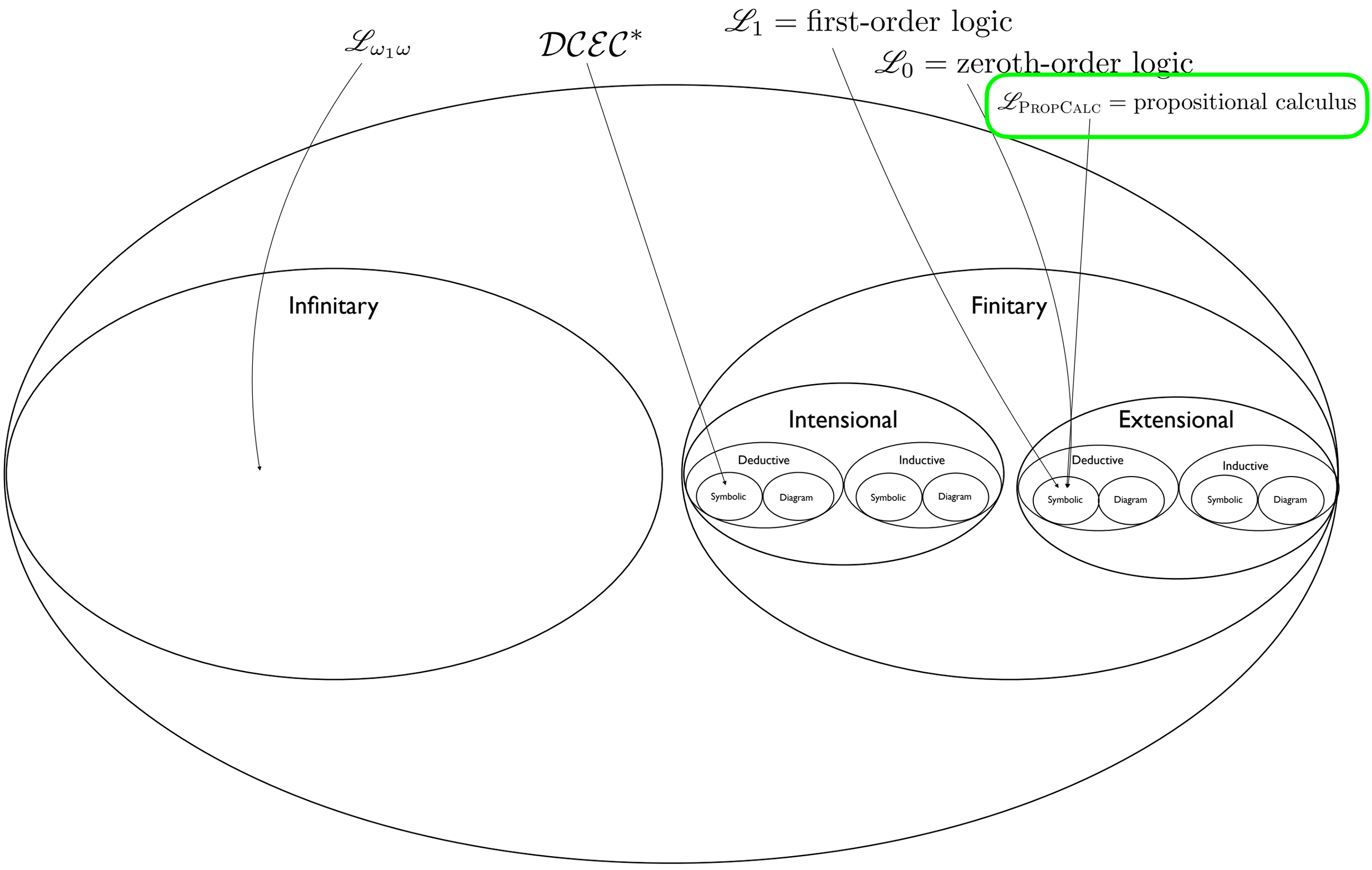
- The key to becoming rational.
- "The science and engineering of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences, e.g., …
  - Engineering! Computer Science!
  - Mathematics itself: see "reverse mathematics"!

- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and n
  and you); and mindless machines (like Deep Blue & \
- A key to riches.
- The key to divining the meaning of life (and other su
- The better way to program computers; and fundam
  computers.
- One of two fundamental approaches to studying mi
  machines…
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?…
- …

