Rigorously & “Brainishly” Speaking, What are We?

Bringsjord v. Granger

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Intro to Logic-based AI (ILBAI)
12/08/2025

RAIR
Rensselaer AI and Reasoning Lab

version Dec 8 2025 for ILBAI F25

Logistics; Submission Info (Final Projects)

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- Grades: Everyone has an A for 40% (Required) — but finish if it's open for you. 20% A if you came/come :). Gift of 20% for everyone. = 80% A = 4.0.

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- Questions? Adjustments/updates Final Projects?

Possible Last-Minute Paper

(Review *k*-order ladder: iPad)

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(Review *k*-order ladder: iPad)

Does $\mathscr{L}_3 =$ TOL work in HyperSlate? Partially? Not at all? What's possible and what's not? What exactly is needed inference-rule-wise for a full natural-deduction system for TOL. Can a chatbot like GPT-5 preview etc. handle TOL reasoning challenges expressed in English? What specimens do you have for your answer?

AI & The News …

AI & The News (relating to today's topics)

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Google DeepMind CEO Demis Hassabis says AI scaling 'must be pushed to the maximum'

By Lakshmi Varanasi + Follow

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Dec 7, 2025, 5:47 PM ET

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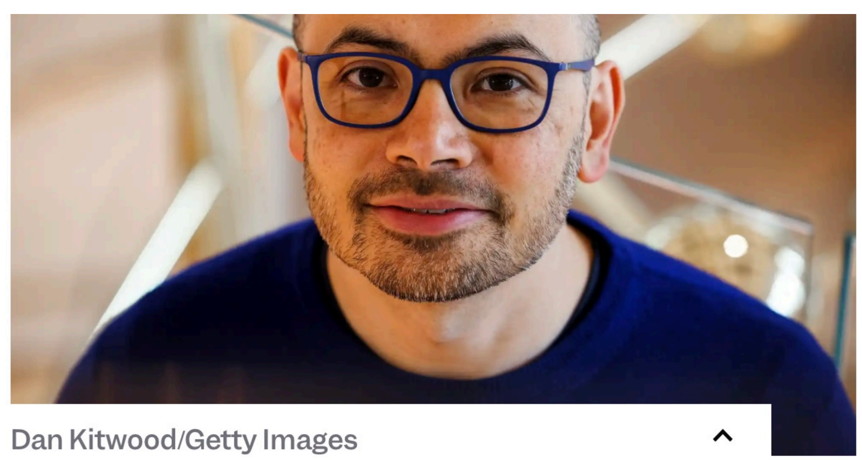

Dan Kitwood/Getty Images

Dec 7, 2025, 5:47 PM ET

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https://www.youtube.com/watch?v=36OBX5IQjGc

Does Reinforcement Learning Really Incentivize Reasoning Capacity in LLMs Beyond the Base Model?

Yang Yue, Zhiqi Chen, Rui Lu, Andrew Zhao, Zhaokai Wang, Yang Yue, Shiji Song, Gao Huang

Published: 18 Sep 2025, Last Modified: 28 Oct 2025 NeurIPS 2025 oral Everyone Revisions BibTeX

Keywords: reinforcement learning with verifiable reward, LLM reasoning

TL;DR: We systematically examine the current state of RLVR and surprisingly find that it does not elicit fundamentally new reasoning patterns—revealing a gap between the potential of RL and the actual impact of current RLVR methods.

Abstract:
Reinforcement Learning with Verifiable Rewards (RLVR) has recently demonstrated notable success in enhancing the reasoning performance of large language models (LLMs), particularly in mathematics and programming tasks. It is widely believed that, similar to how traditional RL helps agents to explore and learn new strategies, RLVR enables LLMs to continuously self-improve, thus acquiring novel reasoning abilities that exceed the capacity of the corresponding base models. In this study, we take a critical look at \textit{the current state of RLVR} by systematically probing the reasoning capability boundaries of RLVR-trained LLMs across diverse model families, RL algorithms, and math/coding/visual reasoning benchmarks, using pass@\textit{k} at large \textit{k} values as the evaluation metric. While RLVR improves sampling efficiency towards the correct path, we surprisingly find that current training does \emph{not} elicit fundamentally new reasoning patterns. We observe that while RLVR-trained models outperform their base models at smaller values of k (\eg, k=1), base models achieve higher pass@k score when k is large. Moreover, we observe that the reasoning capability boundary of LLMs often narrows as RLVR training progresses. Further coverage and perplexity analysis shows that the reasoning paths generated by RLVR models are already included in the base models' sampling distribution, suggesting that their reasoning abilities originate from and are \textit{bounded} by the base model. From this perspective, treating the base model as an upper bound, our quantitative analysis shows that six popular RLVR algorithms perform similarly and remain far from optimal in fully leveraging the potential of the base model. In contrast, we find that distillation can introduce new reasoning patterns from the teacher and genuinely expand the model's reasoning capabilities. Taken together, our findings suggest that current RLVR methods have not fully realized the potential of RL to elicit genuinely novel reasoning abilities in LLMs. This underscores the need for improved RL paradigms—such as continual scaling and multi-turn agent-environment interaction—to unlock this potential.

Roots of the Debate

Theoretical Computer Science 633 (2016) 100–111

Contents lists available at ScienceDirect

Theoretical Computer Science

www.elsevier.com/locate/tcs

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Received 8 November 2015
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http://dx.doi.org/10.1016/j.tcs.2016.03.021

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    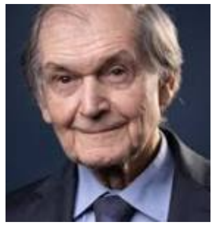

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Theoretical Computer Science 317 (2004) 167–190

Theoretical Computer Science

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The modal argument for hypercomputing minds

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Received 14 July 2003; received in revised form 21 October 2003

Abstract

We now know both that hypercomputation (or super-recursive computation) is mathematically well-understood, and that it provides a theory that according to some accounts for some real-life computation (e.g., operating systems that, unlike Turing machines, never simply output an answer and halt) better than the standard theory of computation at and below the "Turing Limit." But one of the things we do not know is whether the human mind hypercomputes, or merely computes—this despite informal arguments from Gödel, Lucas, Penrose and others for the view that, in light of incompleteness theorems, the human mind has powers exceeding those of TMs and their equivalents. All these arguments fail; their fatal flaws have been repeatedly exposed in the literature. However, we give herein a novel, formal *modal* argument showing that since it's mathematically *possible* that human minds are hypercomputers, such minds *are* in fact hypercomputers. We take considerable pains to anticipate and rebut objections to this argument.

Keywords: Computationalism; Hypercomputation; Incompleteness theorems

1. Introduction

Four decades ago, Lucas [50] expressed supreme confidence that Gödel's first incompleteness theorem (= Gödel I) entails the falsity of computationalism, the view that human persons are computing machines (e.g., Turing machines). Put barbarically, Lucas' basic idea is that minds are more powerful than Turing machines. Today, given our understanding of hypercomputation in theoretical computer science, and given the absolute consensus reigning in cognitive science that the human mind is, at least in large part, *some* sort of information-processing device, we know enough to infer that if Lucas is right, the mind is a hypercomputer. However, Lucas' arguments have

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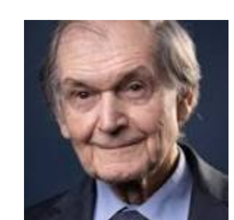
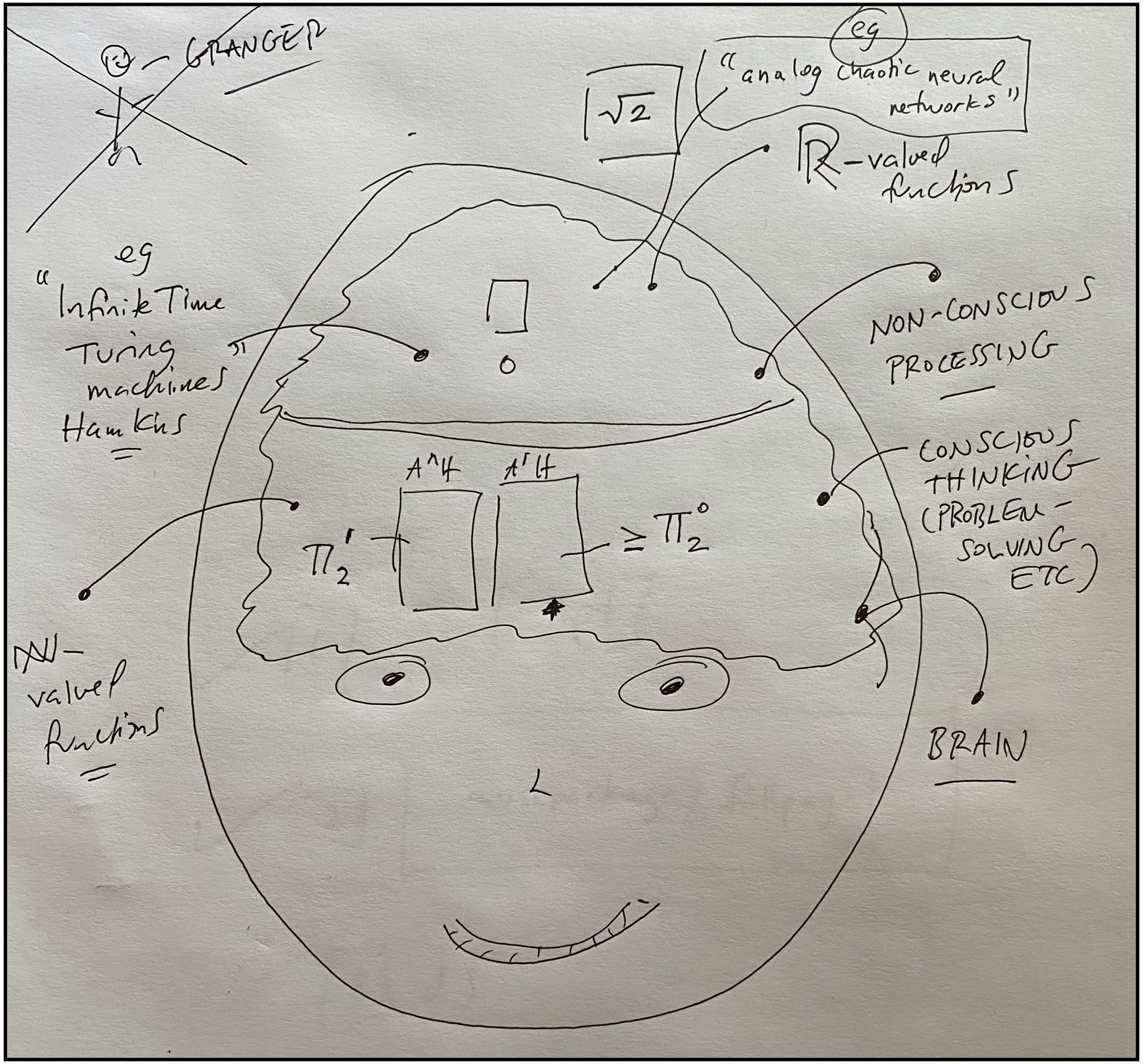
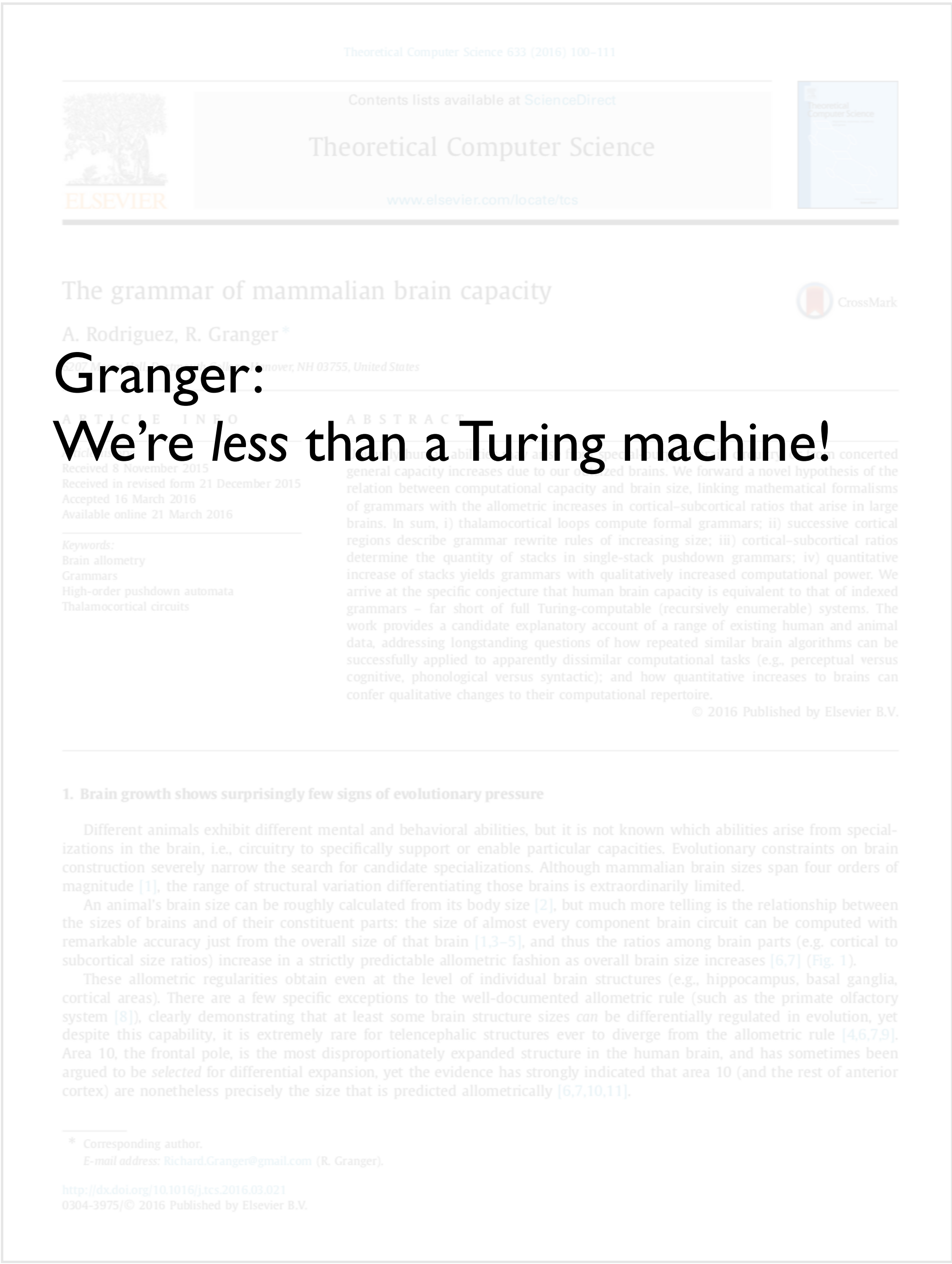
doi:10.1016/j.tcs.2003.12.010




GRANGER
eg
"analog chaotic neural networks"
√2
ℝ-valued functions
eg
"Infinite Time Turing machines"
Hamkins
NON-CONSCIOUS PROCESSING
CONSCIOUS THINKING (PROBLEM-SOLVING ETC)
ℕ-valued functions
BRAIN

Some Roots of the Debate



Theoretical Computer Science 631 (2016) 100–111

Contents lists available at ScienceDirect

Theoretical Computer Science

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The grammar of mammalian brain capacity

A. Rodriguez, R. Granger *

Received 8 November 2015
Received in revised form 21 December 2015
Accepted 16 March 2016
Available online 21 March 2016

Keywords:
Brain allometry
Grammars
High-order pushdown automata
Thalamocortical circuits

general capacity increases due to our ... brains. We forward a novel hypothesis of the relation between computational capacity and brain size, linking mathematical formalisms of grammars with the allometric increases in cortical-subcortical ratios that arise in large brains. In sum, i) thalamocortical loops compute formal grammars; ii) successive cortical regions describe grammar rewrite rules of increasing size; iii) cortical-subcortical ratios determine the quantity of stacks in single-stack pushdown grammars; iv) quantitative increase of stacks yields grammars with qualitatively increased computational power. We arrive at the specific conjecture that human brain capacity is equivalent to that of indexed grammars – far short of full Turing-computable (recursively enumerable) systems. The work provides a candidate explanatory account of a range of existing human and animal data, addressing longstanding questions of how repeated similar brain algorithms can be successfully applied to apparently dissimilar computational tasks (e.g., perceptual versus cognitive, phonological versus syntactic); and how quantitative increases to brains can confer qualitative changes to their computational repertoire.

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1. Brain growth shows surprisingly few signs of evolutionary pressure

Different animals exhibit different mental and behavioral abilities, but it is not known which abilities arise from specializations in the brain, i.e., circuitry to specifically support or enable particular capacities. Evolutionary constraints on brain construction severely narrow the search for candidate specializations. Although mammalian brain sizes span four orders of magnitude [1], the range of structural variation differentiating those brains is extraordinarily limited.

An animal's brain size can be roughly calculated from its body size [2], but much more telling is the relationship between the sizes of brains and of their constituent parts: the size of almost every component brain circuit can be computed with remarkable accuracy just from the overall size of that brain [1,3–5], and thus the ratios among brain parts (e.g. cortical to subcortical size ratios) increase in a strictly predictable allometric fashion as overall brain size increases [6,7] (Fig. 1).

These allometric regularities obtain even at the level of individual brain structures (e.g., hippocampus, basal ganglia, cortical areas). There are a few specific exceptions to the well-documented allometric rule (such as the primate olfactory system [8]), clearly demonstrating that at least some brain structure sizes *can* be differentially regulated in evolution, yet despite this capability, it is extremely rare for telencephalic structures ever to diverge from the allometric rule [4,6,7,9]. Area 10, the frontal pole, is the most disproportionately expanded structure in the human brain, and has sometimes been argued to be *selected* for differential expansion, yet the evidence has strongly indicated that area 10 (and the rest of anterior cortex) are nonetheless precisely the size that is predicted allometrically [6,7,10,11].

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http://dx.doi.org/10.1016/j.tcs.2016.03.021
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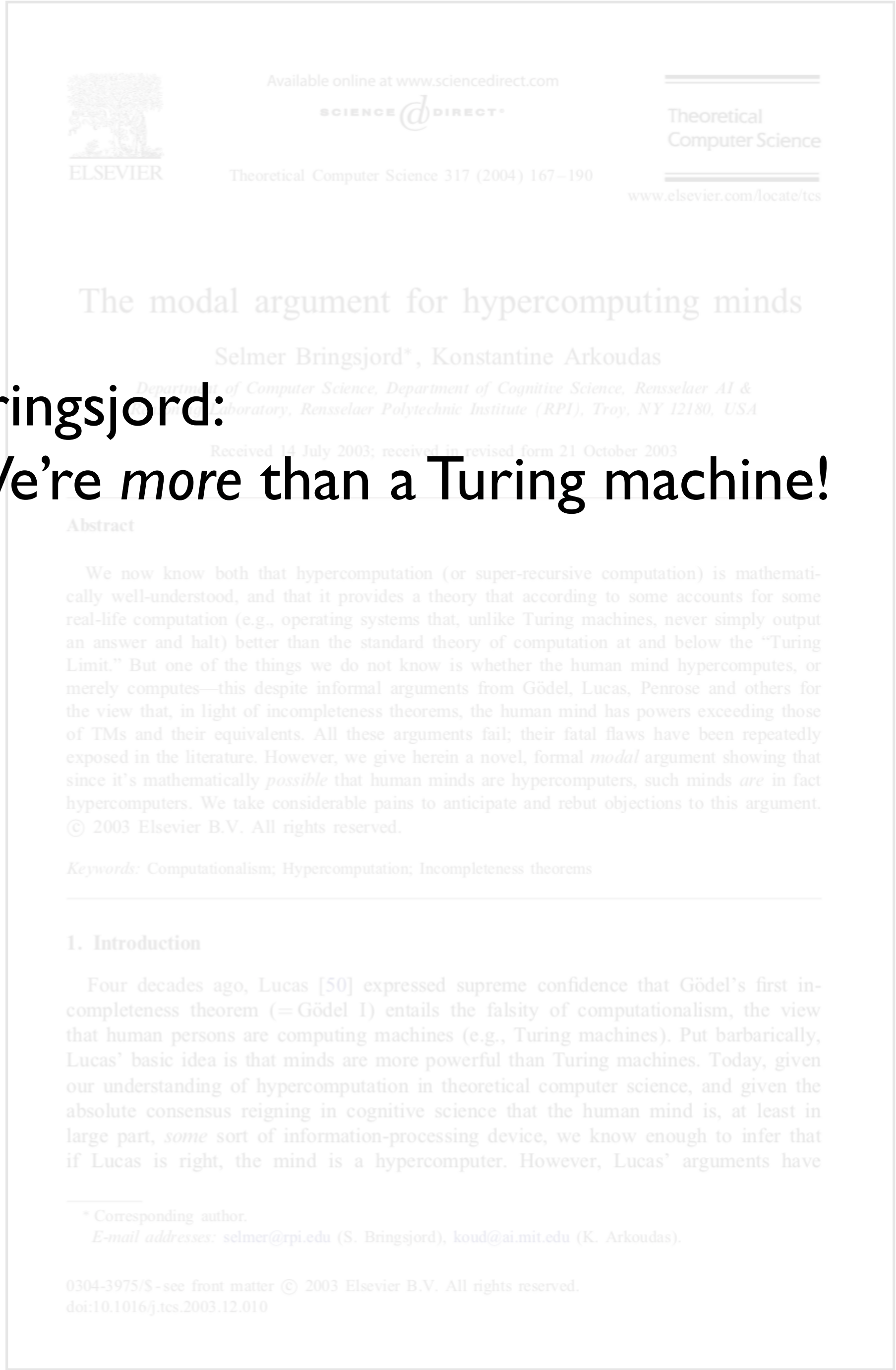
Granger:
We're *less* than a Turing machine!



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Theoretical Computer Science 317 (2004) 167–190

Theoretical Computer Science

www.elsevier.com/locate/tcs

The modal argument for hypercomputing minds

Selmer Bringsjord*, Konstantine Arkoudas

Received 11 July 2003; received in revised form 21 October 2003

Abstract

We now know both that hypercomputation (or super-recursive computation) is mathematically well-understood, and that it provides a theory that according to some accounts for some real-life computation (e.g., operating systems that, unlike Turing machines, never simply output an answer and halt) better than the standard theory of computation at and below the "Turing Limit." But one of the things we do not know is whether the human mind hypercomputes, or merely computes—this despite informal arguments from Gödel, Lucas, Penrose and others for the view that, in light of incompleteness theorems, the human mind has powers exceeding those of TMs and their equivalents. All these arguments fail; their fatal flaws have been repeatedly exposed in the literature. However, we give herein a novel, formal *modal* argument showing that since it's mathematically *possible* that human minds are hypercomputers, such minds *are* in fact hypercomputers. We take considerable pains to anticipate and rebut objections to this argument.
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Keywords: Computationalism; Hypercomputation; Incompleteness theorems

1. Introduction

Four decades ago, Lucas [50] expressed supreme confidence that Gödel's first incompleteness theorem (= Gödel I) entails the falsity of computationalism, the view that human persons are computing machines (e.g., Turing machines). Put barbarically, Lucas' basic idea is that minds are more powerful than Turing machines. Today, given our understanding of hypercomputation in theoretical computer science, and given the absolute consensus reigning in cognitive science that the human mind is, at least in large part, *some* sort of information-processing device, we know enough to infer that if Lucas is right, the mind is a hypercomputer. However, Lucas' arguments have

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doi:10.1016/j.tcs.2003.12.010

Bringsjord:
We're *more* than a Turing machine!

Fatal Objection?

I can simulate a logic machine that's at least a Turing machine … e.g. by simulating some of what `o1 preview` provides me. Let's explore for SOL …

LOGIC MACHINES AND DIAGRAMS

Martin Gardner

McGRAW-HILL BOOK COMPANY, INC.
New York Toronto London 1958

Unlucky Timing + Lack of Understanding

9: The Future of Logic Machines

The ease with which formal logics can be translated into electric circuits leaves little doubt that we are entering a period in the history of logic that will witness a steady development in the construction of more powerful and versatile electrically operated machines. This does not mean that the nonelectrical logic device has reached any state of near perfection. The few that have been constructed are obviously crude models, and there are probably all kinds of ways in which compact little logic machines, operating along mechanical lines, can be designed. But the power of such devices is so limited that attempts to invent better ones will likely be rare and undertaken only in a recreational spirit. The most exciting, as well as the most potentially useful area of exploration will undoubtedly be in the electrical and electronic direction.

Electrical syllogism machines are so easily constructed and their uselessness so apparent that it is unlikely much thought will be given to improving them. The few that have been built are almost devoid of theoretical interest because their circuits bear no formal analogy to the logical structure of the syllogism. For classroom purposes it should be possible, however, to construct a class logic machine that would have such formal analogy, and it is surprising that this has not, to my knowledge, been attempted. Such a machine would not be confined to the traditional *S, M, P* labels, with their limited premises and conclusions. It would take care of many more variables,

and these could be applied to the terms of any number of class-inclusion statements. When such statements were fed to the machine it would show at once all the valid inferences that could be drawn. Such a machine would have a network structure analogous to the topological properties of the Venn circles. There is of course such an analogy in the network of propositional calculus machines, since the underlying structure of class and propositional logic is the same; but the truth-value machines are not designed primarily for class logic and a great deal of awkward translation has to take place before such machines can handle even simple syllogisms with particular statements. It should not be difficult to construct electrical machines designed specifically for class logic, and perhaps capable (like the Stanhope demonstrator) of handling statements involving "most," as well as statements with numerical quantifiers.

In the field of the propositional calculus, a great deal of experimental work is now going on. We can reasonably expect that simpler, more efficient, more powerful machines of this type will be devised in the near future. Will such machines have any practical uses? D. G. Prinz and J. B. Smith (in their chapter on logic machines in the anthology *Faster Than Thought,* edited by B. V. Bowden, 1953) suggest the following areas in which logic computers may some day be put to use: checking the consistency of legal documents, rule books of various sorts, and political policy statements; checking signal operations at railway junctions; preparing complex time schedules for university classes, plane landings at an airport, and so on. The rapidly growing field of "operations research" is riddled with problems for which logic machines may prove helpful. Edmund C. Berkeley, in his description of the Kalin-Burkhart machine (*Giant Brains,* 1949, Chapter 9), gives a complicated problem involving insurance coverage and shows how quickly it can be solved on the machine. Although none of these areas has so far grown complex enough to justify the frequent use of logic calculators, it may be that the employment of such devices will come with increasing complexity and may even be a factor in making such an increase possible.

It is amusing to speculate on what might happen to speculative philosophy if progress in semantics should some day permit the symbolic codification of systems of metaphysics. Fed with the required axioms and factual data, a machine might then examine the

Unlucky Timing + Lack of Understanding

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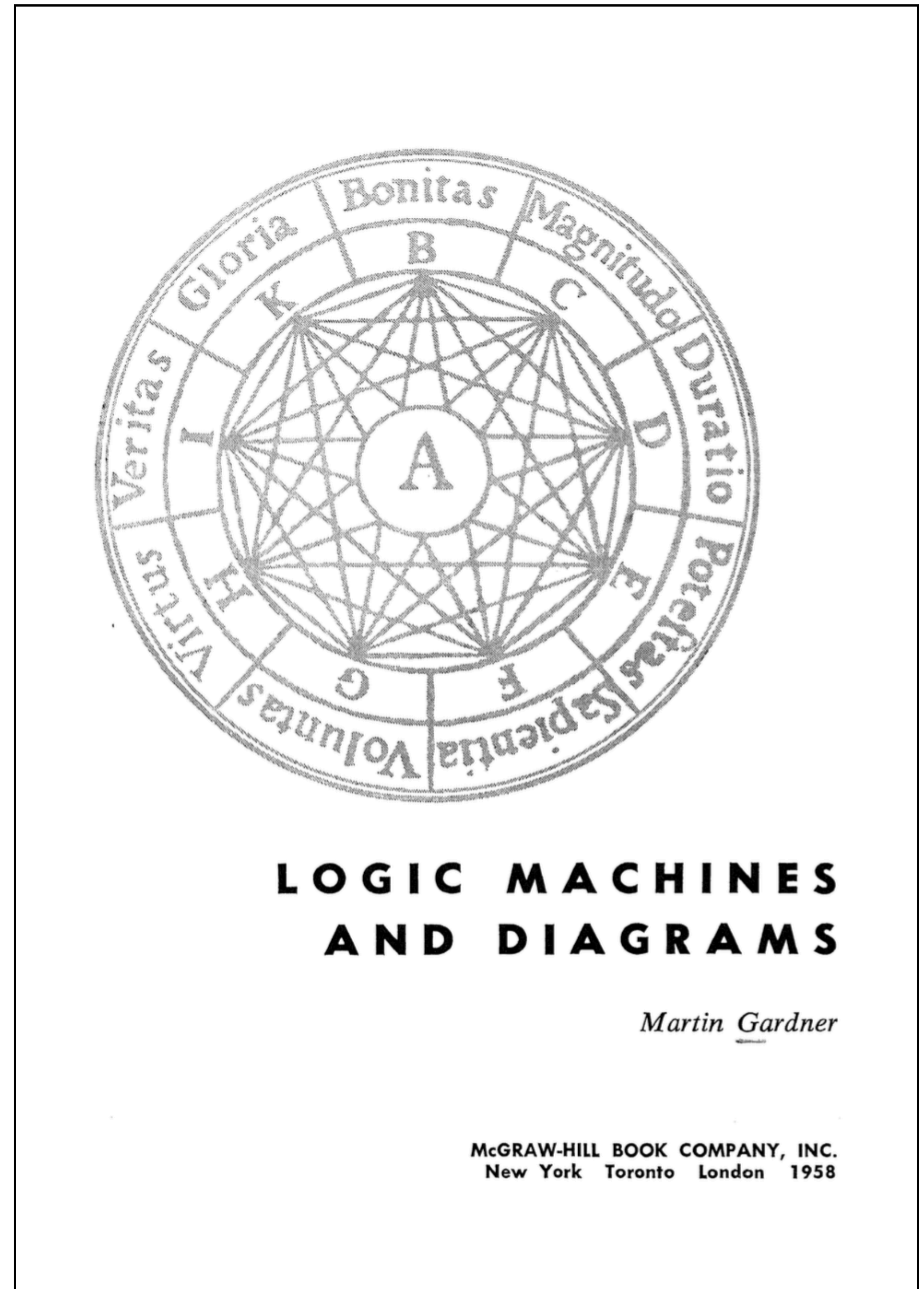