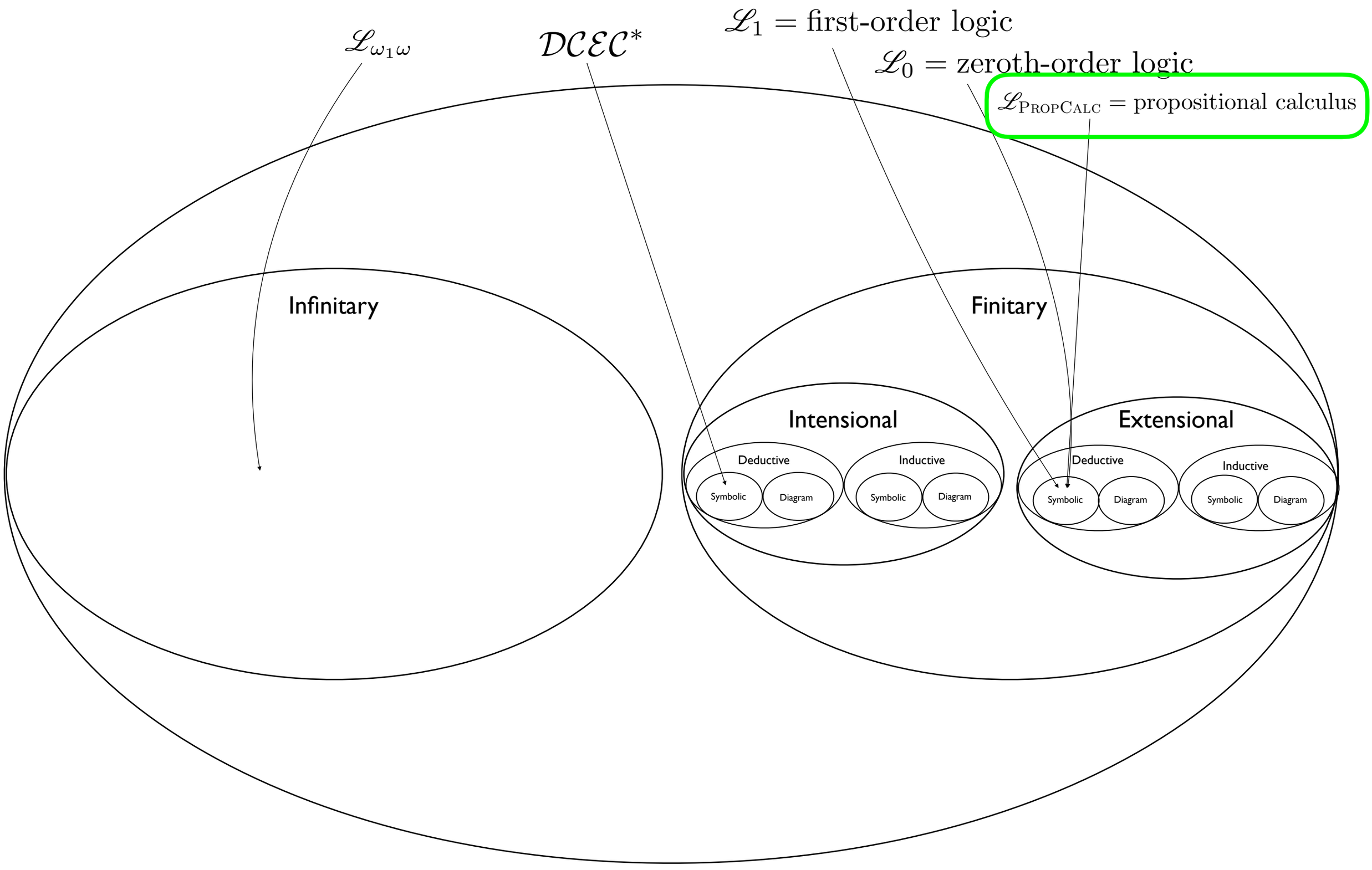
The Universe of Logics



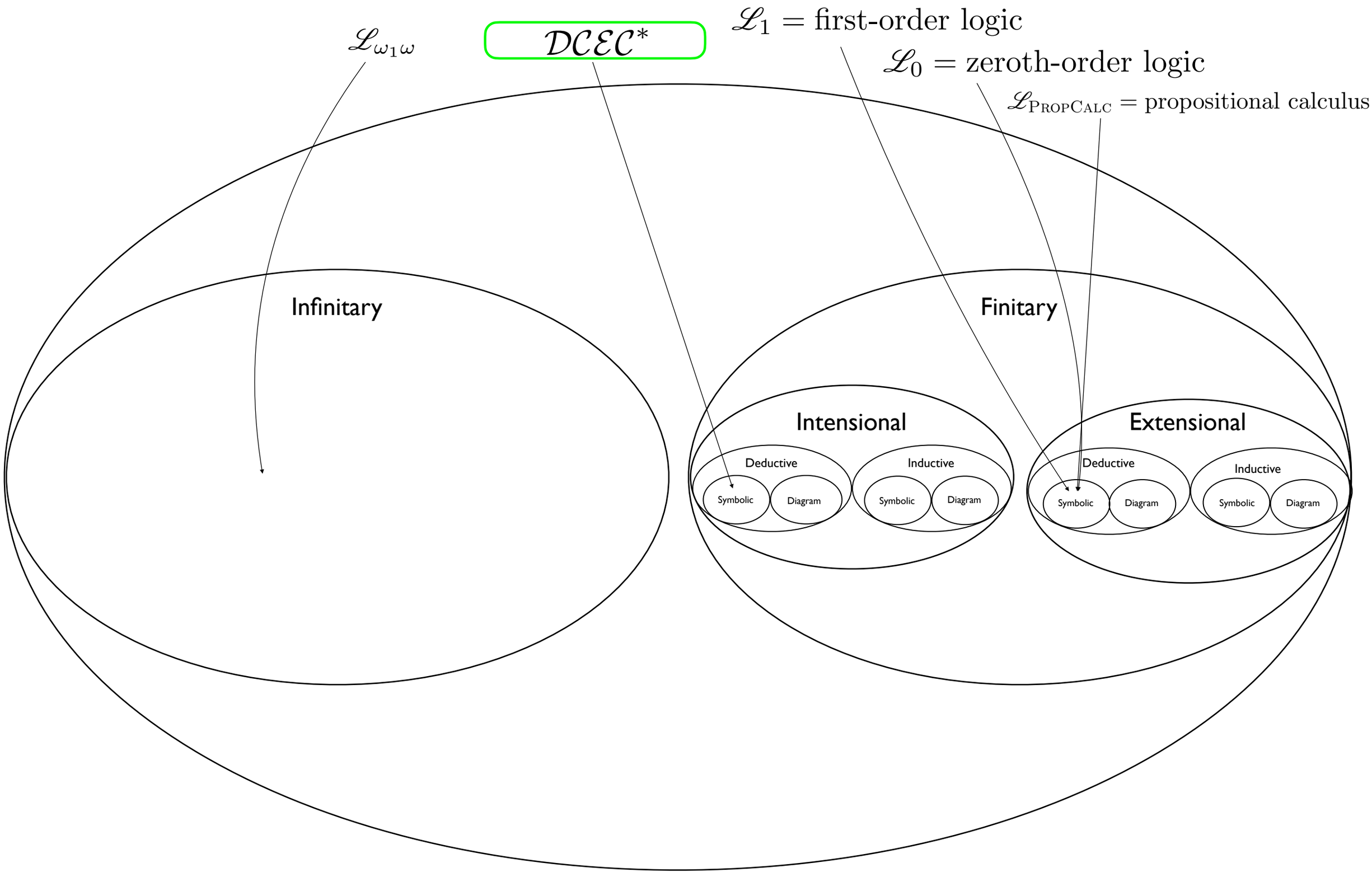
The Universe of Logics



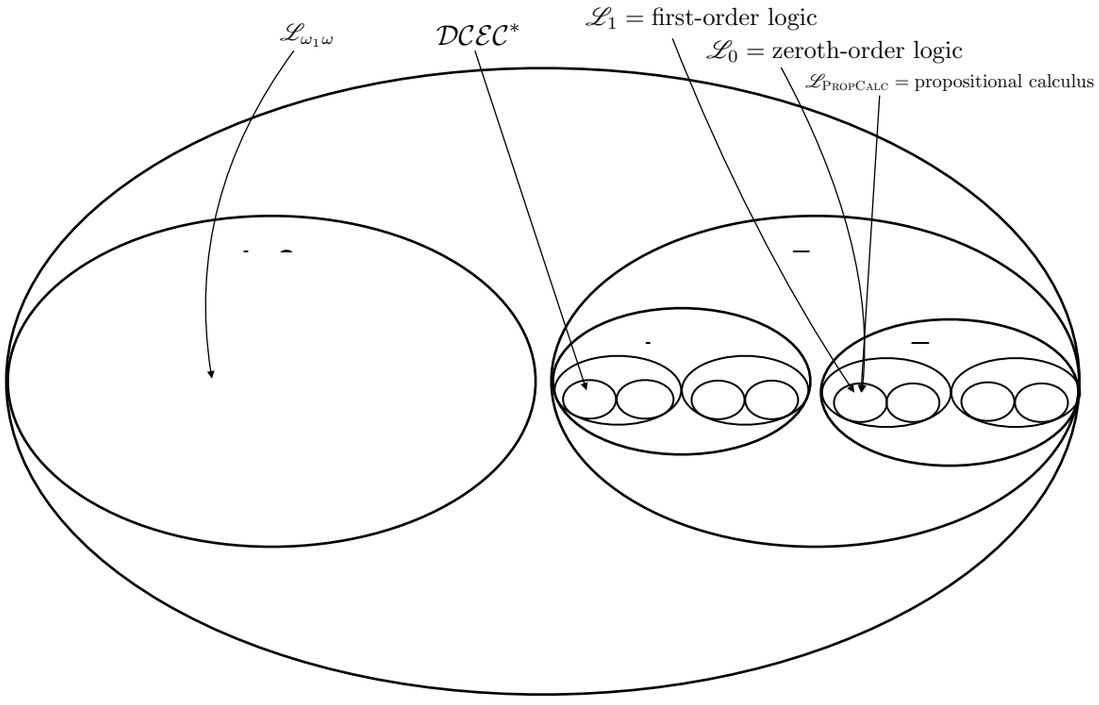
The Universe of Logics



The Universe of Logics

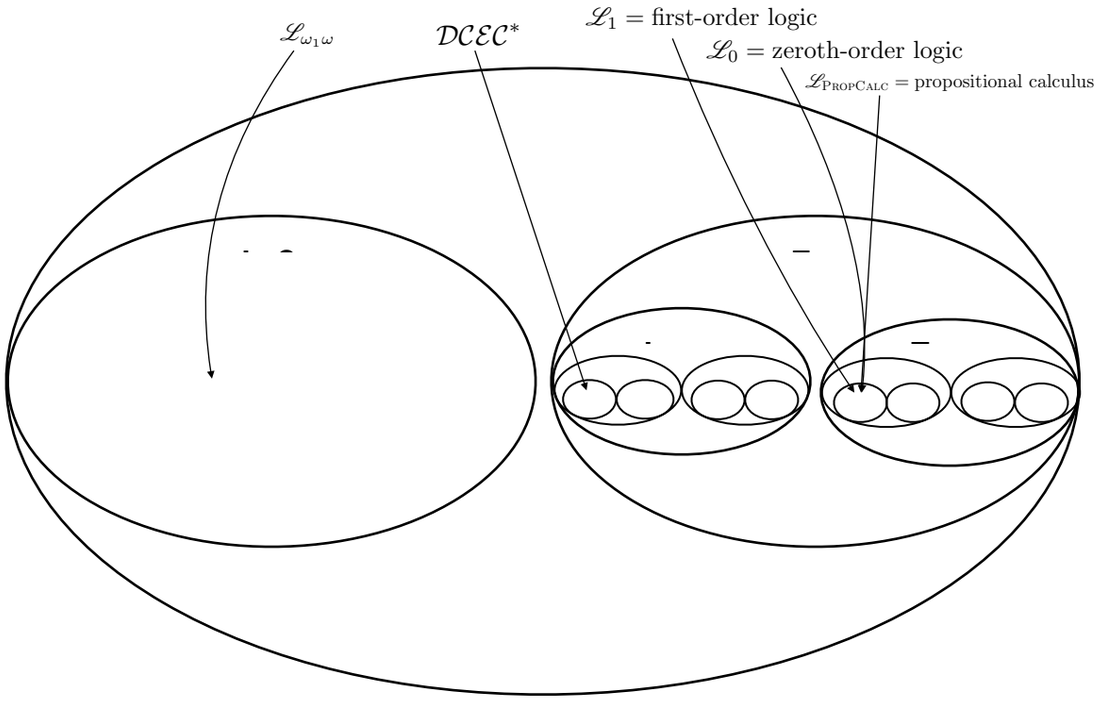


The Universe of Logics



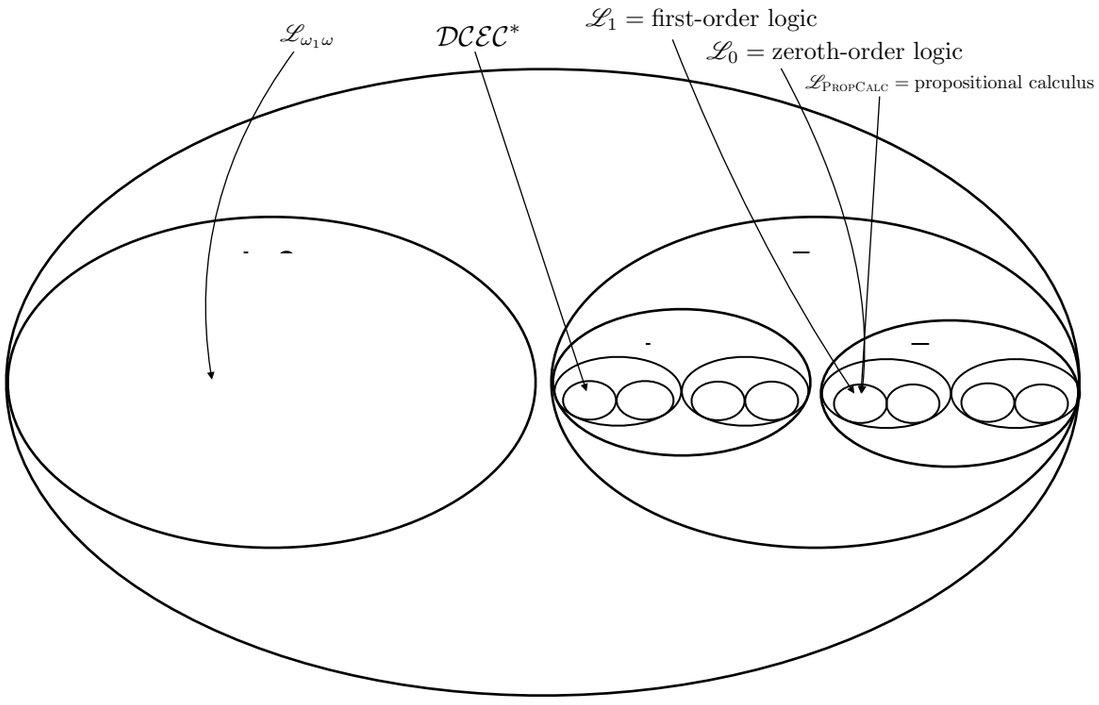
Non-Physical

The Universe of Logics

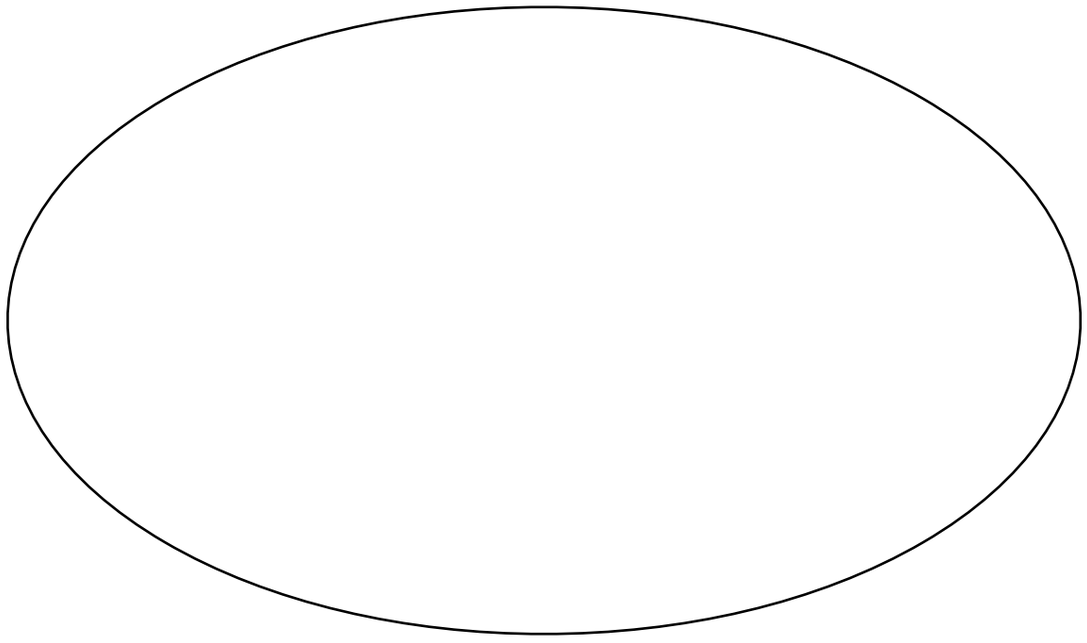


Non-Physical

The Universe of Logics

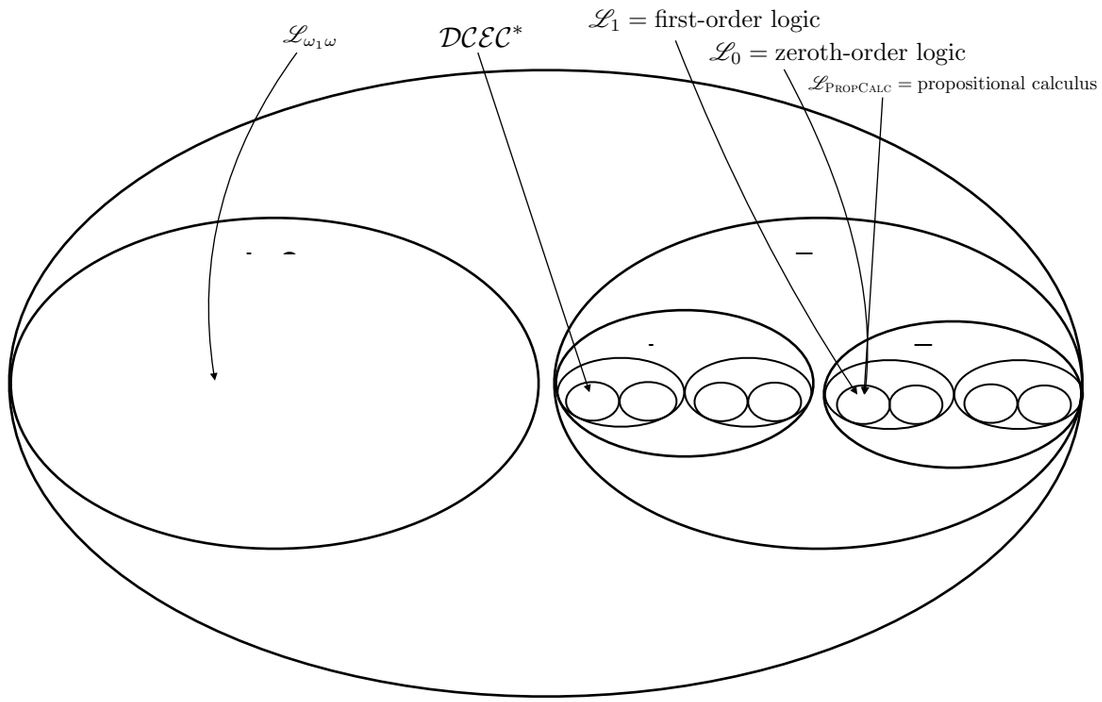


The Physical Universe

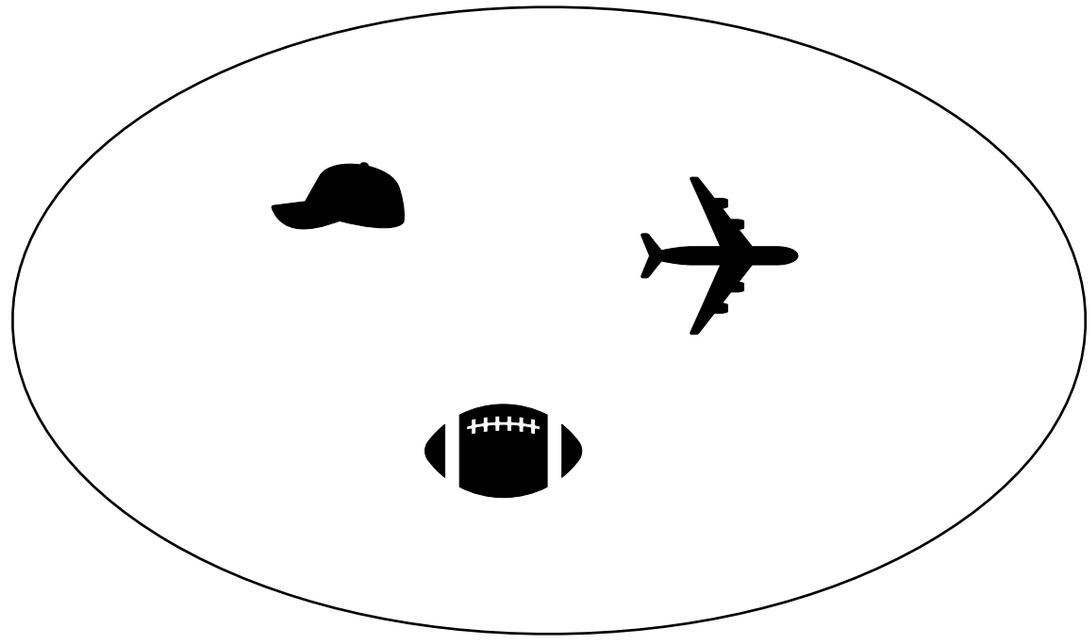


Non-Physical

The Universe of Logics

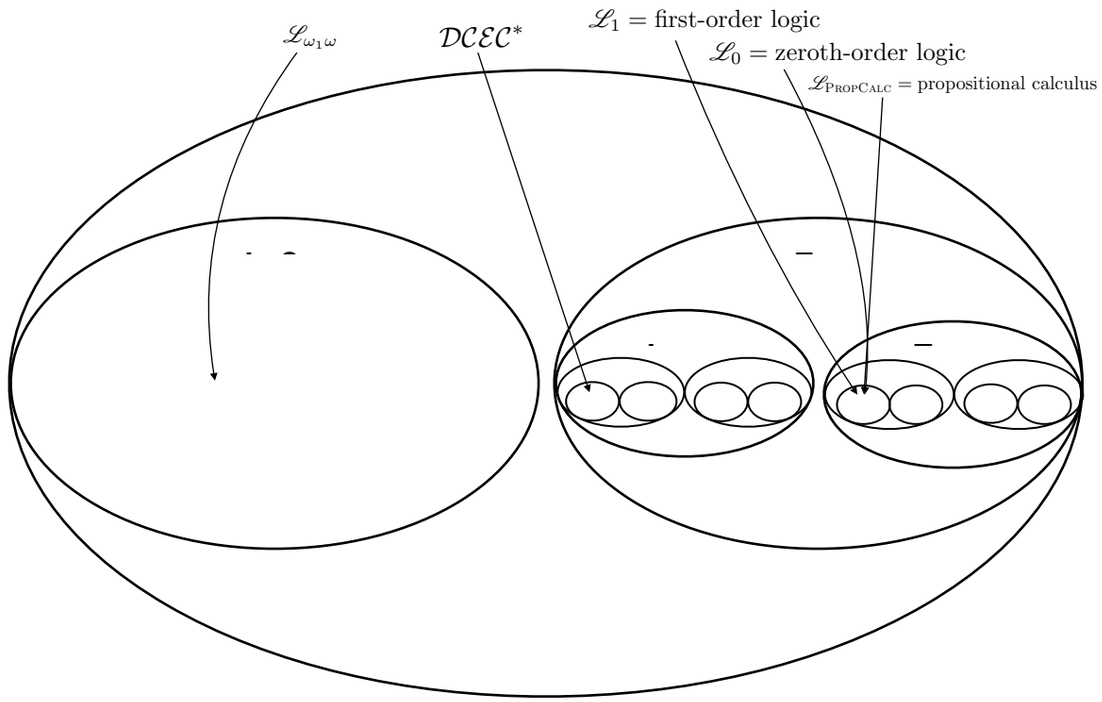


The Physical Universe

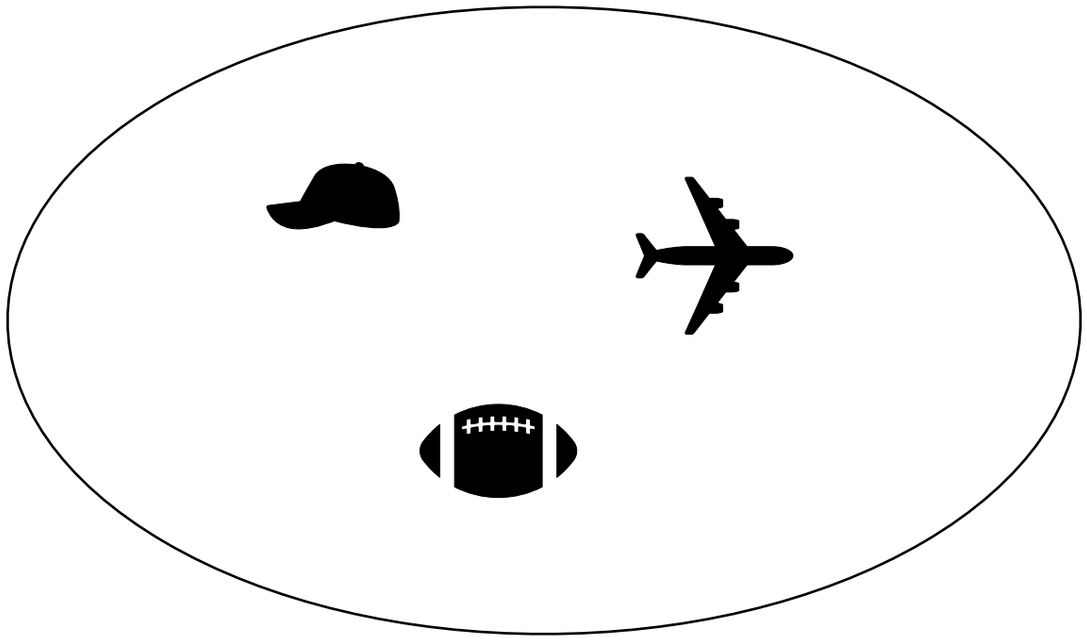


Non-Physical

The Universe of Logics

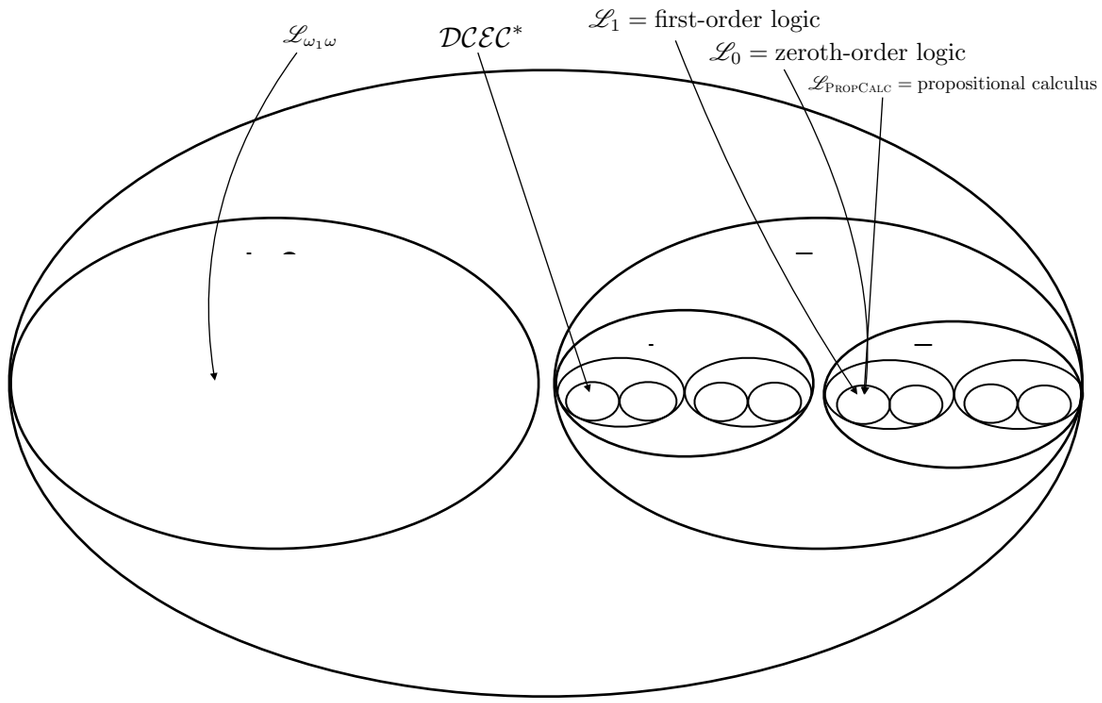


The Physical Universe

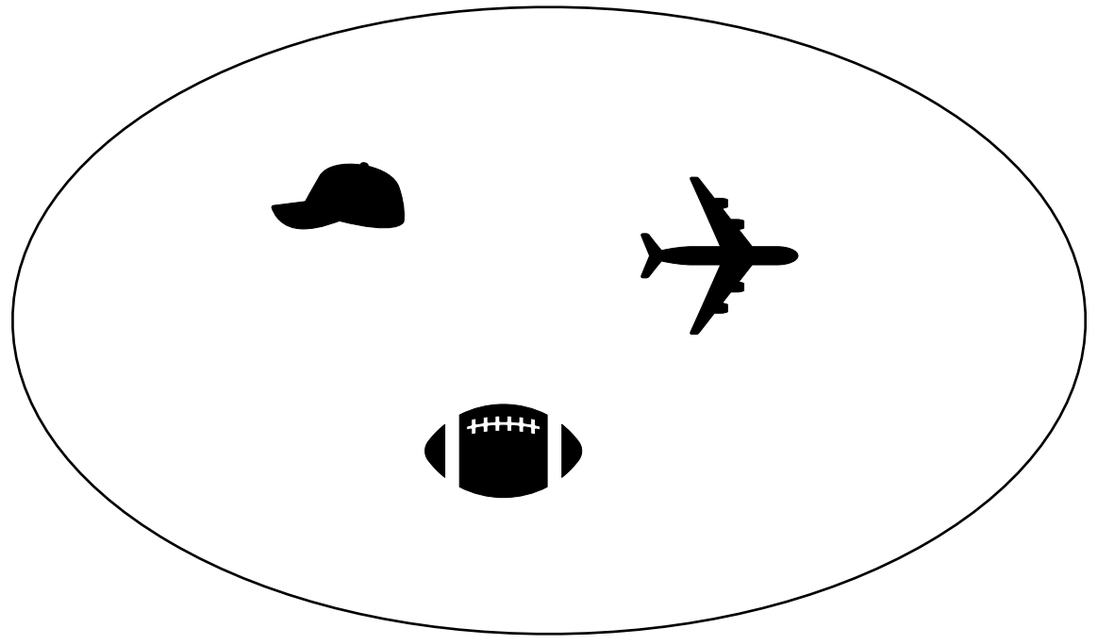


Non-Physical

The Universe of Logics



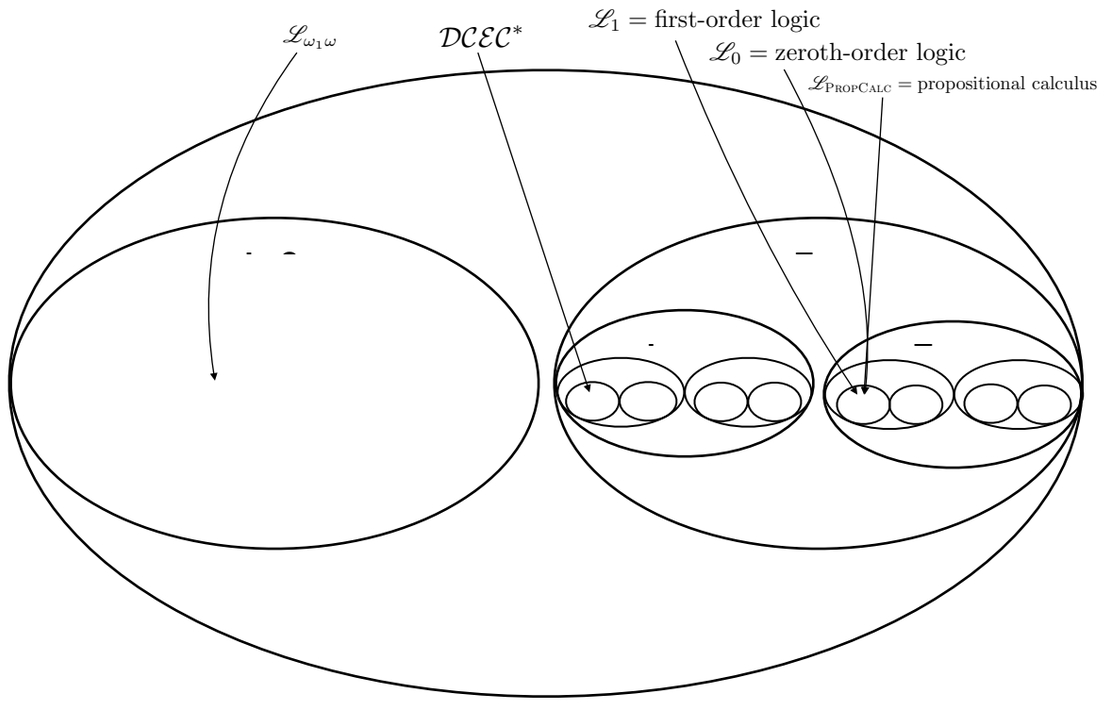
The Physical Universe



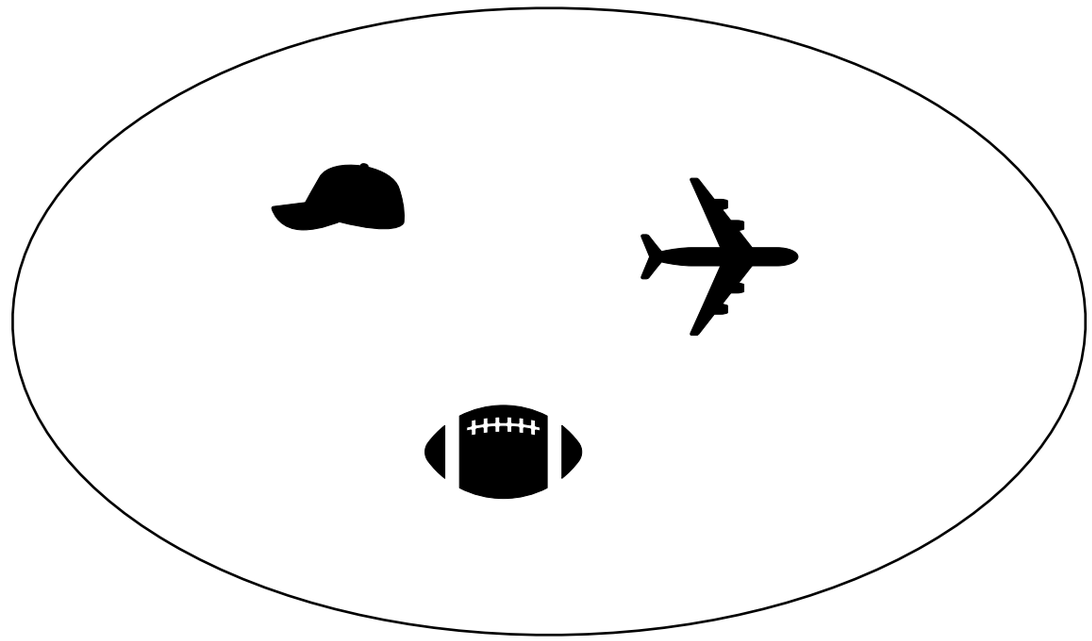
$$\frac{\phi, \phi \rightarrow \psi}{\psi} \quad \textit{modus ponens}$$

Non-Physical

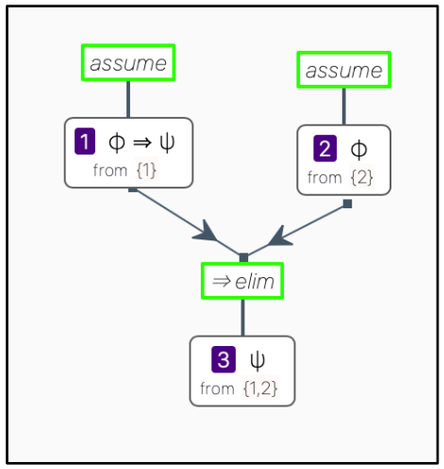