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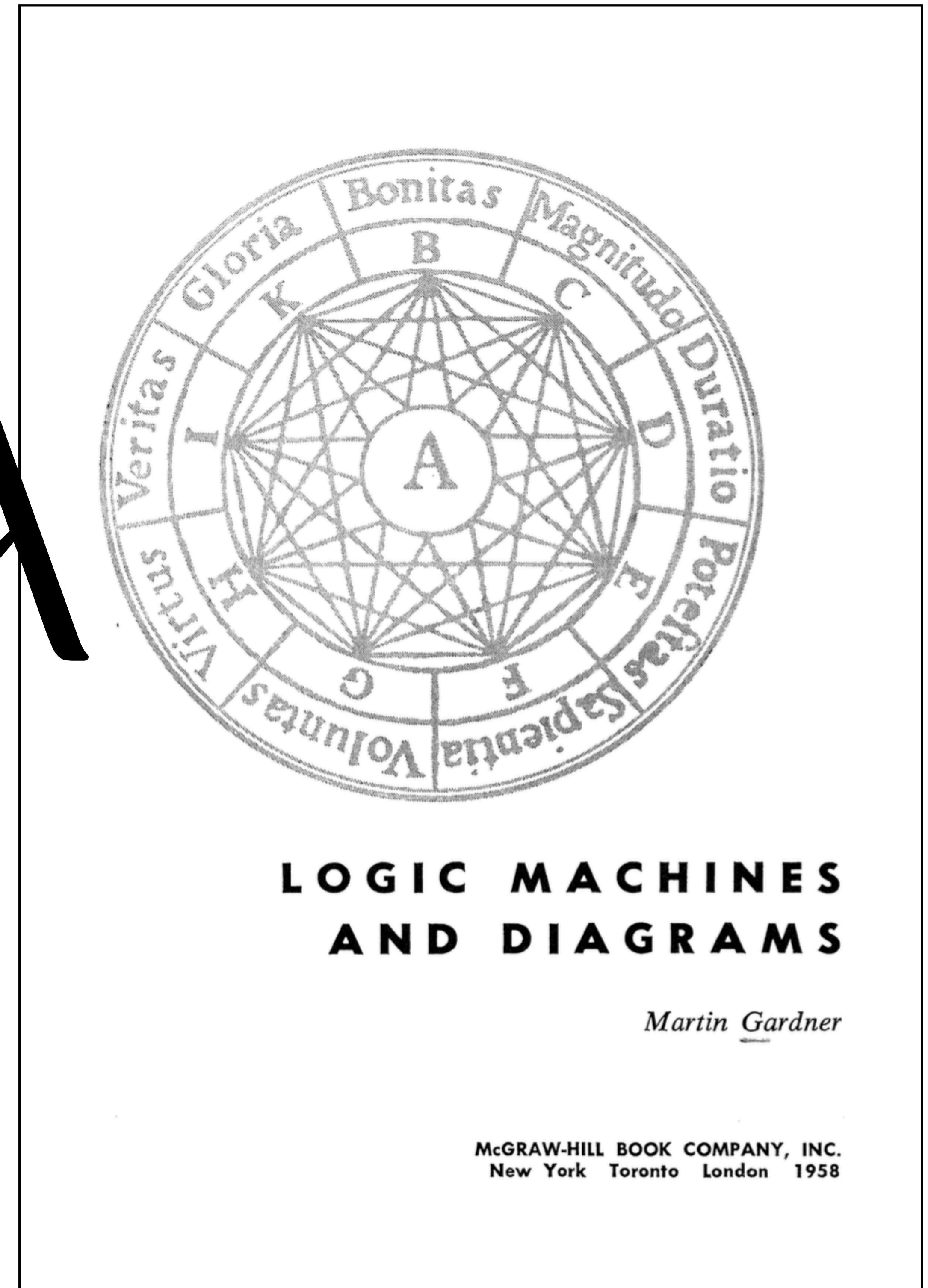

LOGIC MACHINES AND DIAGRAMS

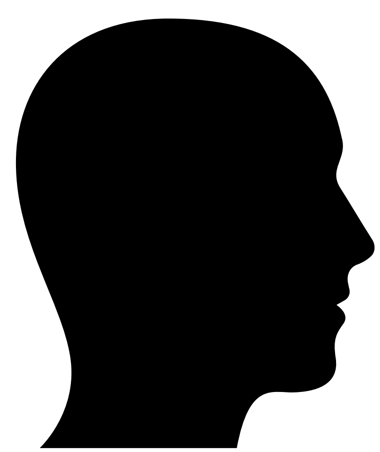
Martin Gardner

McGRAW-HILL BOOK COMPANY, INC.
New York Toronto London 1958

Unlucky Timing + Lack of Understanding

$$\lambda$$

Human Cognitive Reality



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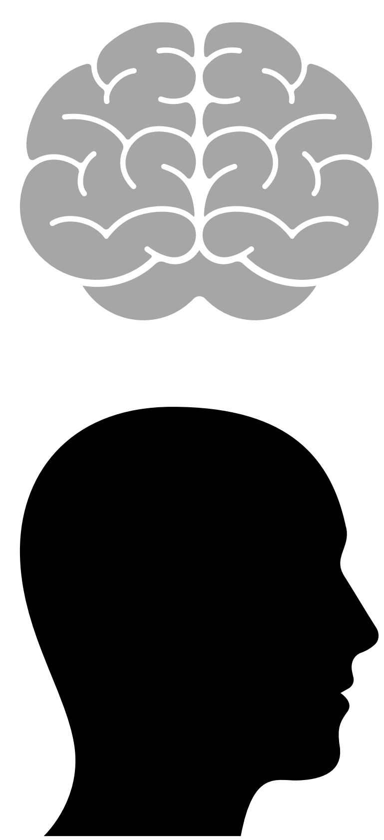

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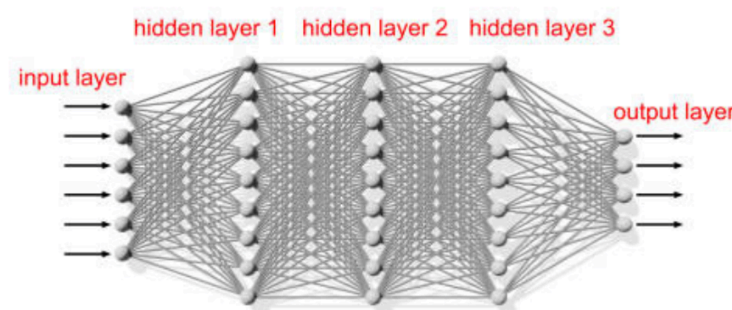
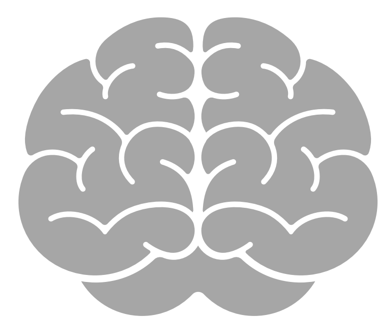
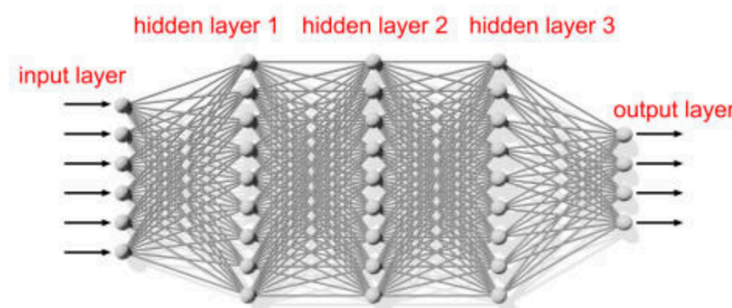
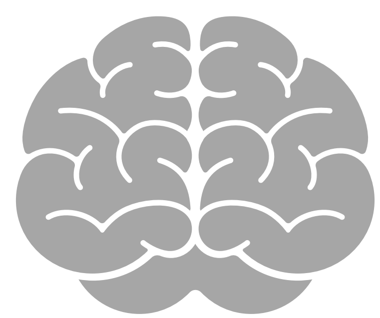


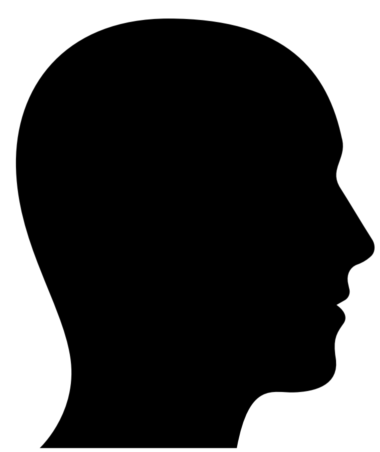


Human Cognitive Reality

innate and distinctive: $\iota\ \mathscr{L}_3 + \iota\ \mu\mathscr{L}_3 +$ *art d’infaillibilité*







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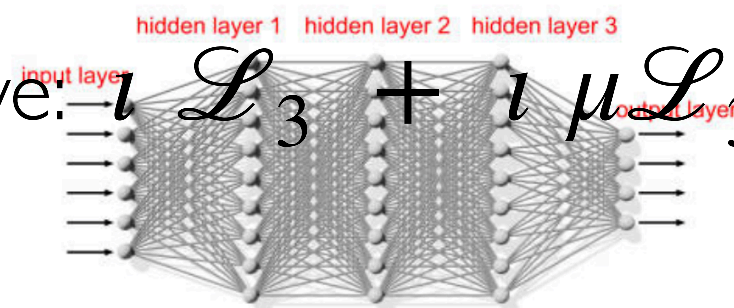

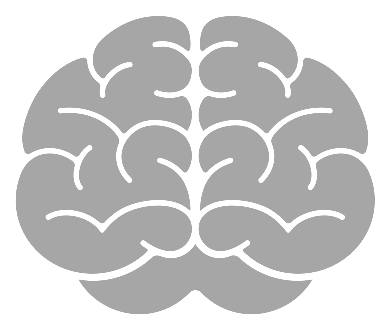

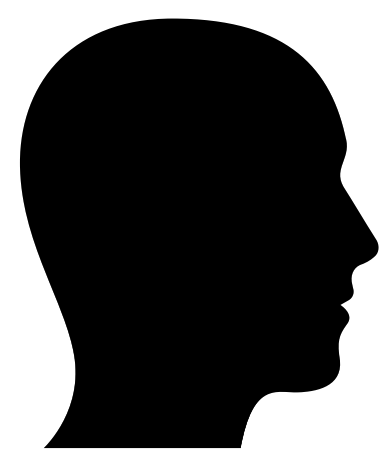

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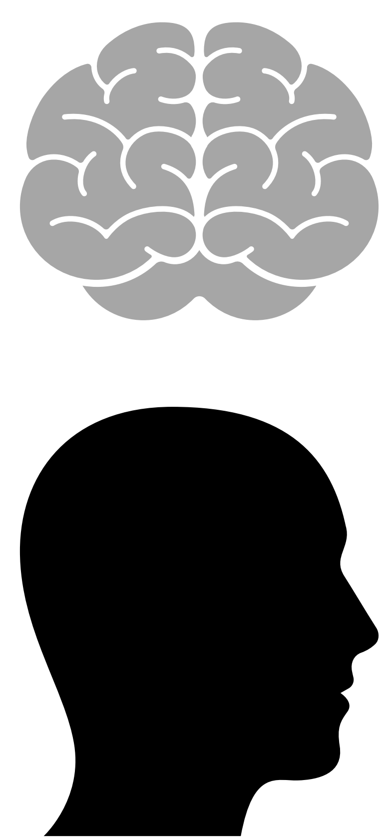