The Universe of Logics



The Physical Universe

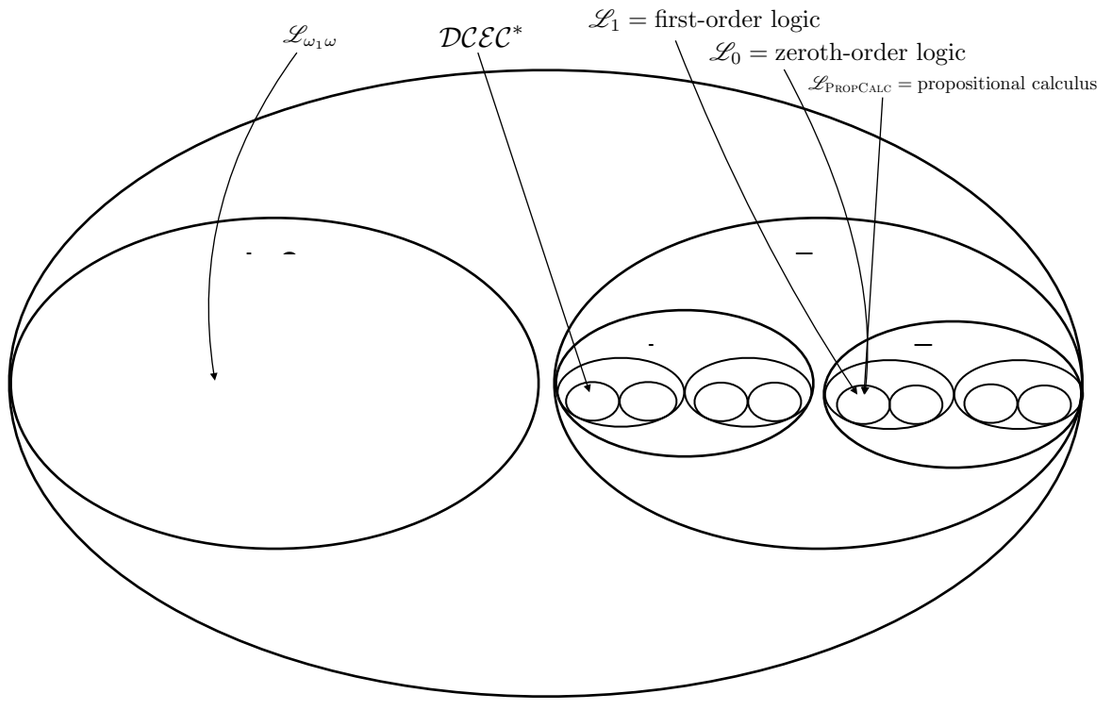


$$\frac{\phi, \phi \rightarrow \psi}{\psi}$$ *modus ponens*

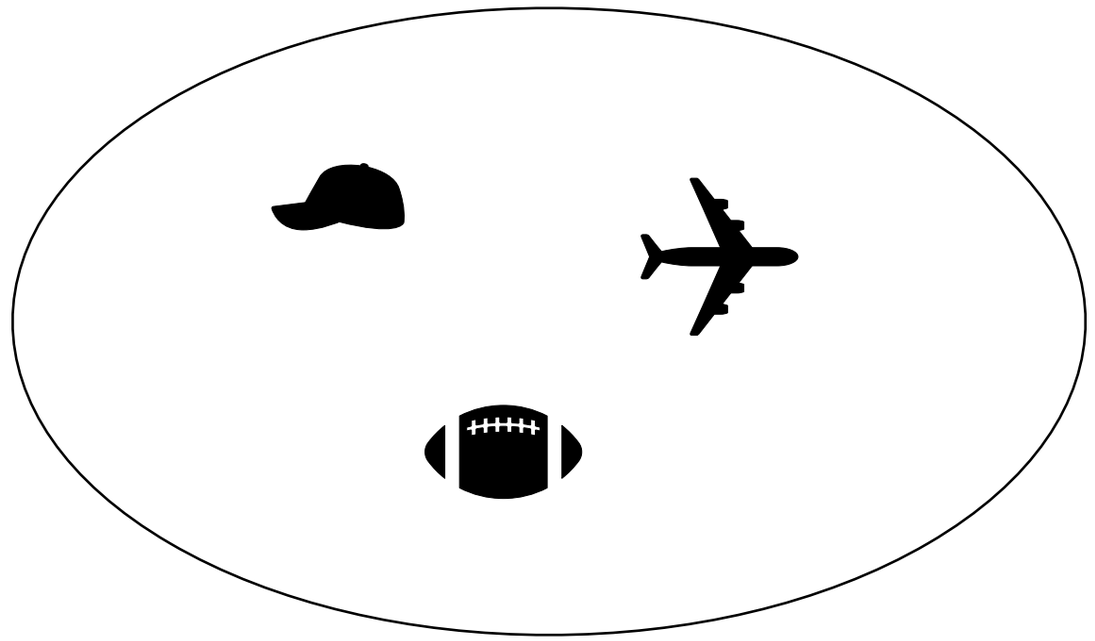


Non-Physical

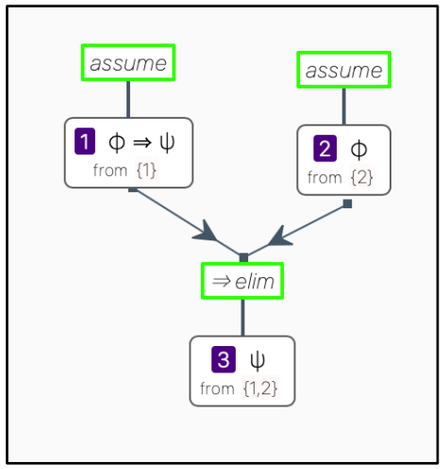
The Universe of Logics



The Physical Universe



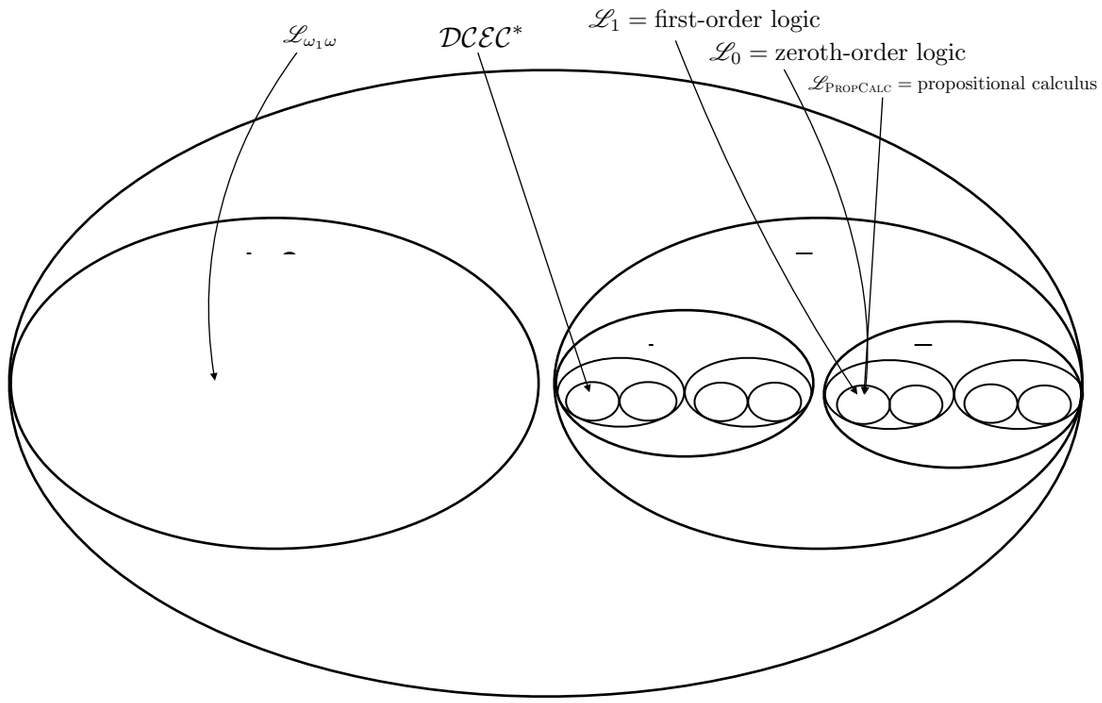
$$\frac{\phi, \phi \rightarrow \psi}{\psi} \quad \textit{modus ponens}$$



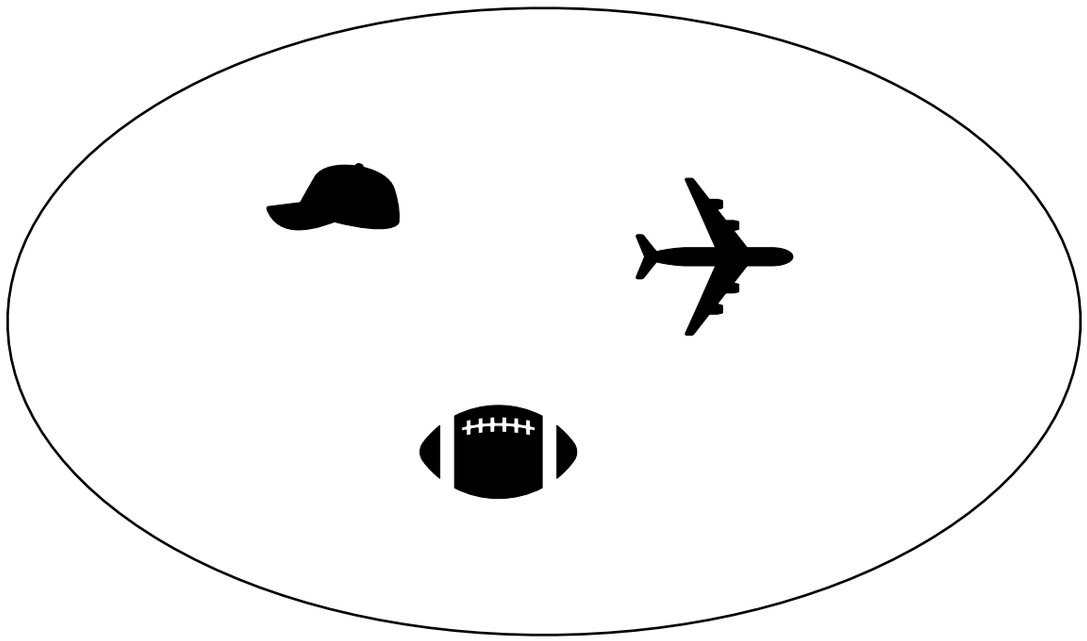
Ross, J. (1992) "Immaterial Aspects of Thought" *Journal of Philosophy* ***89.3***: 136–150.

Non-Physical

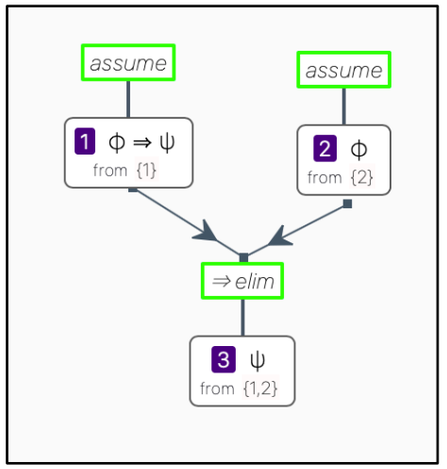
The Universe of Logics



The Physical Universe



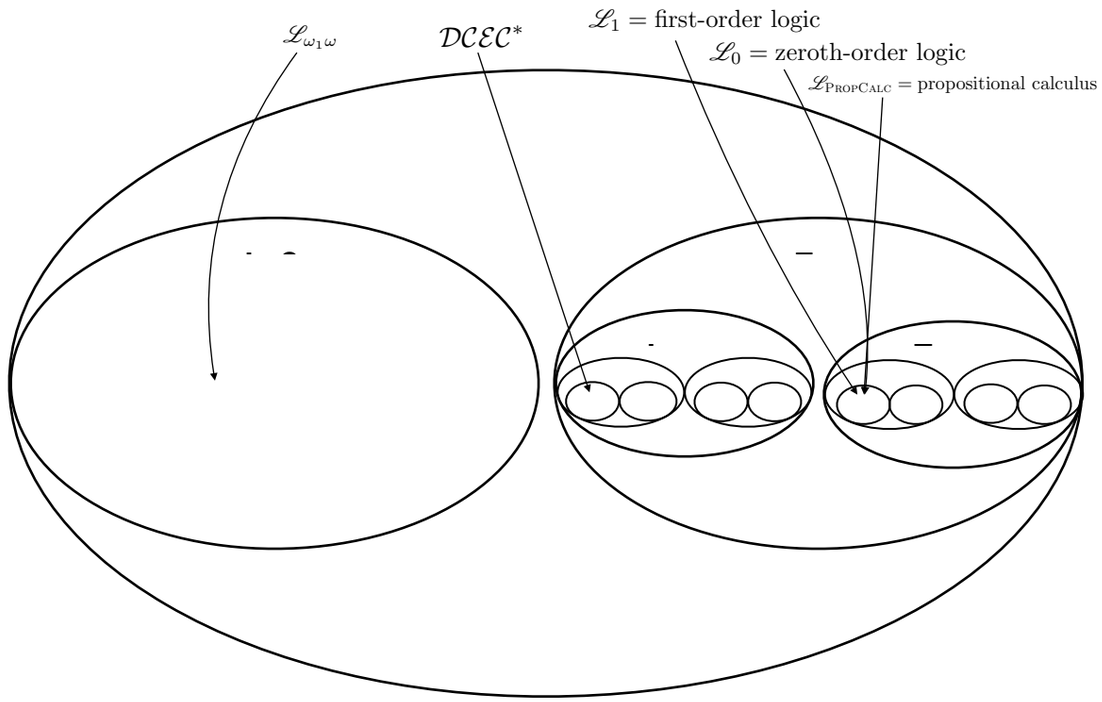
$$\frac{\phi, \phi \rightarrow \psi}{\psi} \quad \textit{modus ponens}$$



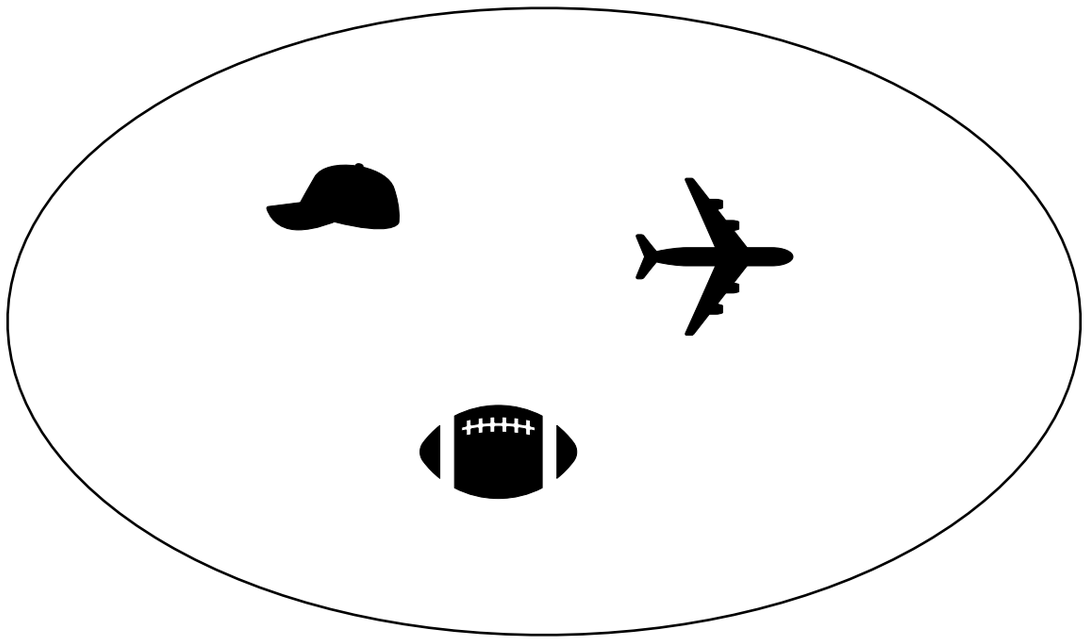
Ross, J. (1992) "Immaterial Aspects of Thought" *Journal of Philosophy* ***89.3***: 136–150.

Non-Physical

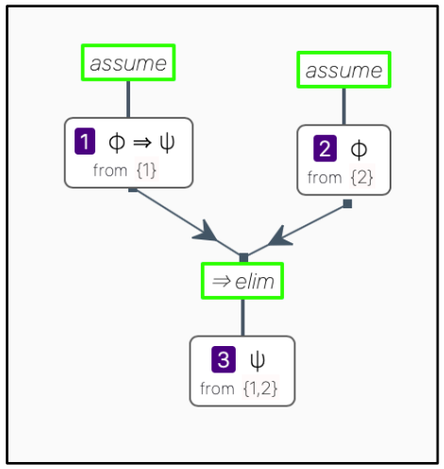
The Universe of Logics



The Physical Universe



$$\frac{\phi, \phi \rightarrow \psi}{\psi} \quad \textit{modus ponens}$$

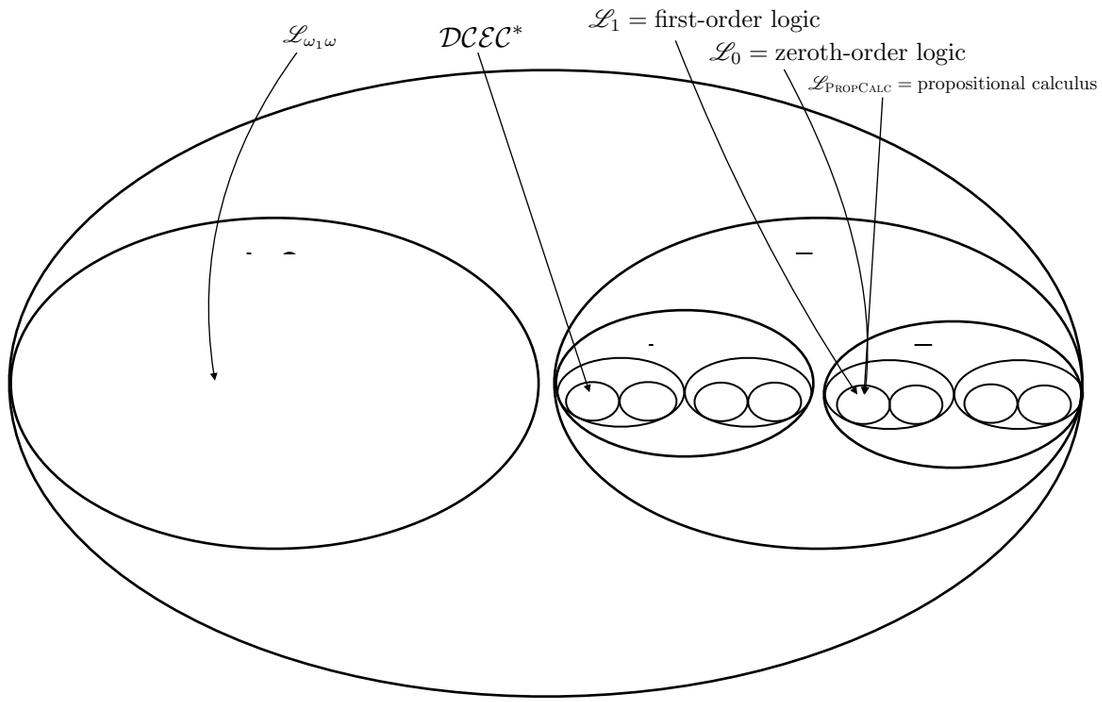


Ross, J. (1992) "Immaterial Aspects of Thought" *Journal of Philosophy* ***89.3***: 136–150.

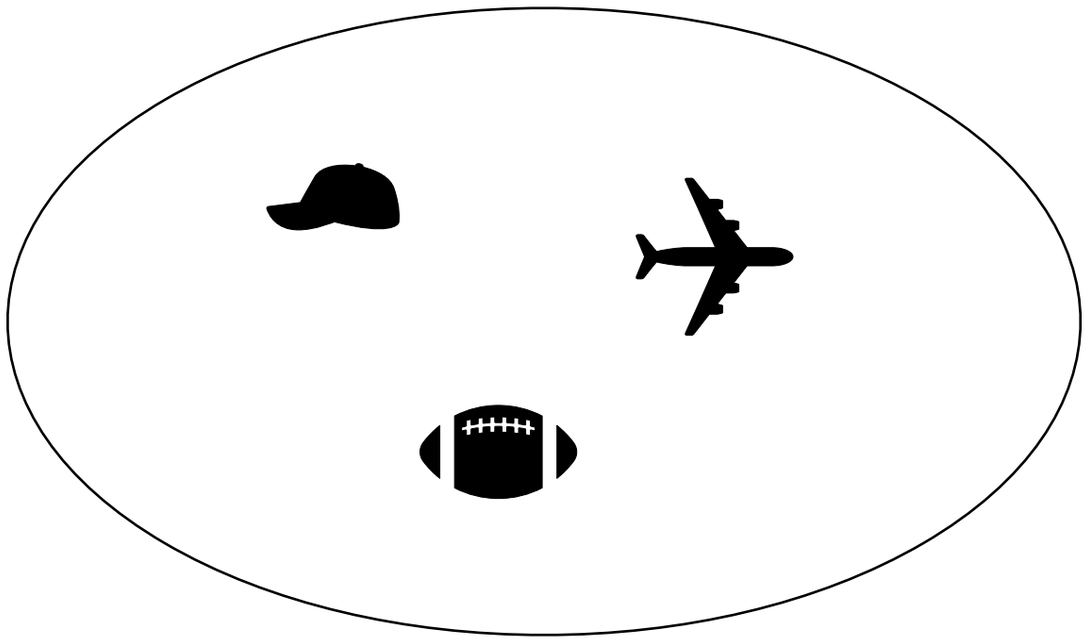
Non-Physical

?