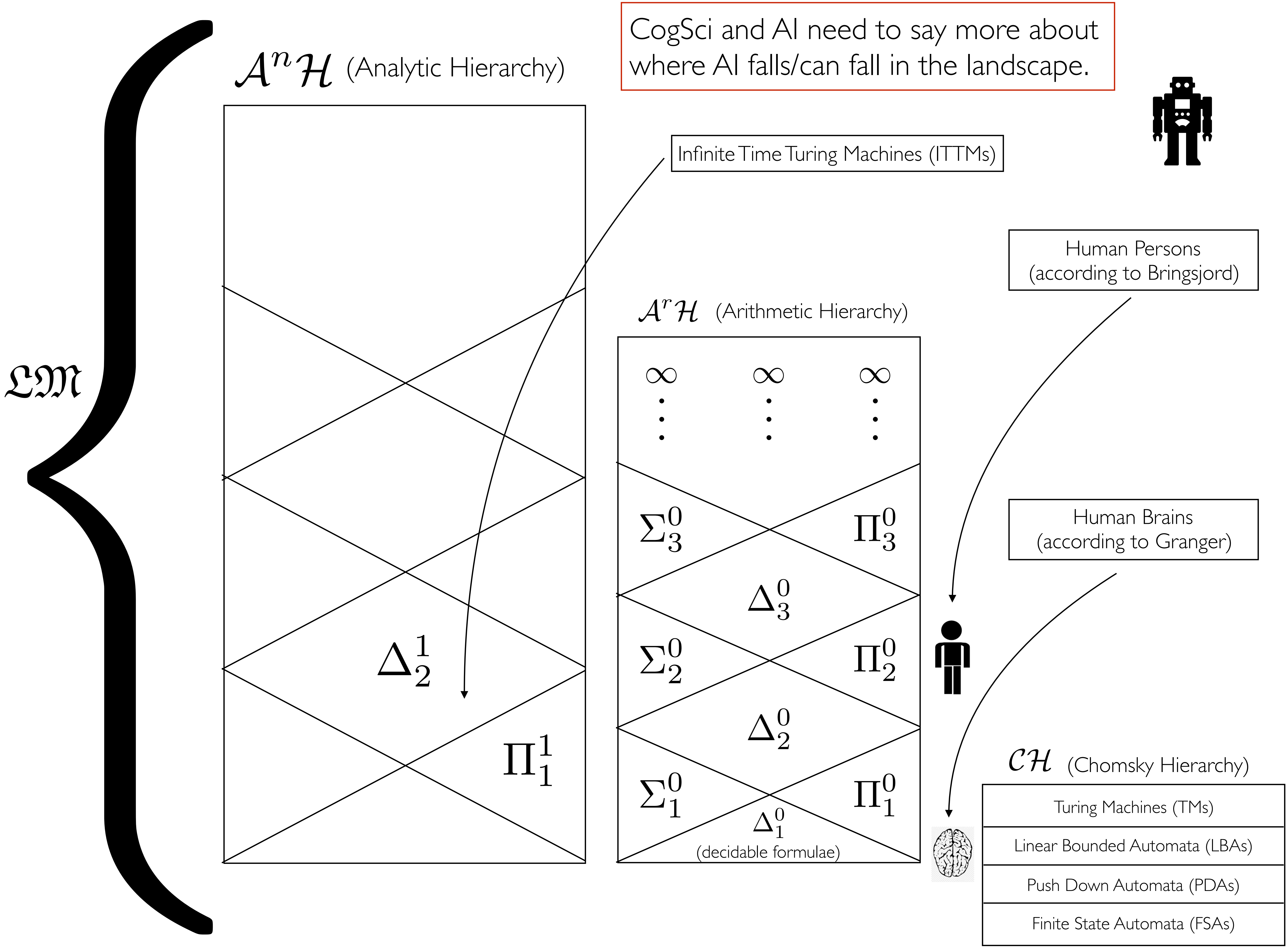
CogSci and AI need to say more about where AI falls/can fall in the landscape.
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(decidable formulae)
Human Persons (according to Bringsjord)
Human Brains (according to Granger)
$\mathcal{CH}$ (Chomsky Hierarchy)
Turing Machines (TMs)
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Push Down Automata (PDAs)
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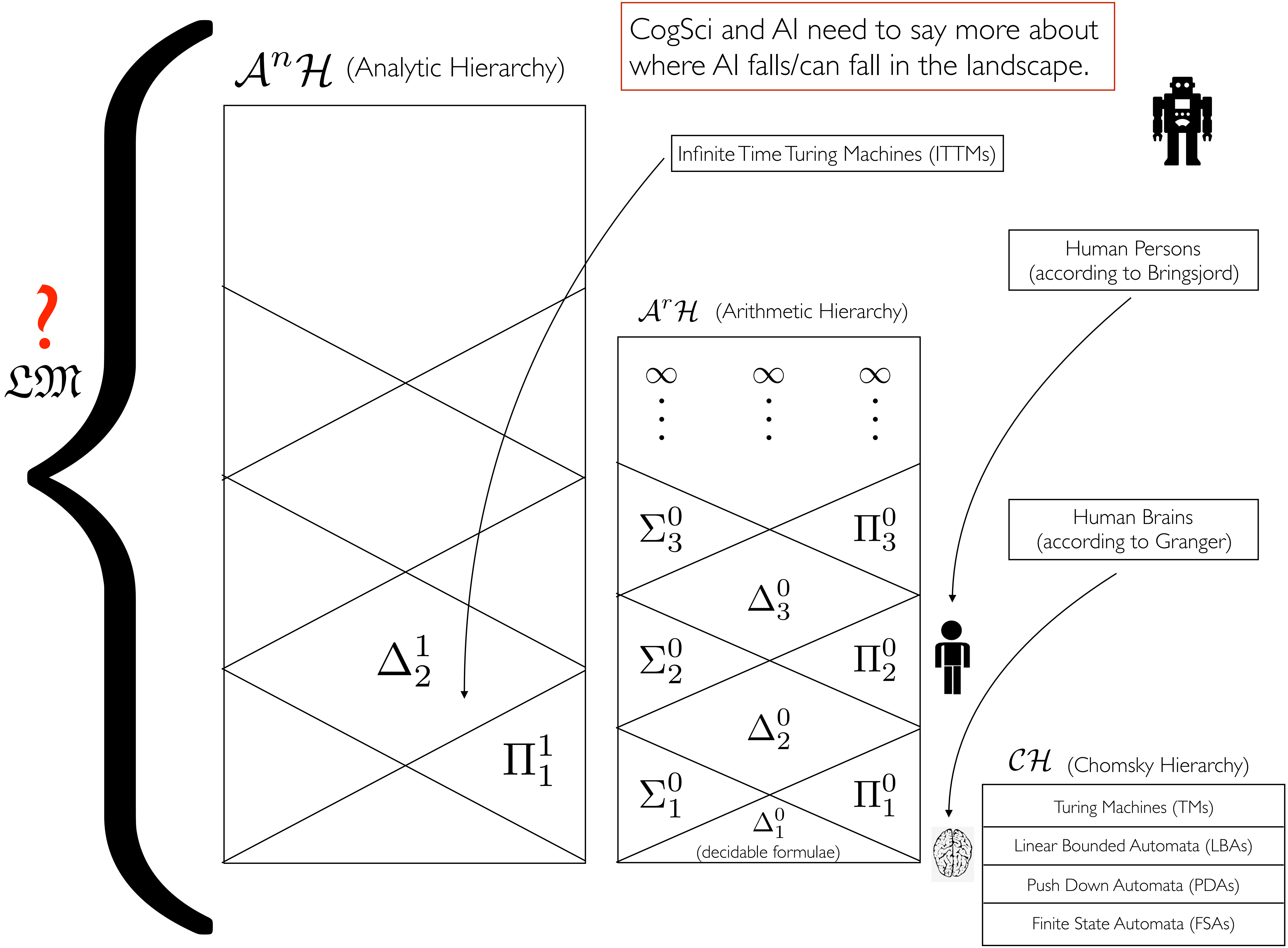
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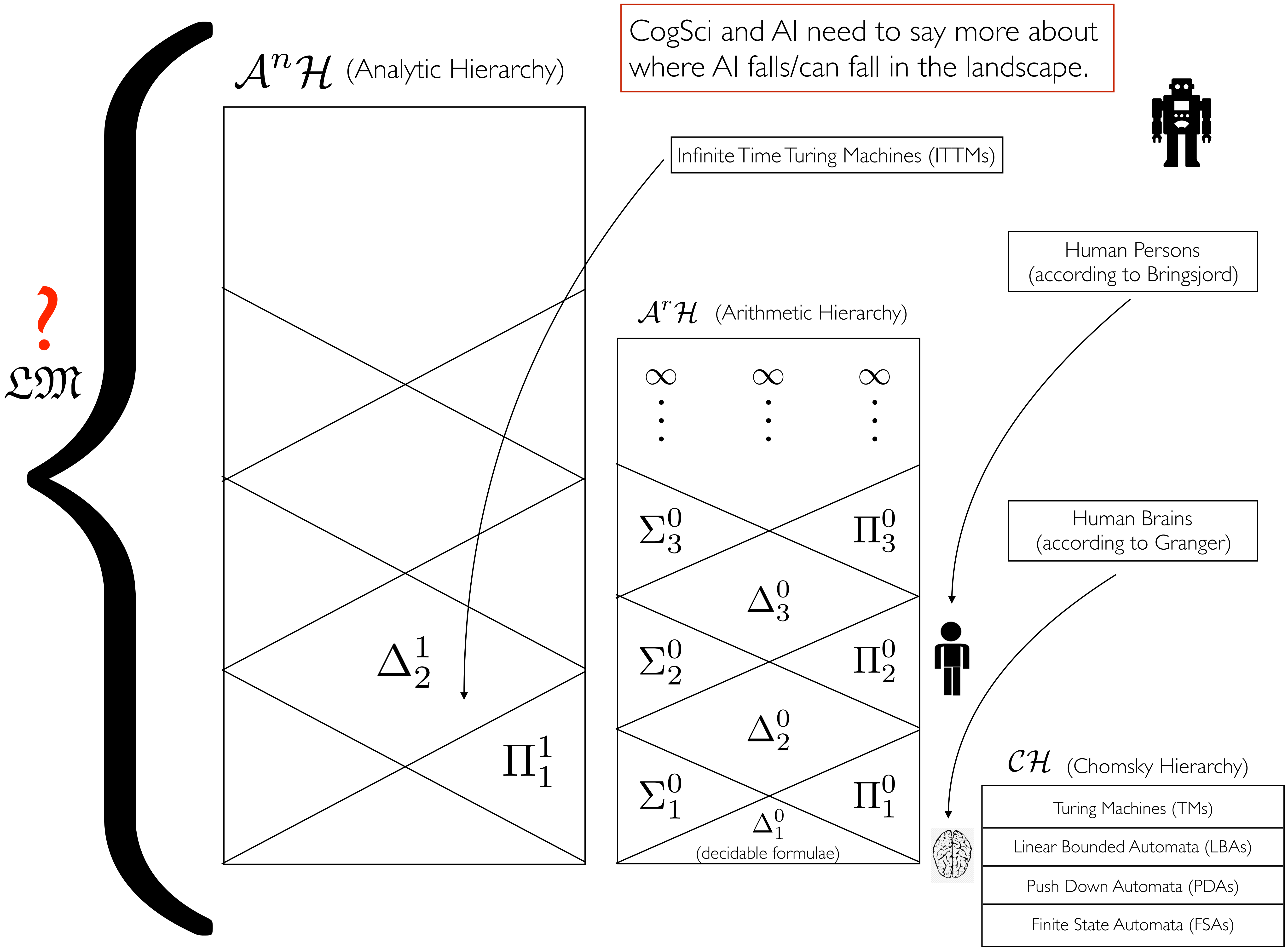

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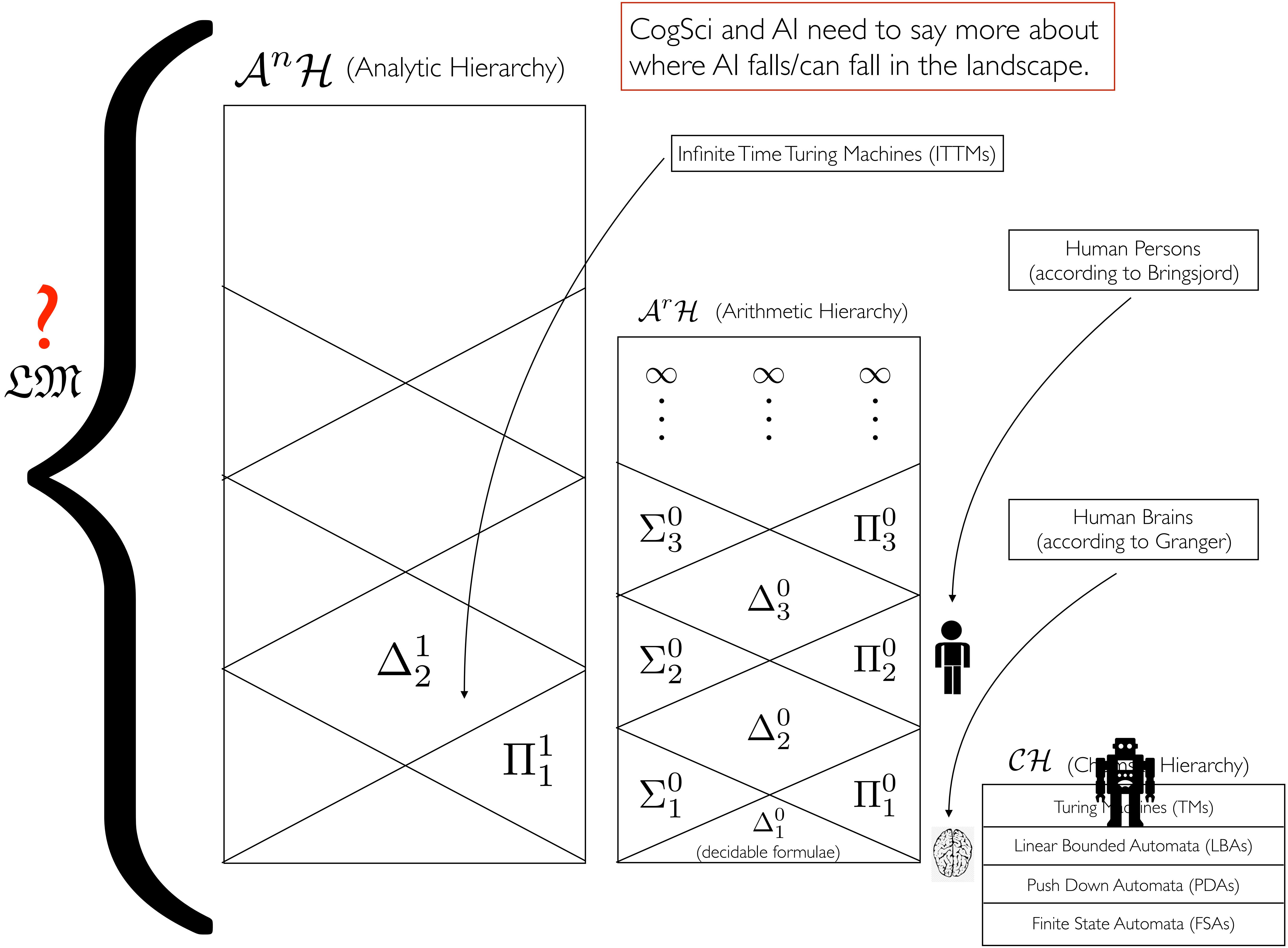