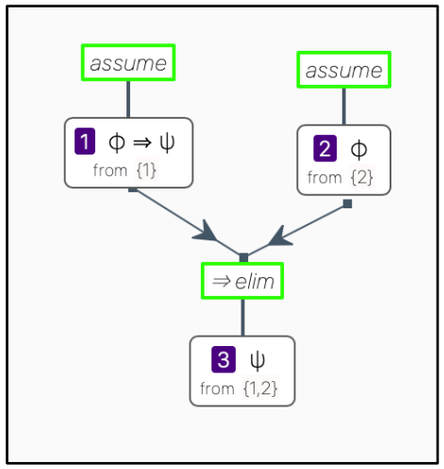
The Universe of Logics



The Physical Universe



$$\frac{\phi, \phi \rightarrow \psi}{\psi} \quad \textit{modus ponens}$$

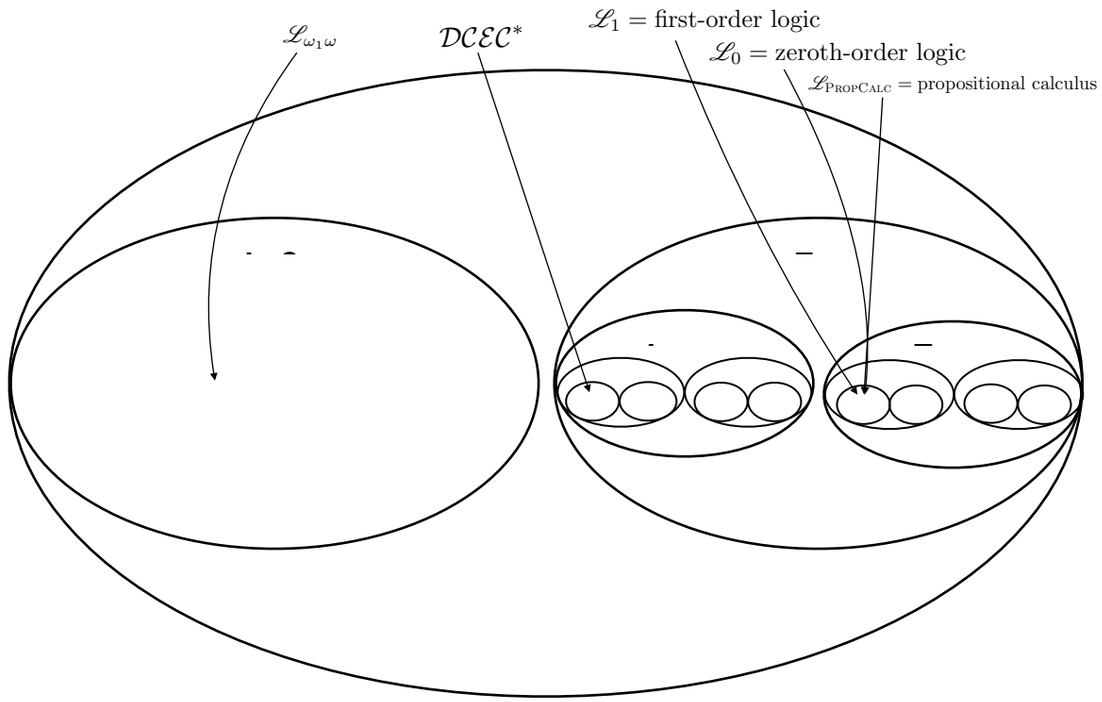


Ross, J. (1992) "Immaterial Aspects of Thought" *Journal of Philosophy* ***89.3***: 136–150.

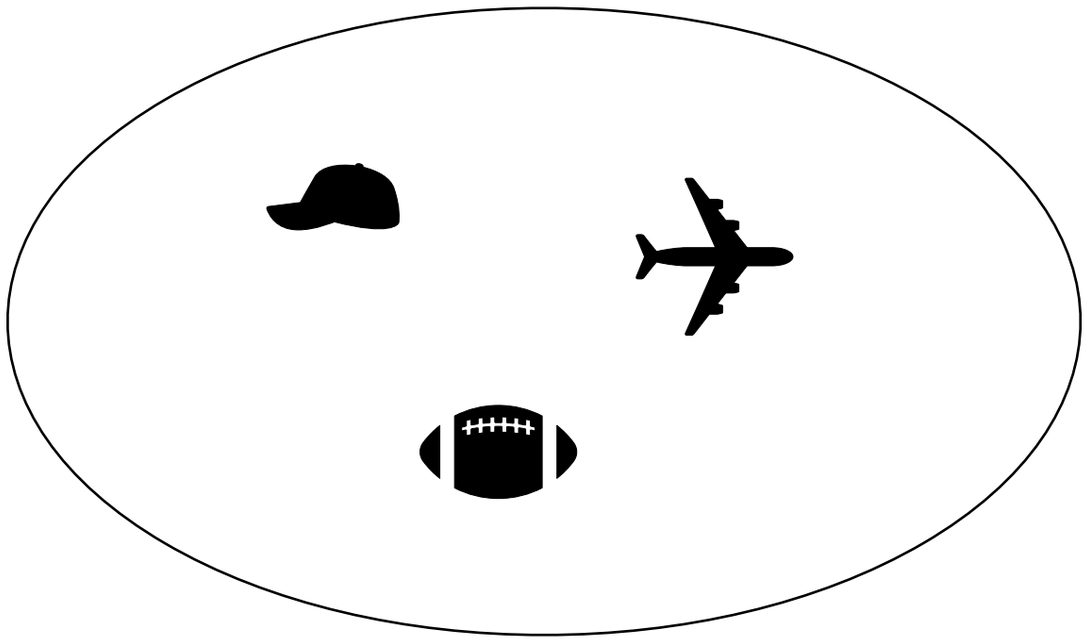
Non-Physical

?

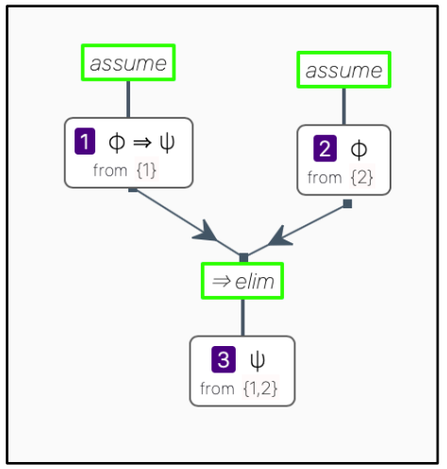
The Universe of Logics



The Physical Universe



$$\frac{\phi, \phi \rightarrow \psi}{\psi} \quad \textit{modus ponens}$$



Ross, J. (1992) "Immaterial Aspects of Thought" *Journal of Philosophy* ***89.3***: 136–150.

Background Claim

$\mathcal{R}$ Humans, at least neurobiologically normal ones, are fundamentally rational, where rationality is constituted by certain logico-mathematically based reasoning and decision-making in response to real-world stimuli, including stimuli given in the form of focused tests; but mere animals are not fundamentally rational, since, *contra* Darwin, their minds are fundamentally qualitatively inferior to the human mind. As to whether computing machines/robots are fundamentally rational, the answer is "No." For starters, if x can't read, write, and create, x can't be rational; computing machines/robots can neither read nor write nor create; ergo, they aren't fundamentally rational.

abstract-and-valid inference schemata

Background Claim

$\mathcal{R}$ Humans, at least neurobiologically normal ones, are fundamentally rational, where rationality is constituted by certain logico-mathematically based reasoning and decision-making in response to real-world stimuli, including stimuli given in the form of focused tests; but mere animals are not fundamentally rational, since, *contra* Darwin, their minds are fundamentally qualitatively inferior to the human mind. As to whether computing machines/robots are fundamentally rational, the answer is "No." For starters, if x can't read, write, and create, x can't be rational; computing machines/robots can neither read nor write nor create; ergo, they aren't fundamentally rational.

abstract-and-valid inference schemata

quantification

Background Claim

$\mathcal{R}$ Humans, at least neurobiologically normal ones, are fundamentally rational, where rationality is constituted by certain logico-mathematically based reasoning and decision-making in response to real-world stimuli, including stimuli given in the form of focused tests; but mere animals are not fundamentally rational, since, *contra* Darwin, their minds are fundamentally qualitatively inferior to the human mind. As to whether computing machines/robots are fundamentally rational, the answer is "No." For starters, if x can't read, write, and create, x can't be rational; computing machines/robots can neither read nor write nor create; ergo, they aren't fundamentally rational.

abstract-and-valid inference schemata

quantification

intensional reasoning

Background Claim

$\mathcal{R}$ Humans, at least neurobiologically normal ones, are fundamentally rational, where rationality is constituted by certain logico-mathematically based reasoning and decision-making in response to real-world stimuli, including stimuli given in the form of focused tests; but mere animals are not fundamentally rational, since, *contra* Darwin, their minds are fundamentally qualitatively inferior to the human mind. As to whether computing machines/robots are fundamentally rational, the answer is "No." For starters, if x can't read, write, and create, x can't be rational; computing machines/robots can neither read nor write nor create; ergo, they aren't fundamentally rational.

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

abstract-and-valid inference schemata

quantification

Background Claim

intensional reasoning

recursion

self-reference

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

self-reference

To infinity and beyond! — routinely

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

self-reference

To infinity and beyond! — routinely

HS®

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

self-reference

To infinity and beyond! — routinely

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

self-reference

To infinity and beyond! — routinely

abstract-and-valid inference schemata

quantification

intensional reasoning

HS®

recursion

self-reference

To infinity and beyond! — routinely

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

self-reference

To infinity and beyond! — routinely

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

self-reference

To infinity and beyond! — routinely

abstract-and-valid inference schemata

quantification

intensional reasoning

recursion

self-reference

To infinity and beyond! — routinely

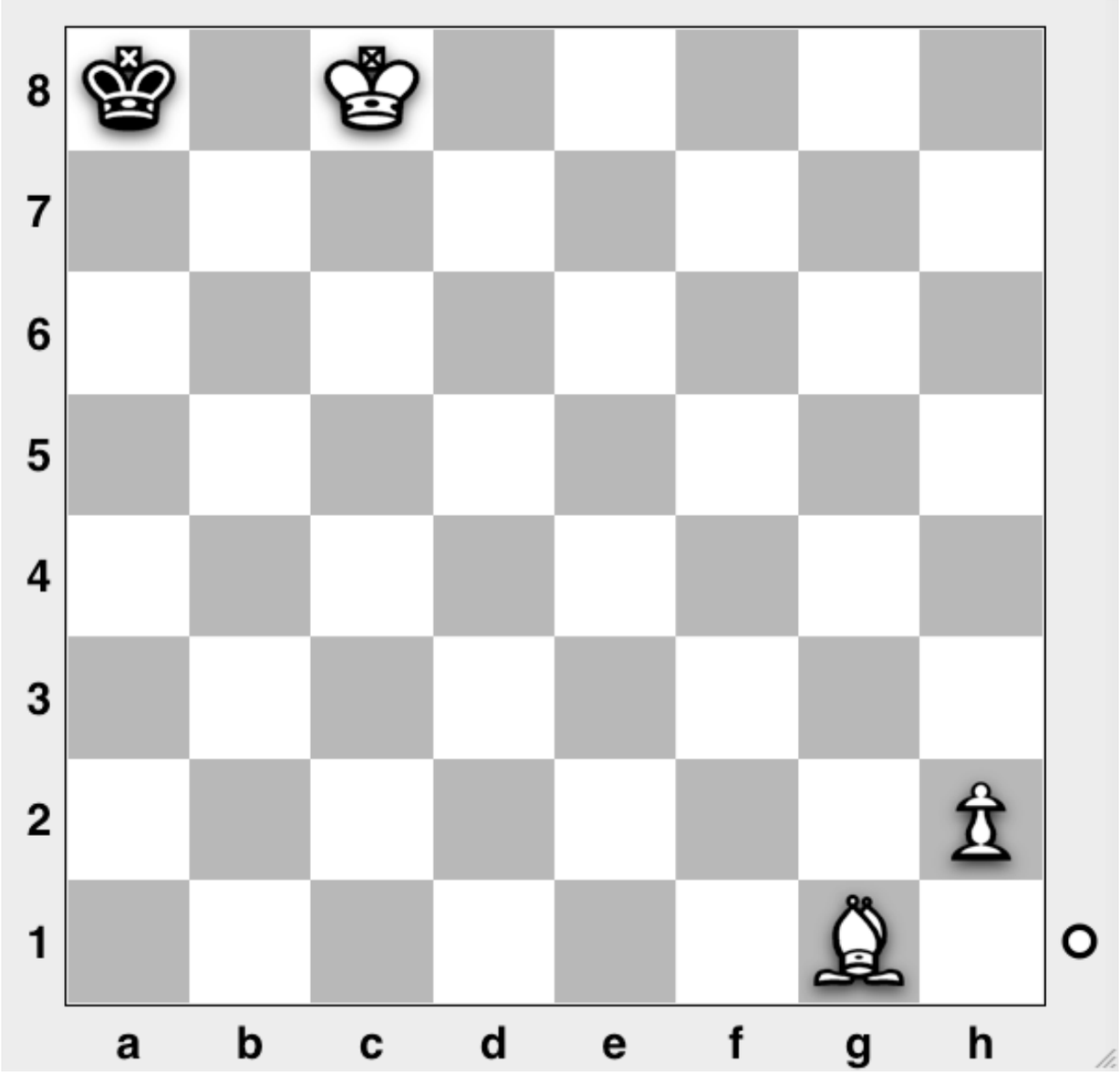
What *is* Logic?