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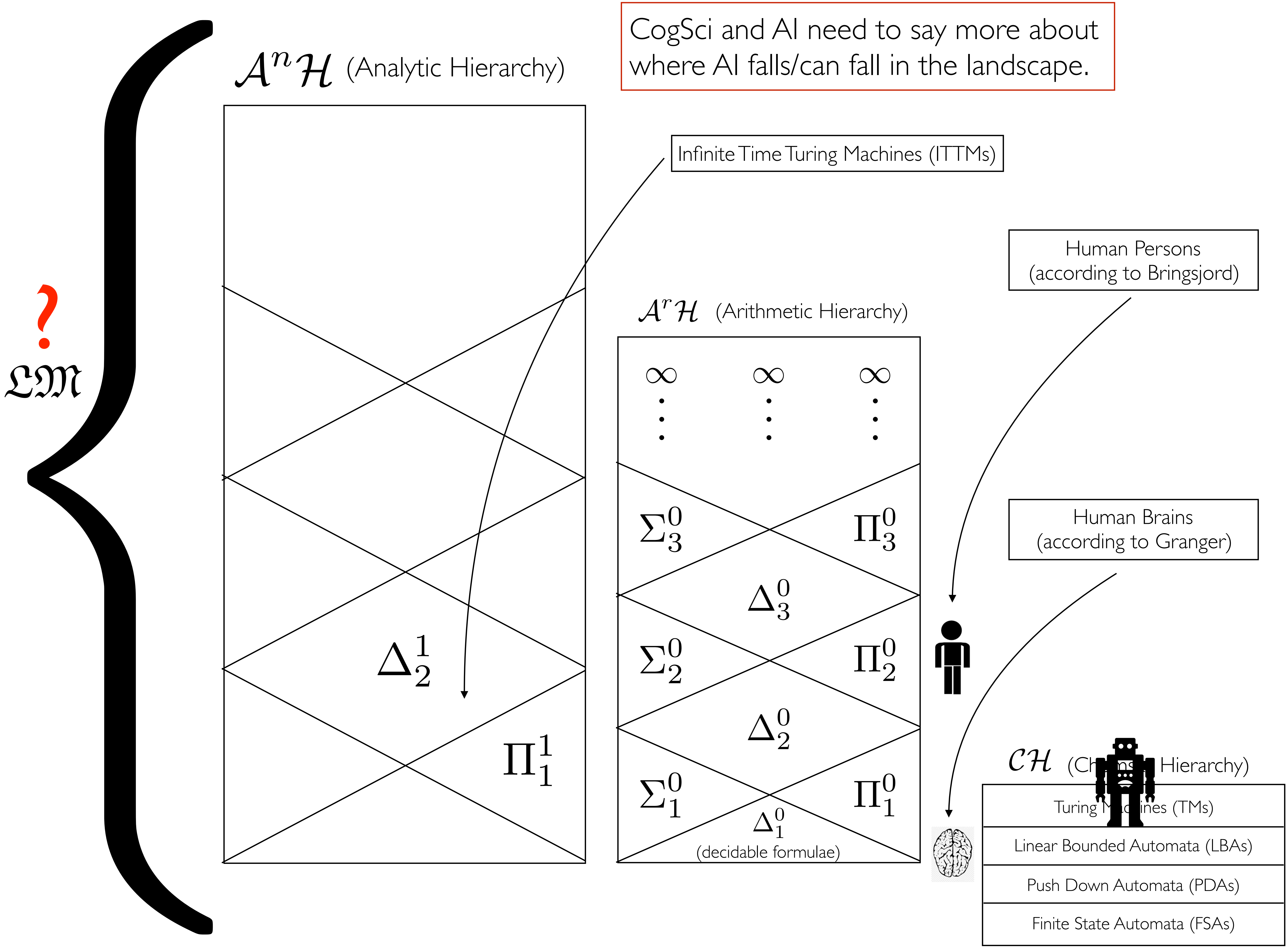

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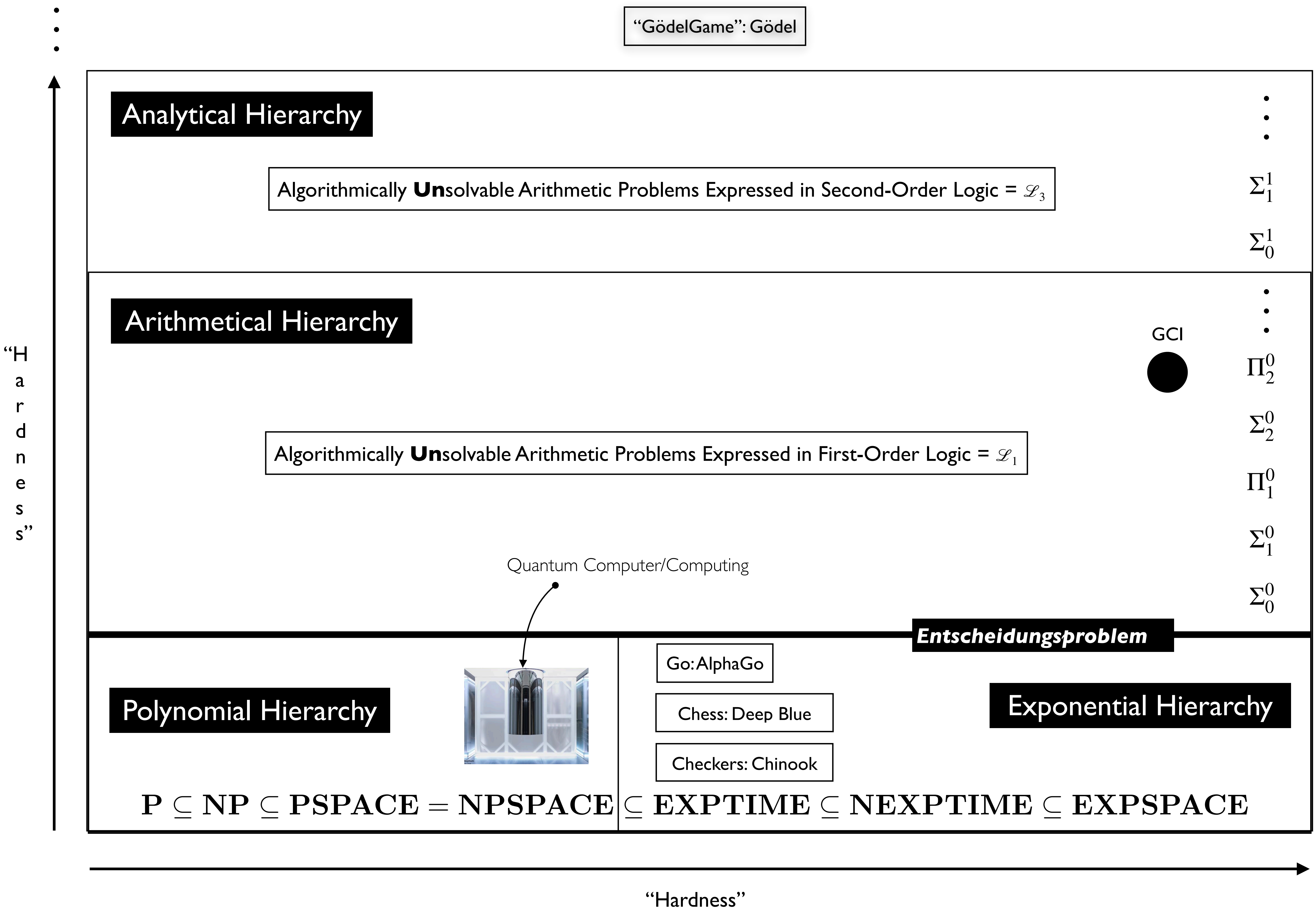
"GödelGame": Gödel
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Π_2^0
Σ_2^0
Algorithmically **Un**solvable Arithmetic Problems Expressed in First-Order Logic = $\mathscr{L}_1$
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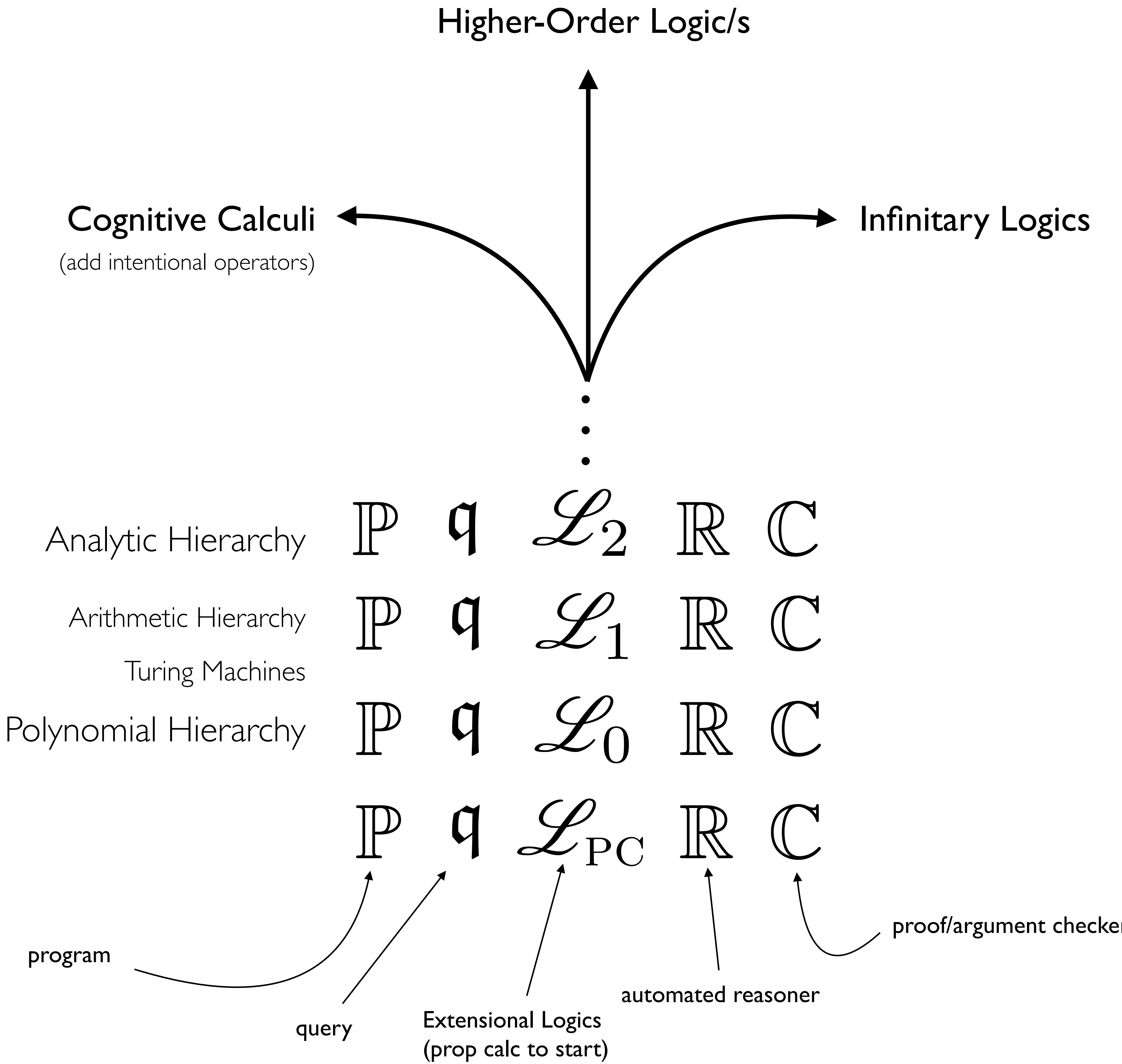
Σ_1^0
Quantum Computer/Computing
Σ_0^0
Entscheidungsproblem
Go: AlphaGo
Chess: Deep Blue
Checkers: Chinook
Polynomial Hierarchy
Exponential Hierarchy
$\mathbf{P} \subseteq \mathbf{NP} \subseteq \mathbf{PSPACE} = \mathbf{NPSPACE} \subseteq \mathbf{EXPTIME} \subseteq \mathbf{NEXPTIME} \subseteq \mathbf{EXPSPACE}$
"Hardness"
"Hardness"



Higher-Order Logic/s
Cognitive Calculi
(add intentional operators)
Infinitary Logics
Analytic Hierarchy
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Arithmetic Hierarchy
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Turing Machines
Polynomial Hierarchy
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$\mathbb{P}$ $\mathfrak{q}$ $\mathscr{L}_{\mathrm{PC}}$ $\mathbb{R}$ $\mathbb{C}$
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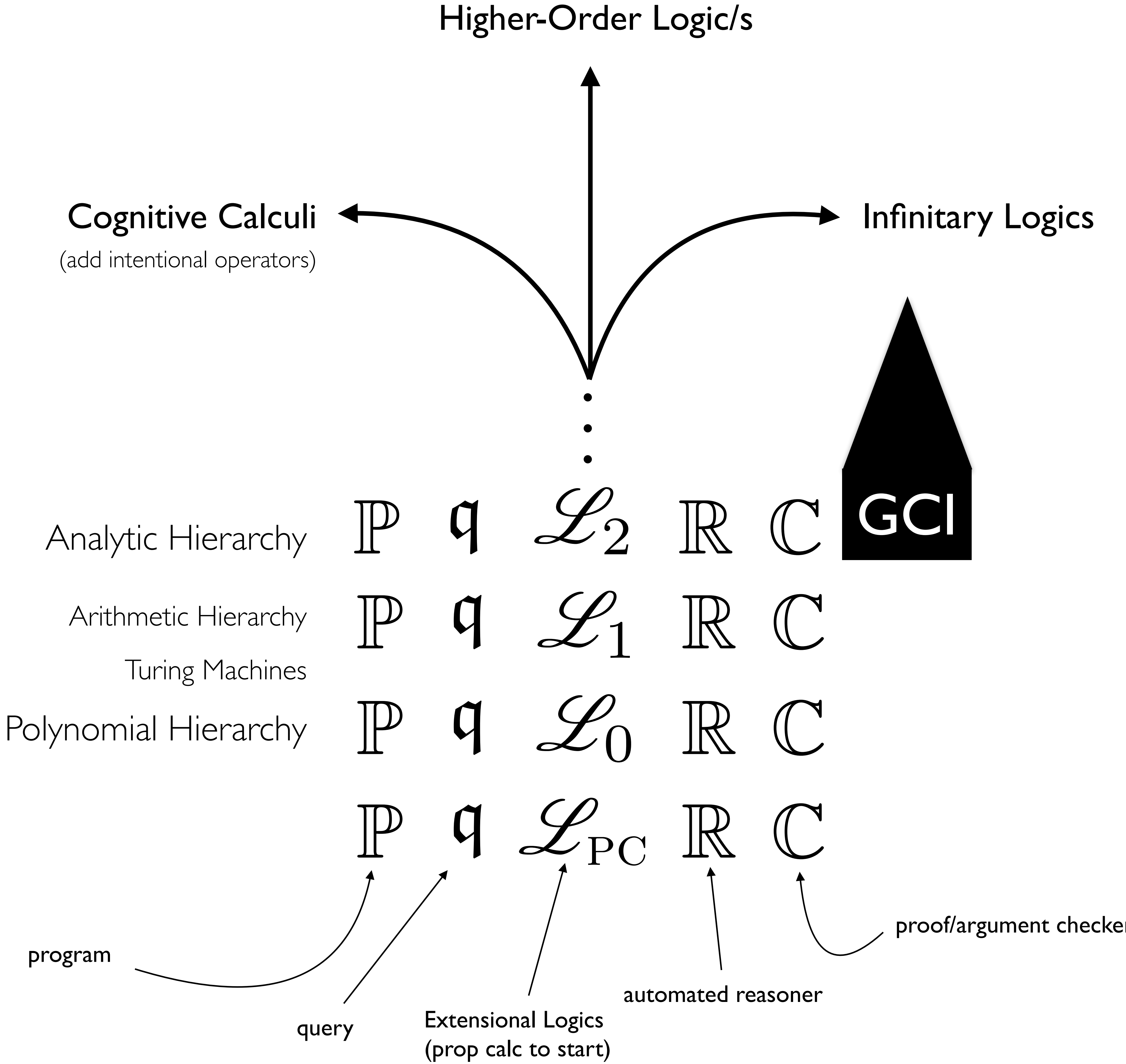
Extensional Logics
(prop calc to start)
automated reasoner
proof/argument checker



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Logic-Machines Hierarchy

Chapter 1
Is Universal Computation a Myth?*

Selmer Bringsjord

Abstract Akl has claimed that universal computation is a myth, and has offered a number of ingenious arguments in support of this claim, one of which features the challenge of tracking the locations of multiple, ever-moving robots on Mars. I provide what I see as a refutation of this argument; my counter-argument is based on a thesis that is less informal and more plausible than the Church-Turing Thesis, and on my own generalized variant of Kolmogorov-Uspensky machines. While I concede that it doesn't deductively follow from the success of my refutation that universal computation is, or can be, real, I conclude by pointing toward a route that I believe can vindicate the counter-claim that universal computation is specifiable, and instantiable.