- The key to becoming rational.
- "The science of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences (e.g., engineering, computer science).
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.
- One of two fundamental approaches to studying minds, and replicating/simulating minds in machines…
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?…
- …

What *is* Logic?

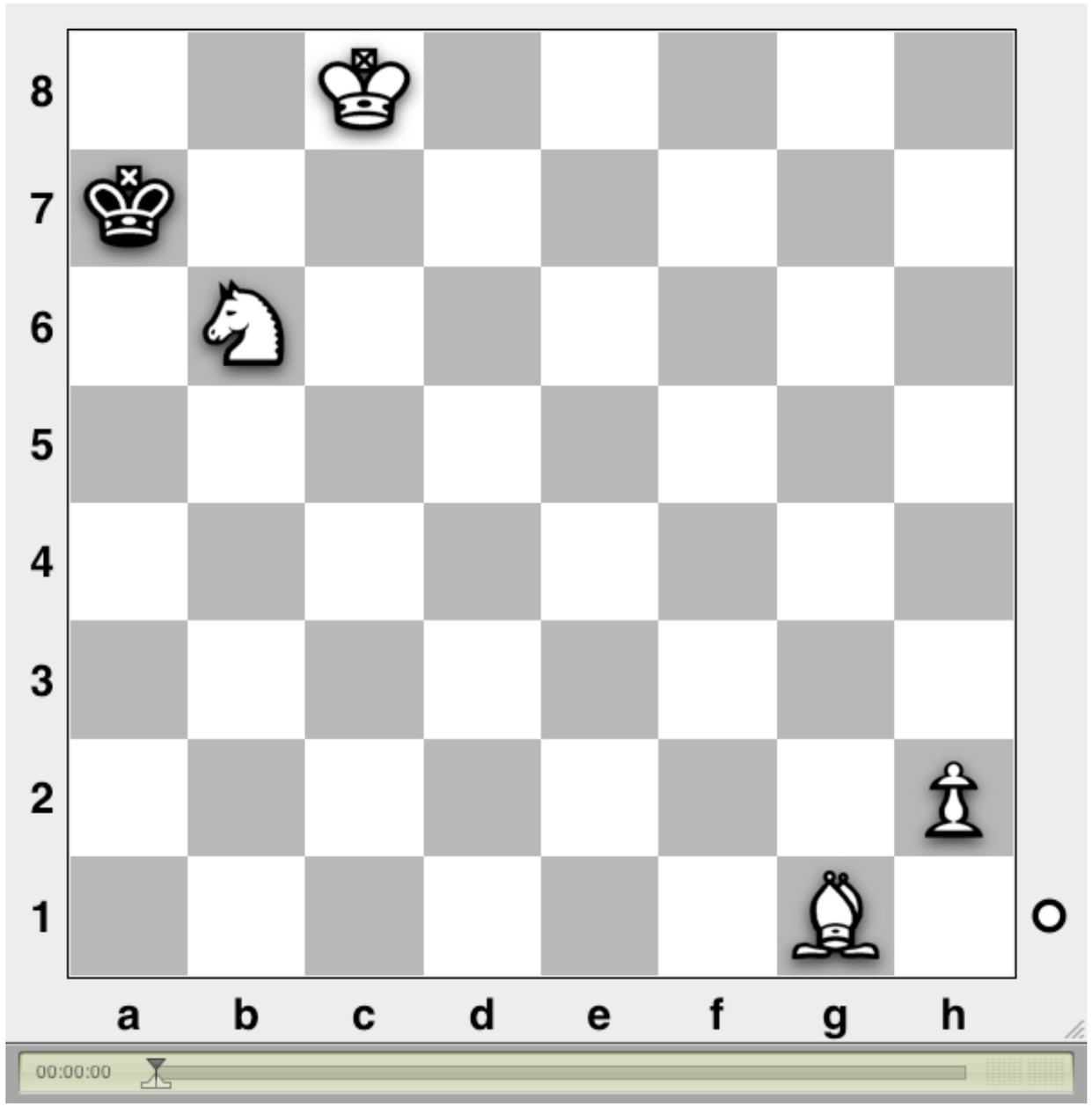
- The key to becoming rational. Or are you *already* rational? …
- "The science of reasoning." — so the not-unreasonable slogan goes.
- The only invincible subject there is.
- The basis for the formal sciences (from mathematics to game theory to decision theory to probability calculi to axiomatic physics ….) — and hence the basis for disciplines based on the formal sciences (e.g., engineering, computer science).
- The way of escape from shallow content and context to pure, immaterial, and immortal form and structure (which is why the exotic, imaginary, and seemingly non-sensical is so pedagogically useful).
- The most challenging subject there is.
- One of the chief differentiators between dogs and monkeys versus you (let alone bears and you); and mindless machines (like Deep Blue & Watson) versus you.
- A key to riches.
- The key to divining the meaning of life (and other such big questions).
- The better way to program computers; and fundamentally the *only* way to *reliably* program computers.
- One of two fundamental approaches to studying minds, and replicating/simulating minds in machines…
- The thing many creatures of fiction have mastered — have you (as a New Yorker)?…
- …

It's White's turn. What move did Black just make?



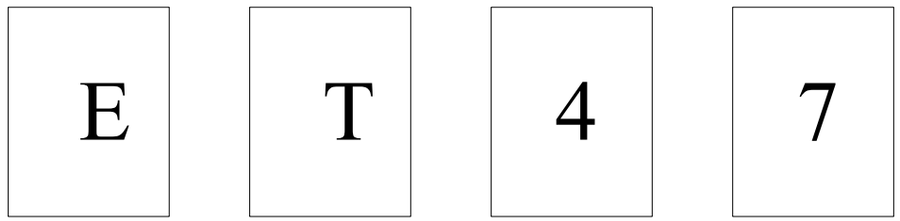
Aha! (Beyond Deep Blue?)

Aha! (Beyond Deep Blue?)



NOTE: Every card in this game has a capital Roman letter on one side, and a number from 1 to 9, inclusive.

Simple Selection Task



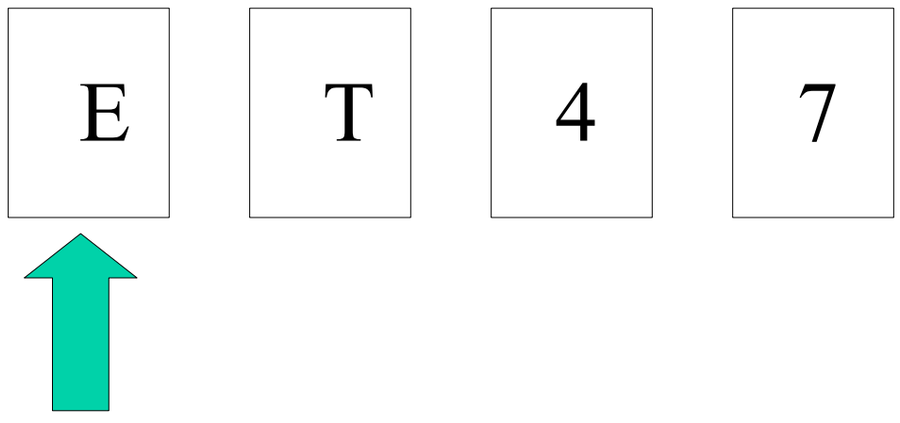
Suppose I claim that the following rule is true.

> If a card has a vowel on one side, it has an even number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

NOTE: Every card in this game has a capital Roman letter on one side, and a number from 1 to 9, inclusive.

Simple Selection Task



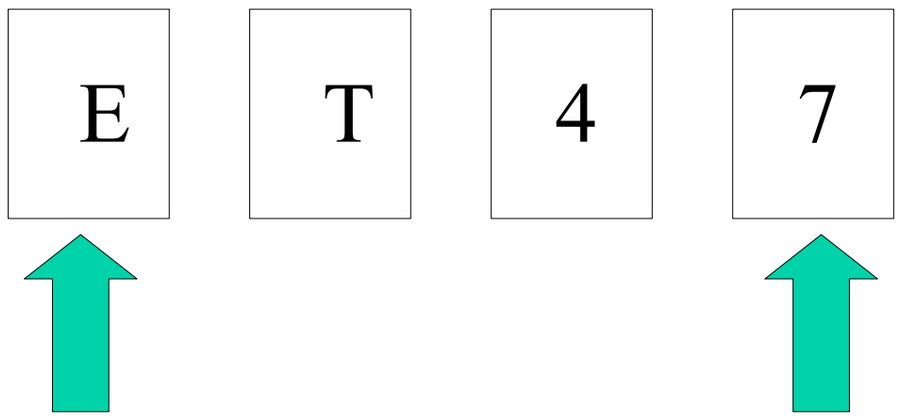
Suppose I claim that the following rule is true.

> If a card has a vowel on one side, it has an even number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

NOTE: Every card in this game has a capital Roman letter on one side, and a number from 1 to 9, inclusive.

Simple Selection Task

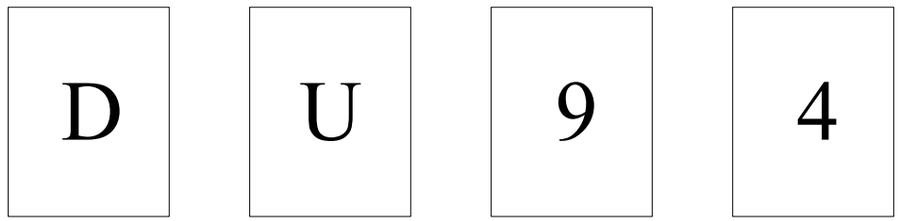


Suppose I claim that the following rule is true.

> If a card has a vowel on one side, it has an even number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

Another Simple Selection Task

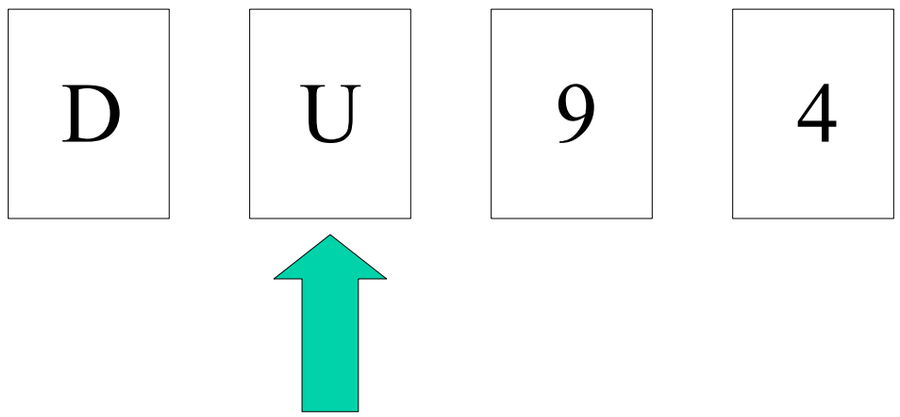


Suppose I claim that the following rule is true.

> If a card has a vowel on one side, it has an even number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

Another Simple Selection Task

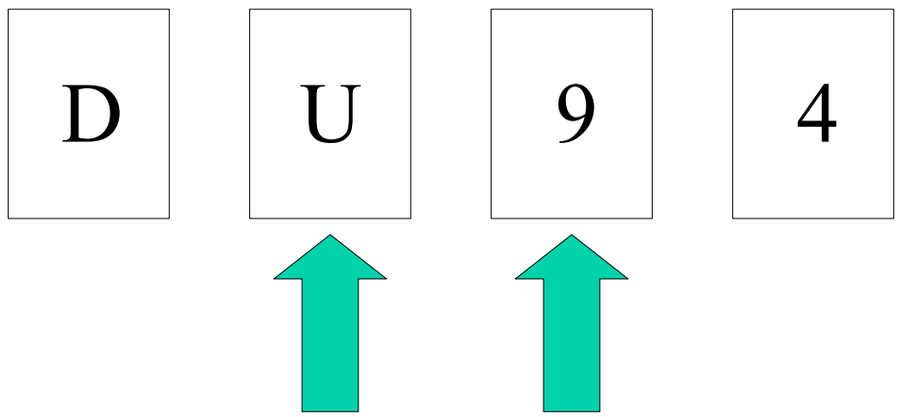


Suppose I claim that the following rule is true.

> If a card has a vowel on one side, it has an even number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

Another Simple Selection Task

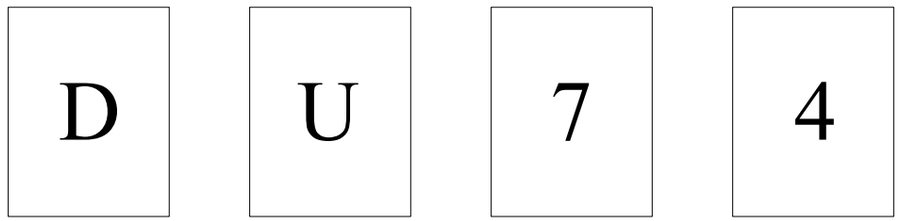


Suppose I claim that the following rule is true.

> If a card has a vowel on one side, it has an even number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

Another Simple Selection Task

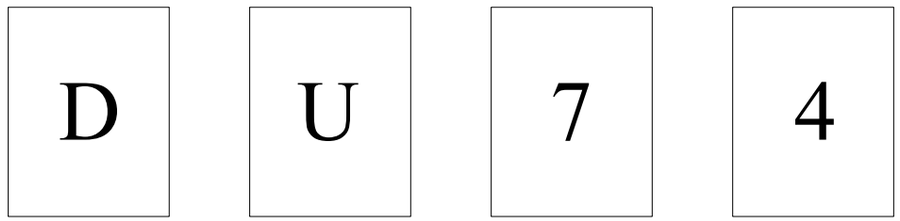


Suppose I claim that the following rule is true.

> If a card has a letter on one side, it has a prime number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

Another Simple Selection Task



Suppose I claim that the following rule is true.

> If a card has a letter on one side, it has a prime number on the other side.

Which card or cards, if any, should you turn over in order to try to efficiently decide whether the rule is true or false?

“NYS 1”

Given the statements

$\neg a \vee \neg b$
b
$c \rightarrow a$

which one of the following statements can you prove?

c
$\neg b$
$\neg c$
h
a
none of the above

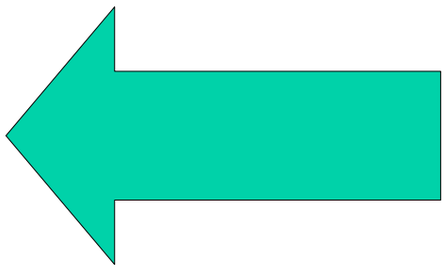
“NYS 1”

Given the statements

¬a ∨ ¬b
b
c → a

which one of the following statements can you prove?

c
¬b
¬c
h
a
none of the above



"NYS 2"

Which one of the following statements is provable from the following statement: "If you are not part of the solution, then you are part of the problem."

If you are part of the solution, then you are not part of the problem.

If you are not part of the problem, then you are part of the solution.

If you are part of the problem, then you are not part of the solution.

If you are not part of the problem, then you are not part of the solution.

"NYS 2"

Which one of the following statements is provable from the following statement: "If you are not part of the solution, then you are part of the problem."

If you are part of the solution, then you are not part of the problem.

If you are not part of the problem, then you are part of the solution.

If you are part of the problem, then you are not part of the solution.

If you are not part of the problem, then you are not part of the solution.

“NYS 3”

Given the statements

¬¬c

c → a

¬a ∨ b

b → d

¬(d ∨ e)

which of the following statements are provable?

¬c

e

h

¬a

all of the above

“NYS 3”

Given the statements

¬¬c

c → a

¬a ∨ b

b → d

¬(d ∨ e)

which of the following statements are provable?

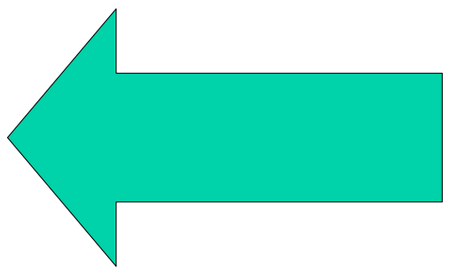
¬c

e

h

¬a

all of the above



The Original King-Ace

Suppose that the following premise is true:

> If there is a king in the hand, then there is an ace in the hand, or else if there isn't a king in the hand, then there is an ace.

What can you infer from this premise?

The Original King-Ace

Suppose that the following premise is true:

> If there is a king in the hand, then there is an ace in the hand, or else if there isn't a king in the hand, then there is an ace.

What can you infer from this premise?

> There is an ace in the hand.

The Original King-Ace

Suppose that the following premise is true:

> If there is a king in the hand, then there is an ace in the hand, or else if there isn't a king in the hand, then there is an ace.

What can you infer from this premise?

> ~~There is an ace in the hand.~~

The Original King-Ace

Suppose that the following premise is true:

> If there is a king in the hand, then there is an ace in the hand, or else if there isn't a king in the hand, then there is an ace.

What can you infer from this premise?

NO! ~~There is an ace in the hand.~~

The Original King-Ace

Suppose that the following premise is true:

> If there is a king in the hand, then there is an ace in the hand, or else if there isn't a king in the hand, then there is an ace.

What can you infer from this premise?

NO! ~~There is an ace in the hand.~~ NO!

The Original King-Ace

Suppose that the following premise is true:

> If there is a king in the hand, then there is an ace in the hand, or else if there isn't a king in the hand, then there is an ace.

What can you infer from this premise?

NO! ~~There is an ace in the hand.~~ NO!

In fact, what you *can* infer is that there *isn't* an ace in the hand!

King-Ace 2

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand; or if there isn't a king in the hand, then there is an ace; but not both of these if-then statements are true.

What can you infer from this premise?

King-Ace 2

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand; or if there isn't a king in the hand, then there is an ace; but not both of these if-then statements are true.

What can you infer from this premise?

There is an ace in the hand.

King-Ace 2

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand; or if there isn't a king in the hand, then there is an ace; but not both of these if-then statements are true.

What can you infer from this premise?

~~There is an ace in the hand.~~

King-Ace 2

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand; or if there isn't a king in the hand, then there is an ace; but not both of these if-then statements are true.

What can you infer from this premise?

NO! ~~There is an ace in the hand.~~

King-Ace 2

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand; or if there isn't a king in the hand, then there is an ace; but not both of these if-then statements are true.

What can you infer from this premise?

NO! ~~There is an ace in the hand.~~ NO!

King-Ace 2

Suppose that the following premise is true:

If there is a king in the hand, then there is an ace in the hand; or if there isn't a king in the hand, then there is an ace; but not both of these if-then statements are true.

What can you infer from this premise?

NO! ~~There is an ace in the hand.~~ NO!

In fact, what you *can* infer is that there *isn't* an ace in the hand!

Informal Proofs/Arguments **vs.** Formal Proofs/Arguments

Informal Proofs/Arguments vs. Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

Informal Proofs/Arguments vs. Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

no ambiguous natural language
(e.g. English or Chinese)

Informal Proofs/Arguments vs. Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

cannot be executed & checked
by a computing machine

no ambiguous natural language
(e.g. English or Chinese)

Informal Proofs/Arguments	vs.	Formal Proofs/Arguments
has ambiguous natural language (e.g. English or Chinese)		no ambiguous natural language (e.g. English or Chinese)
cannot be executed & checked by a computing machine		*can* be executed & checked by a computing machine

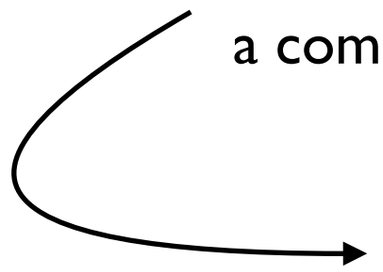
Informal Proofs/Arguments vs. Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

cannot be executed & checked
by a computing machine

no ambiguous natural language
(e.g. English or Chinese)

can be executed & checked by
a computing machine



Informal Proofs/Arguments vs. Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

cannot be executed & checked
by a computing machine

no ambiguous natural language
(e.g. English or Chinese)

can be executed & checked by
a computing machine

HyperSlate®

Informal Proofs/Arguments vs. Formal Proofs/Arguments

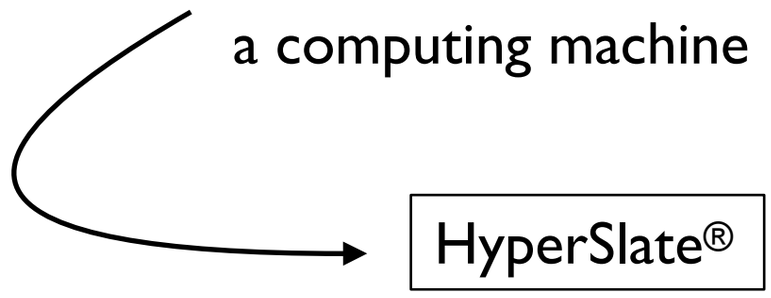
has ambiguous natural language
(e.g. English or Chinese)

cannot be executed & checked
by a computing machine

supposed to have learned
how to produce, to an
appreciable degree, in High
School — but likely didn't

no ambiguous natural language
(e.g. English or Chinese)

can be executed & checked by
a computing machine



Informal Proofs/Arguments vs. Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

cannot be executed & checked
by a computing machine

supposed to have learned
how to produce, to an
appreciable degree, in High
School — but likely didn't

no ambiguous natural language
(e.g. English or Chinese)

can be executed & checked by
a computing machine

HyperSlate®

have not learned how to
produce in a relevant
system (though may have
had some Prolog)

FOR NOW

Informal Proofs/Arguments vs. Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

cannot be executed & checked
by a computing machine

supposed to have learned
how to produce, to an
appreciable degree, in High
School — but likely didn't

no ambiguous natural language
(e.g. English or Chinese)

can be executed & checked by
a computing machine

HyperSlate®

have not learned how to
produce in a relevant
system (though may have
had some Prolog)

FOR NOW

STARTING ≥ 1/26/23

Informal Proofs/Arguments

vs.

Formal Proofs/Arguments

has ambiguous natural language
(e.g. English or Chinese)

cannot be executed & checked
by a computing machine

supposed to have learned
how to produce, to an
appreciable degree, in High
School — but likely didn't

no ambiguous natural language
(e.g. English or Chinese)

can be executed & checked by
a computing machine

HyperSlate®

have not learned how to
produce in a relevant
system (though may have
had some Prolog)

King-Ace Solved

(informal proof)

Proposition: There is *not* an ace in the hand.

Proof: We know that at least one of the if-thens (i.e., at least one of the **conditionals**) is false. So we have two cases to consider, viz., that *K* => *A* is false, and that ¬*K* => *A* is false. Take first the first case; accordingly, suppose that *K* => *A* is false. Then it follows that *K* is true (since when a conditional is false, its antecedent holds but its consequent doesn't), and *A* is false. Now consider the second case, which consists in ¬*K* => *A* being false. Here, in a direct parallel, we know ¬*K* and, once again, ¬*A*. In both of our two cases, which are exhaustive, there is no ace in the hand. The proposition is established. **QED**

Bringsjord 1

(1) The following three assertions are either all true or all false:

If Billy helped, Doreen helped.

If Doreen helped, Frank did as well.

If Frank helped, so did Emma.

(2) The following assertion is definitely true: Billy helped.

Can it be inferred from (1) and (2) that Emma helped?

Bringsjord 1

(1) The following three assertions are either all true or all false:

If Billy helped, Doreen helped.

If Doreen helped, Frank did as well.

If Frank helped, so did Emma.

(2) The following assertion is definitely true: Billy helped.

Can it be inferred from (1) and (2) that Emma helped?

YUP! — & now prove it!

Bringsjord 1: Proof

Proof: We have two cases to work from: when the conditionals in (1) are all true, and when they are all false. (In both cases, (2) remains true, and available.) So assume Case 1 first. In this case, we can simply chain through the conditionals by repeated application of *modus ponens* to arrive at the conclusion that Emma helped. Now assume Case 2 holds. This immediately implies that the first two conditionals are false; i.e., we have ~(B =>D) and ~(D => F). Recalling that a conditional fails to hold exactly when its antecedent is true while its consequent is false, we have, in turn: B & ~D, and D & ~F. But then we have a contradiction, viz. ~D & D. Since everything follows ("explosively"!) from a contradiction, we are done. **QED**

Har du lyktes med alle?