1.1 Introduction

Selim Akl's remarkable oeuvre provides innumerable opportunities for one to write about the foundations, both formal and philosophical, of computation. For the present volume, I've seized upon a single opportunity: his ingenious and provocative "The Myth of Universal Computation" (Akl, 2005). My analysis, in a further narrowing, is specifically targeted at a key argument of Akl's within this paper, a fascinating one involving the tracking of multiple robots (assumed to be) on Mars. I denote this argument as '$\mathcal{A}_{\overline{u}_{\mathrm{TM}}}$.' Because I shall use '$\overline{u}_{\mathrm{TM}}$' to denote the statement that no Turing machine can be a universal computer, the subscript in '$\mathcal{A}_{\overline{u}_{\mathrm{TM}}}$' is just a convenient reminder that $\overline{u}_{\mathrm{TM}}$ is the conclusion of this argument.

* I'm indebted to Selim Akl for bringing to my attention countless stimulating ideas, only one of which I explore herein. Many thanks are due as well to Andy Adamatzky for guidance and supernatural patience.

1

Logic-Machines Hierarchy

$\mathbb{P}$ $\mathfrak{q}$ $\mathscr{L}_{\mathrm{PC}}$ $\mathbb{R}$ $\mathbb{C}$


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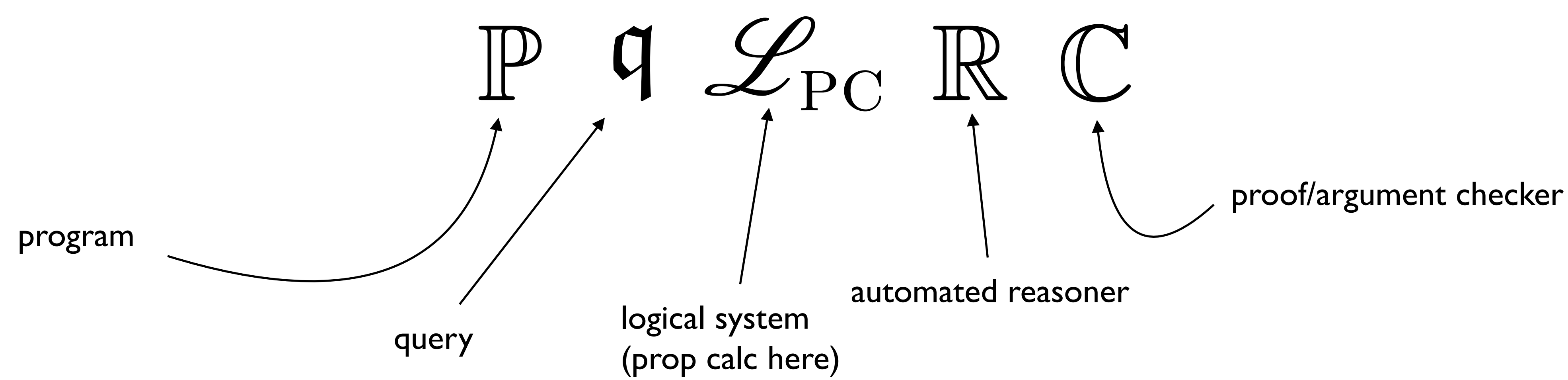
Logic-Machines Hierarchy




Chapter 1
Is Universal Computation a Myth?*

Selmer Bringsjord

Abstract Akl has claimed that universal computation is a myth, and has offered a number of ingenious arguments in support of this claim, one of which features the challenge of tracking the locations of multiple, ever-moving robots on Mars. I provide what I see as a refutation of this argument; my counter-argument is based on a thesis that is less informal and more plausible than the Church-Turing Thesis, and on my own generalized variant of Kolmogorov-Uspensky machines. While I concede that it doesn't deductively follow from the success of my refutation that universal computation is, or can be, real, I conclude by pointing toward a route that I believe can vindicate the counter-claim that universal computation is specifiable, and instantiable.

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$$\mathbb{P} \quad \mathfrak{q} \quad \mathscr{L}_0 \quad \mathbb{R} \quad \mathbb{C}$$

$$\mathbb{P} \quad \mathfrak{q} \quad \mathscr{L}_{\mathrm{PC}} \quad \mathbb{R} \quad \mathbb{C}$$

program

query

logical system
(prop calc here)

automated reasoner

proof/argument checker

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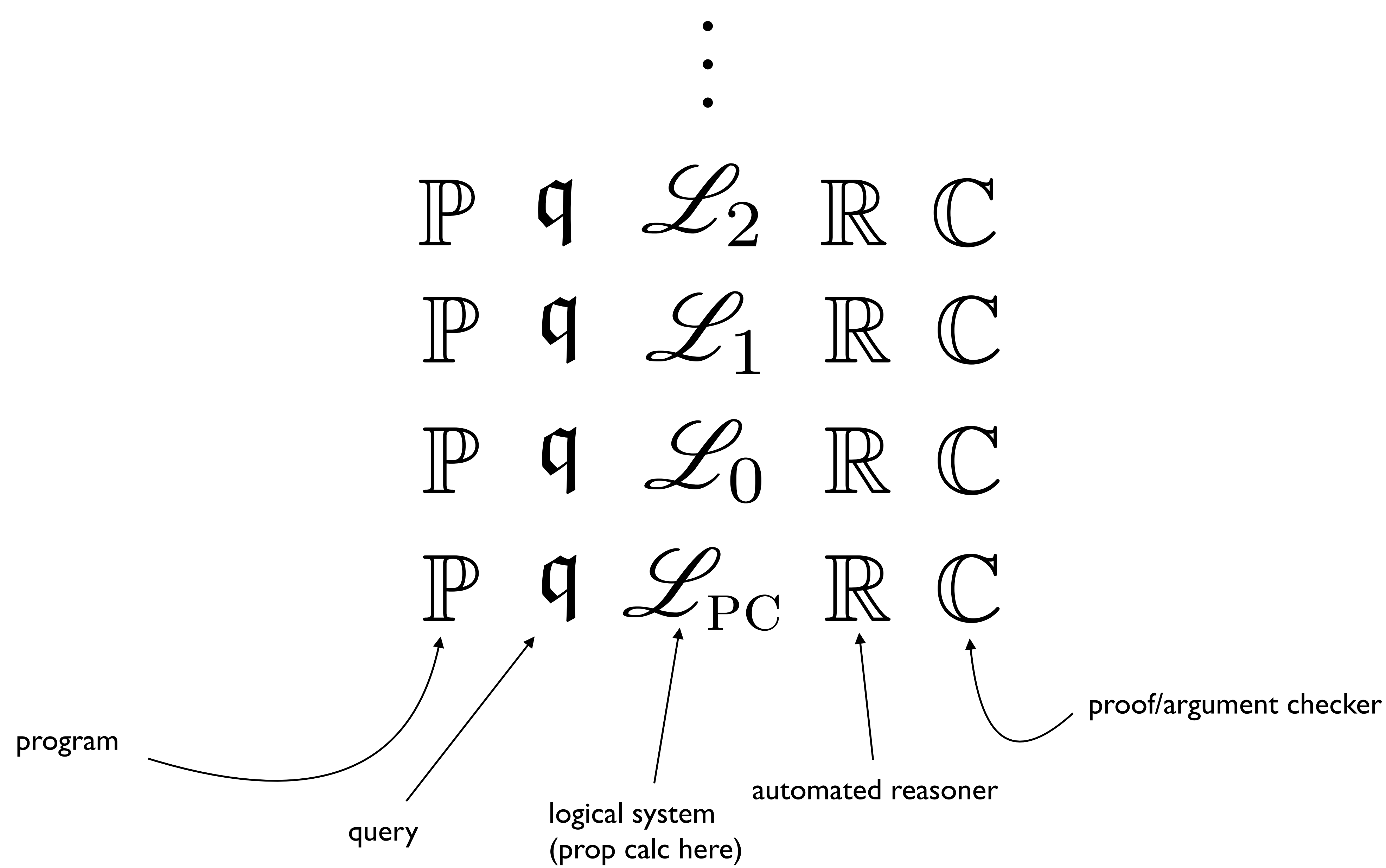

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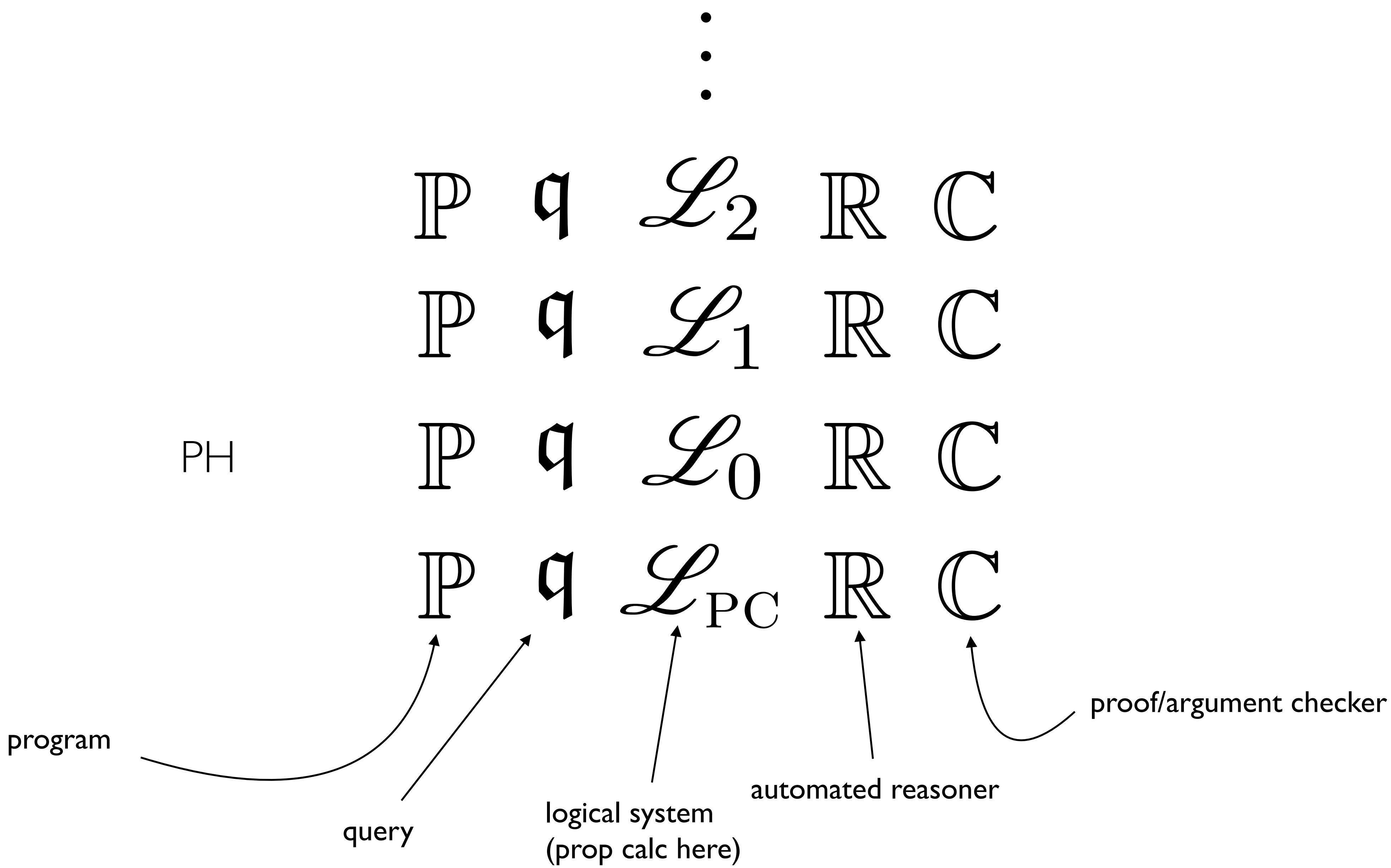

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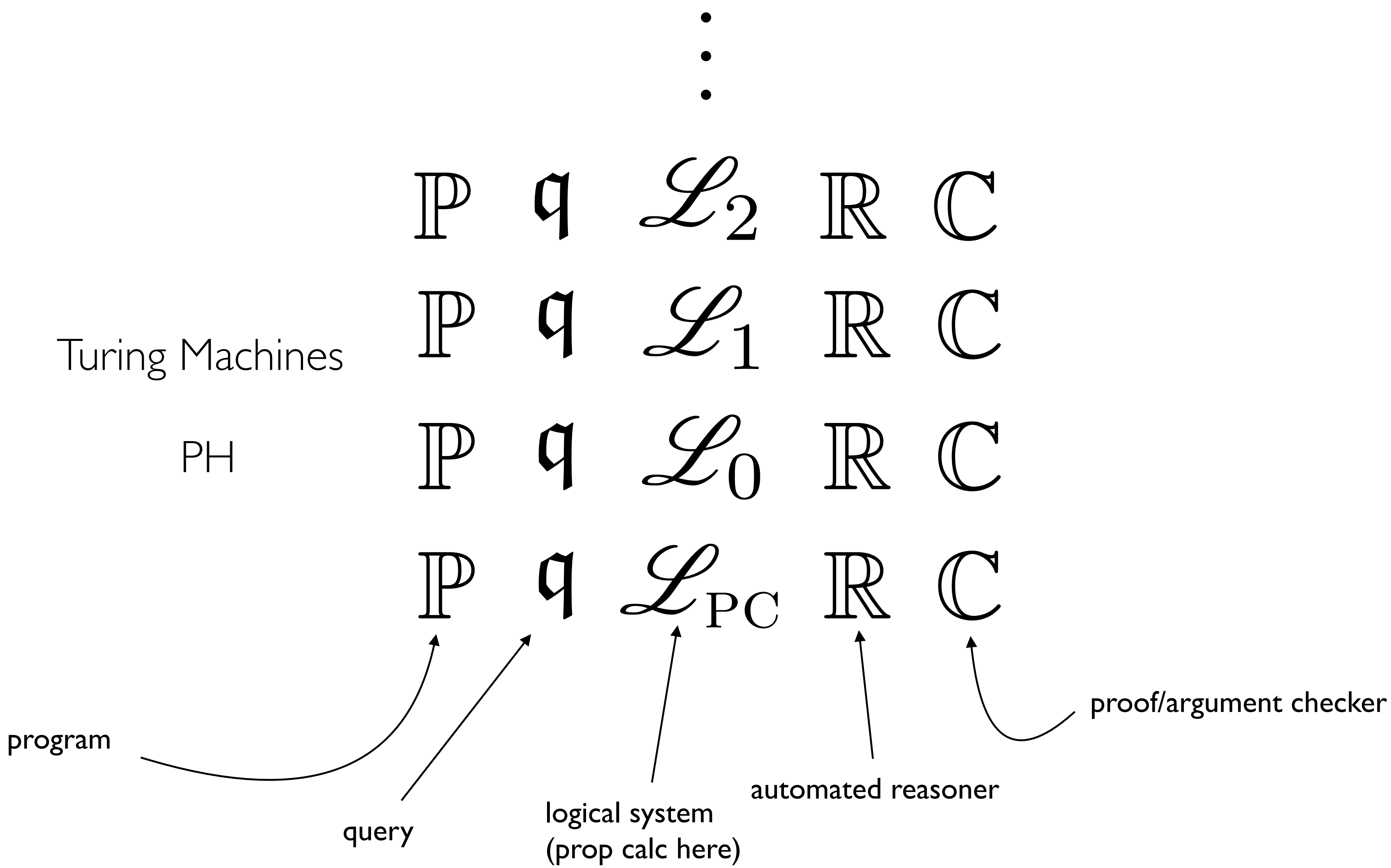

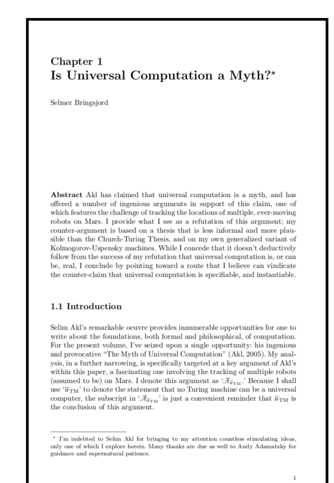
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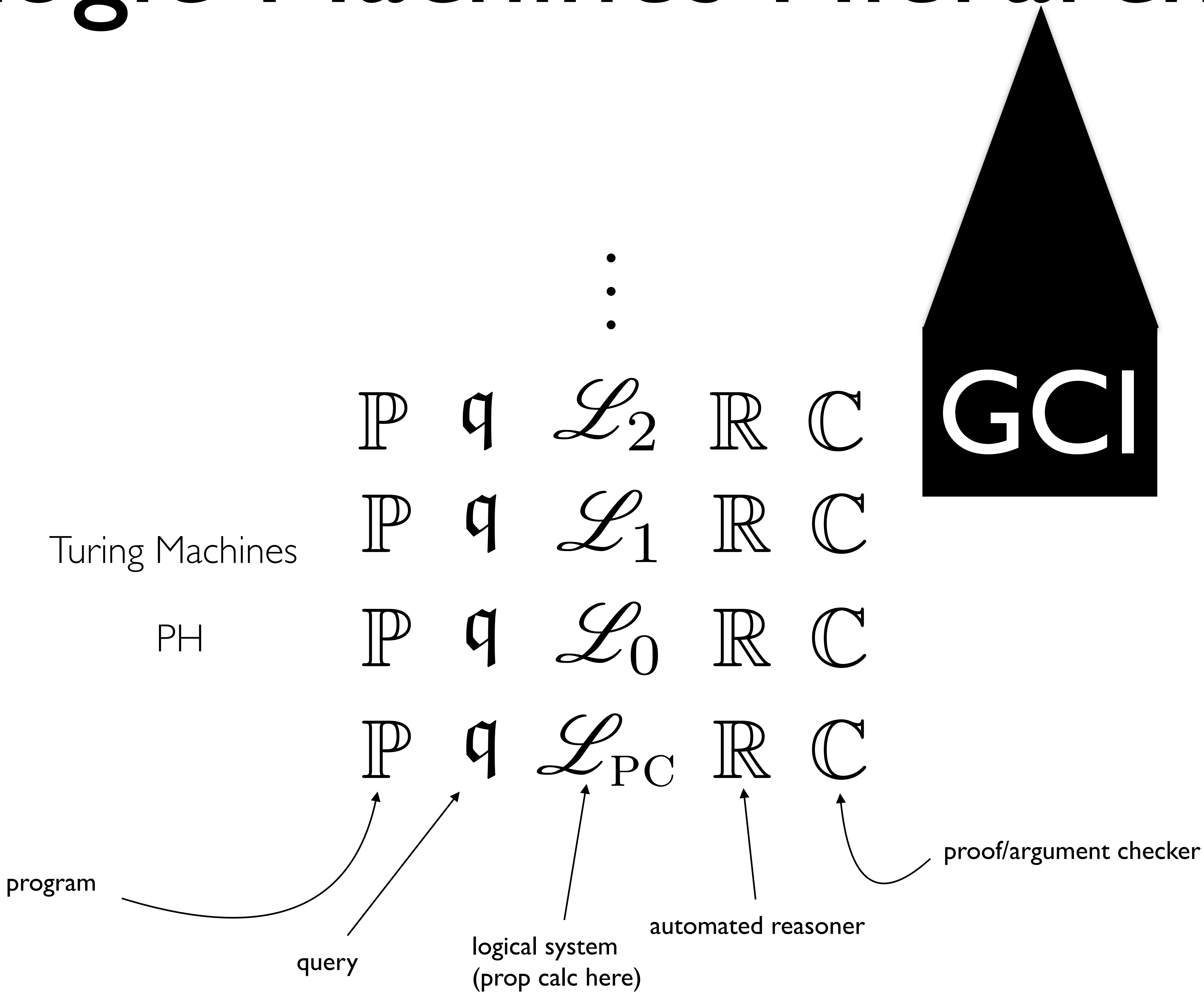

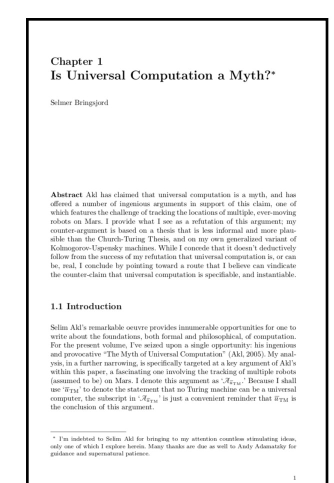

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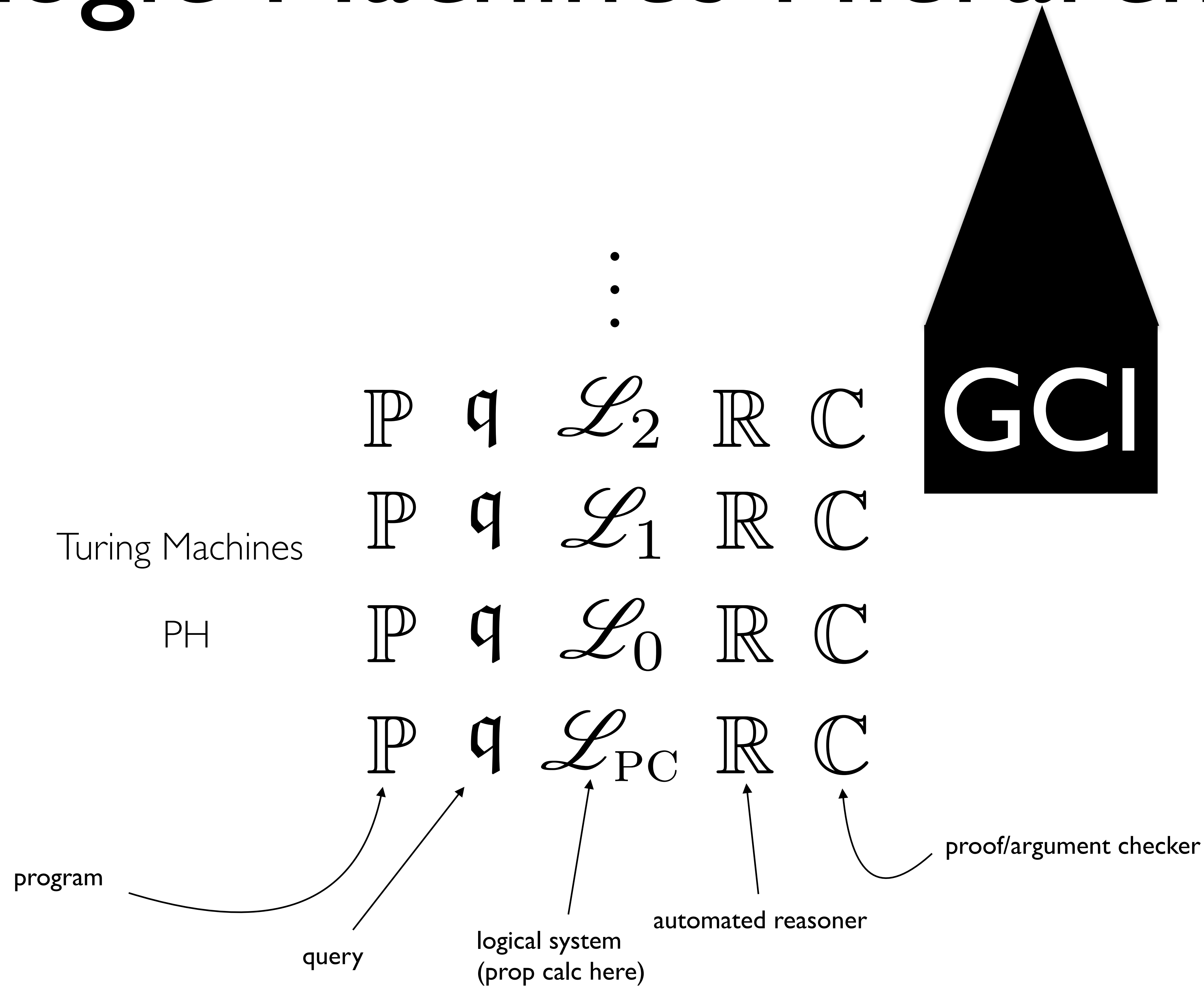

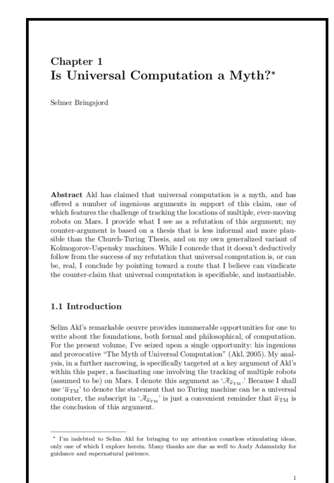

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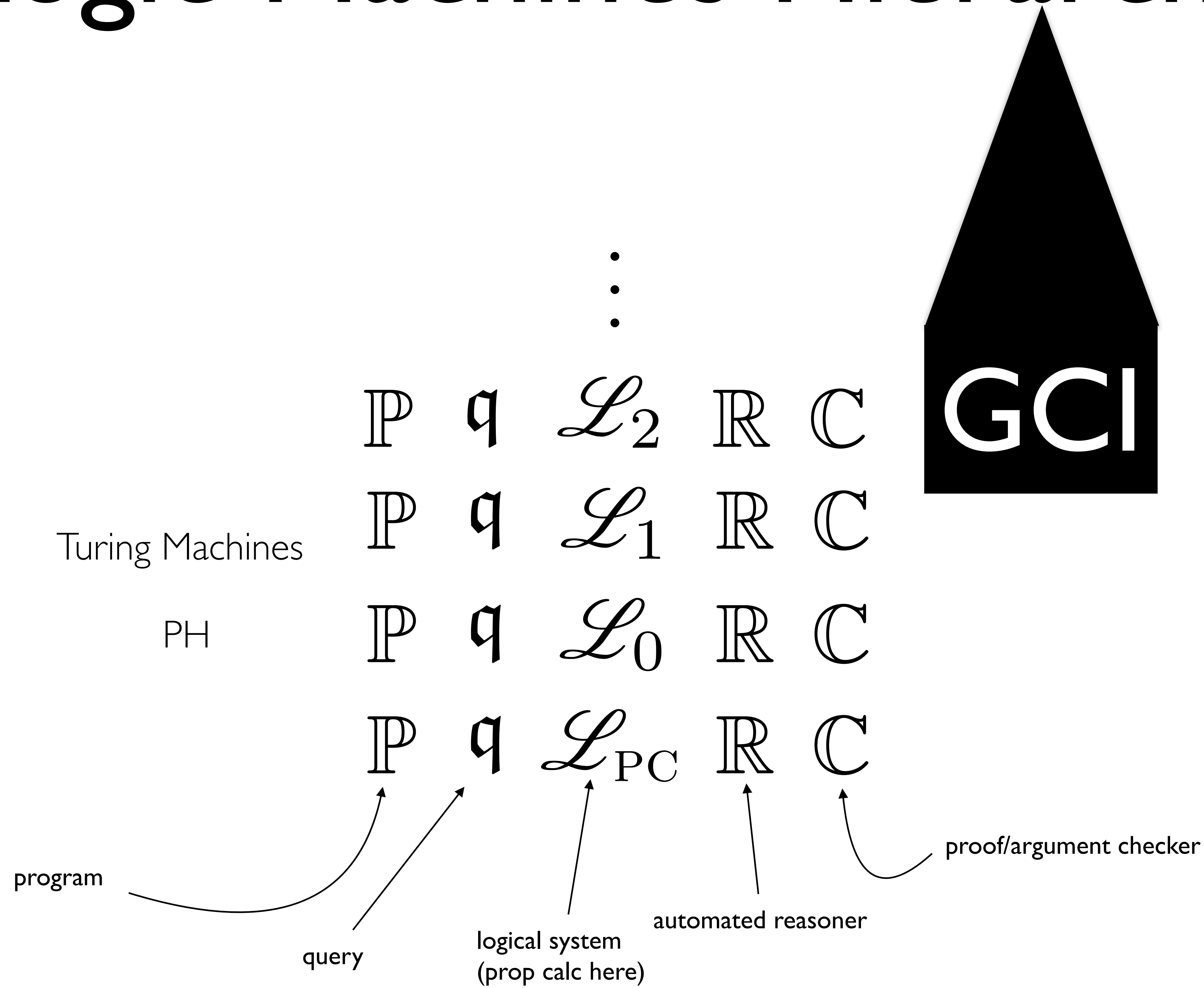

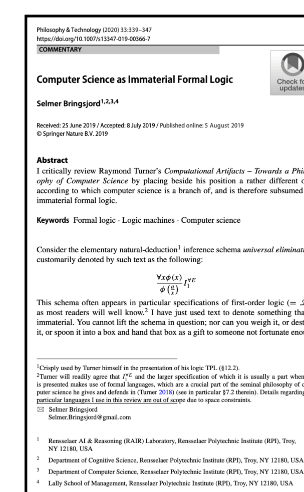

Philosophy & Technology (2020) 33:339–347
https://doi.org/10.1007/s13347-019-00366-7
COMMENTARY

Check for updates

Computer Science as Immaterial Formal Logic

Selmer Bringsjord[1,2,3,4]

Received: 25 June 2019 / Accepted: 8 July 2019 / Published online: 5 August 2019

Abstract
I critically review Raymond Turner's *Computational Artifacts – Towards a Philosophy of Computer Science* by placing beside his position a rather different one, according to which computer science is a branch of, and is therefore subsumed by, immaterial formal logic.

Keywords Formal logic · Logic machines · Computer science

Consider the elementary natural-deduction[1] inference schema *universal elimination*, customarily denoted by such text as the following:

$$\frac{\forall x \phi(x)}{\phi\left(\frac{a}{x}\right)} I_1^{\forall E}$$

This schema often appears in particular specifications of first-order logic ($= \mathscr{L}_1$), as most readers will well know.[2] I have just used text to denote something that is immaterial. You cannot lift the schema in question; nor can you weigh it, or destroy it, or spoon it into a box and hand that box as a gift to someone not fortunate enough

[1] Crisply used by Turner himself in the presentation of his logic TPL (§12.2).
[2] Turner will readily agree that $I_1^{\forall E}$ and the larger specification of which it is usually a part when $\mathscr{L}_1$ is presented makes use of formal languages, which are a crucial part of the seminal philosophy of computer science he gives and defends in (Turner 2018) (see in particular §7.2 therein). Details regarding the particular languages I use in this review are out of scope due to space constraints.

✉ Selmer Bringsjord
Selmer.Bringsjord@gmail.com

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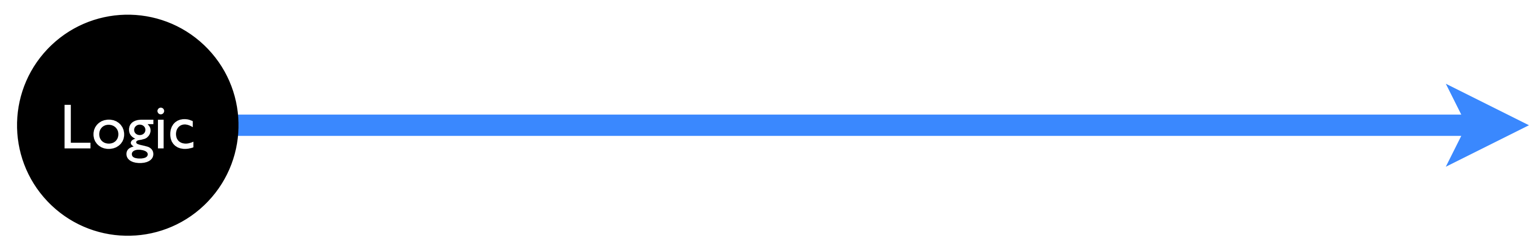
2 Department of Cognitive Science, Rensselaer Polytechnic Institute (RPI), Troy, NY 12180, USA
3 Department of Computer Science, Rensselaer Polytechnic Institute (RPI), Troy, NY 12180, USA
4 Lally School of Management, Rensselaer Polytechnic Institute (RPI), Troy, NY 12180, USA

"'I don't yet know how to handle this '3D' view. Maybe you can help. But I'll try to explain at any rate …"

Logic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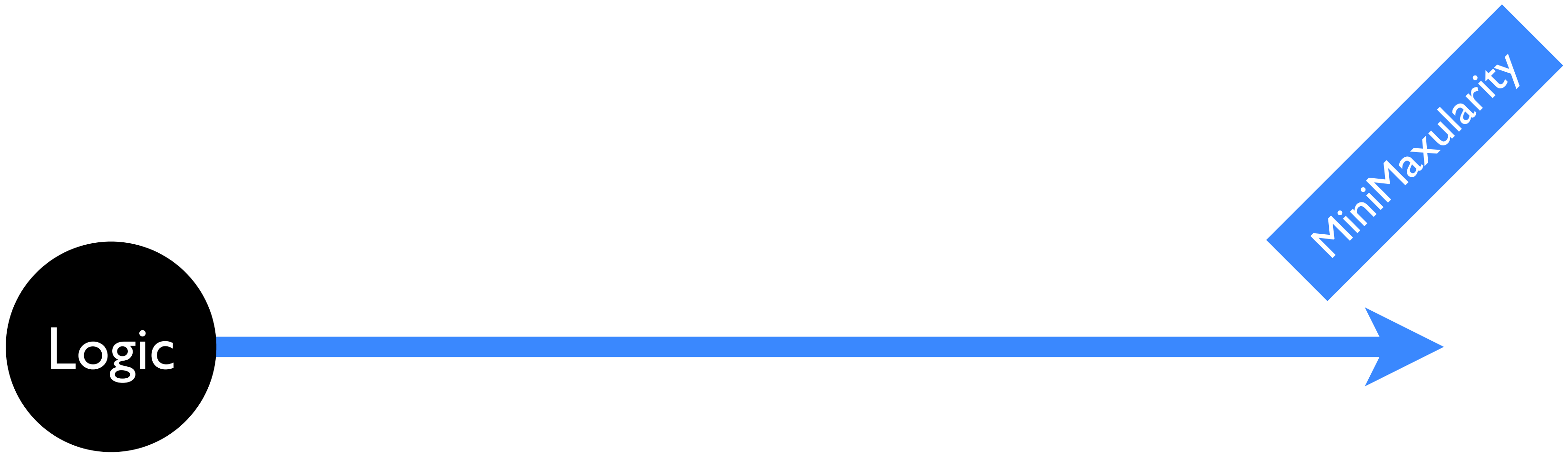
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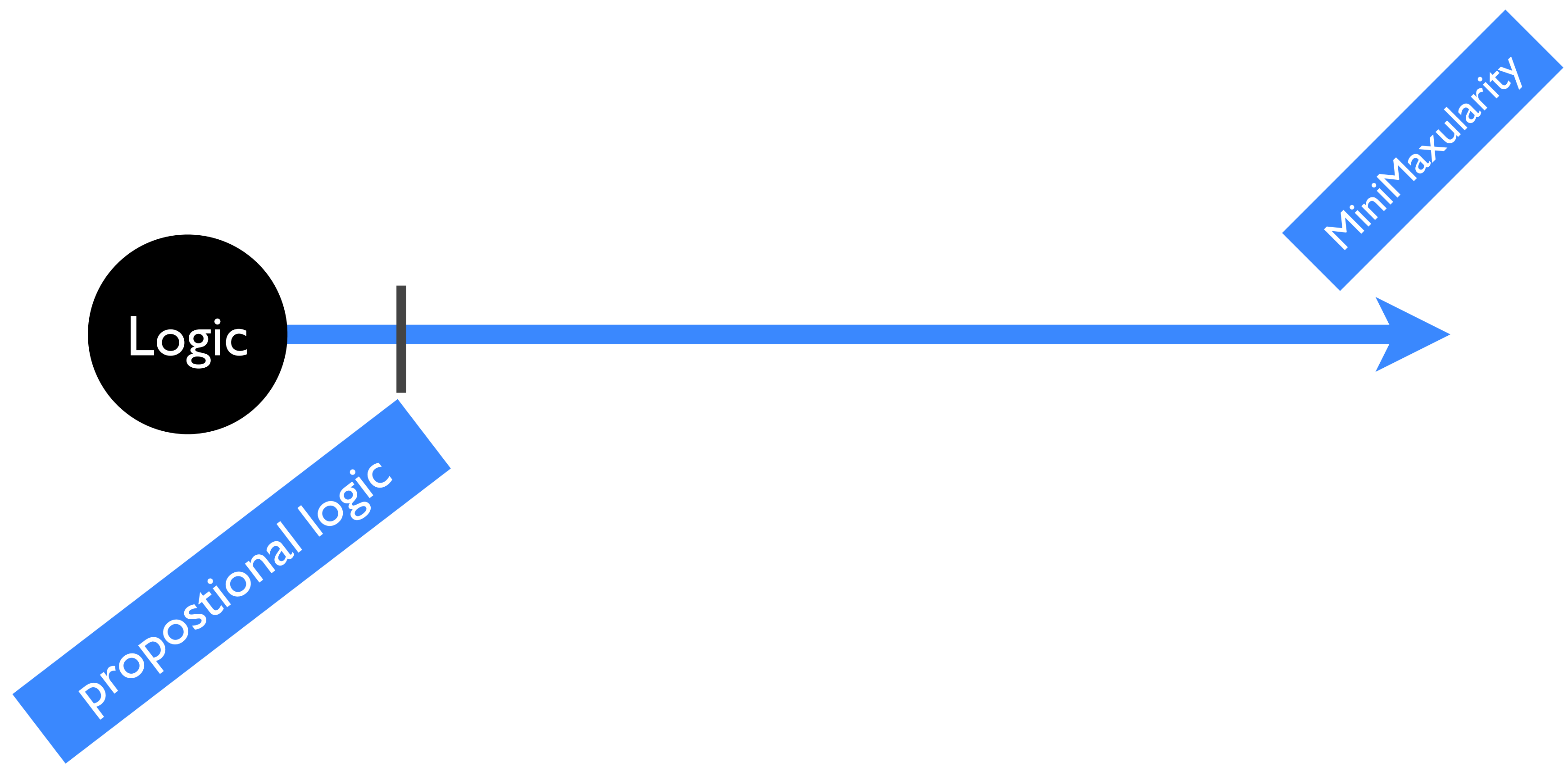
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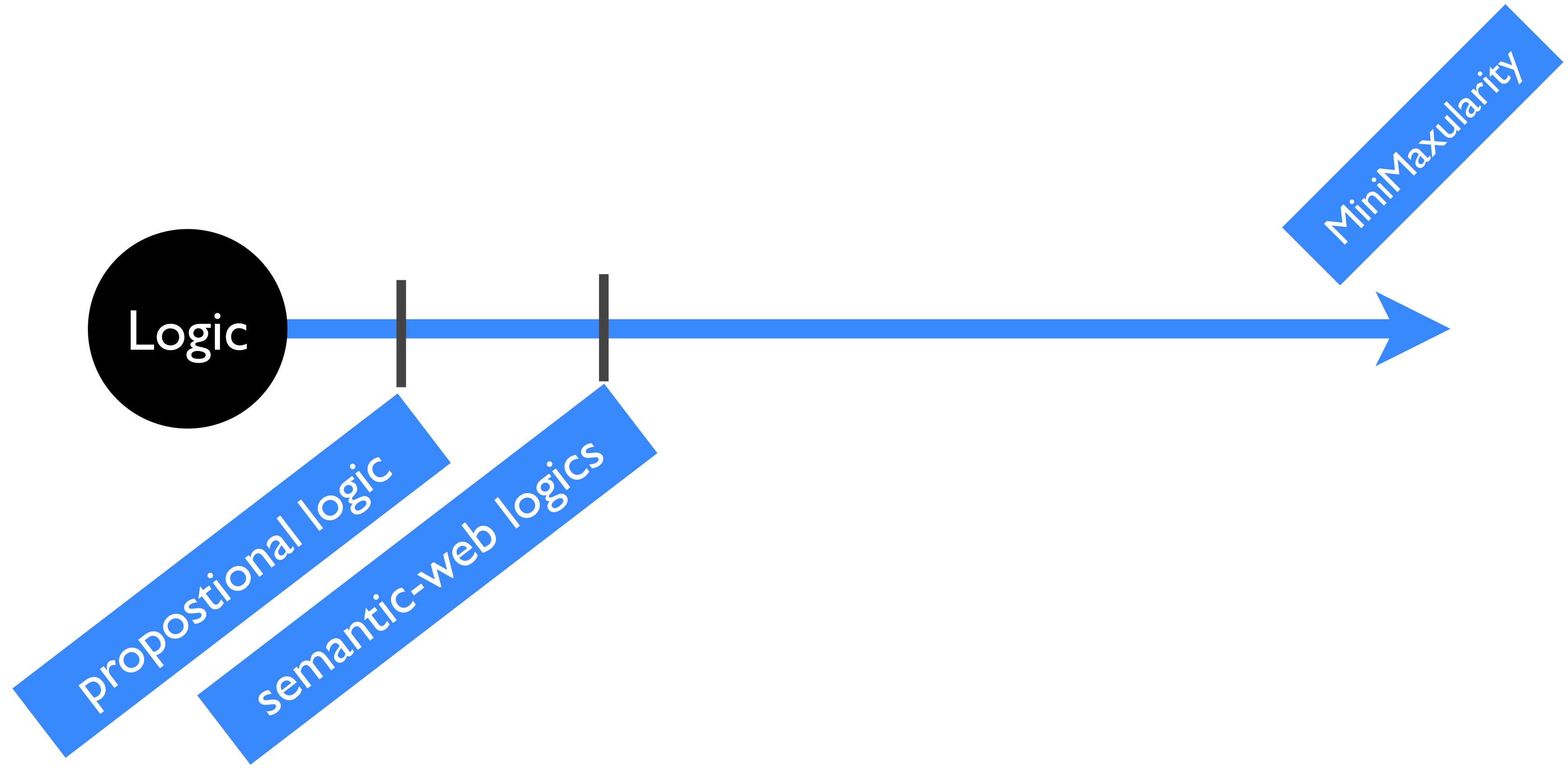
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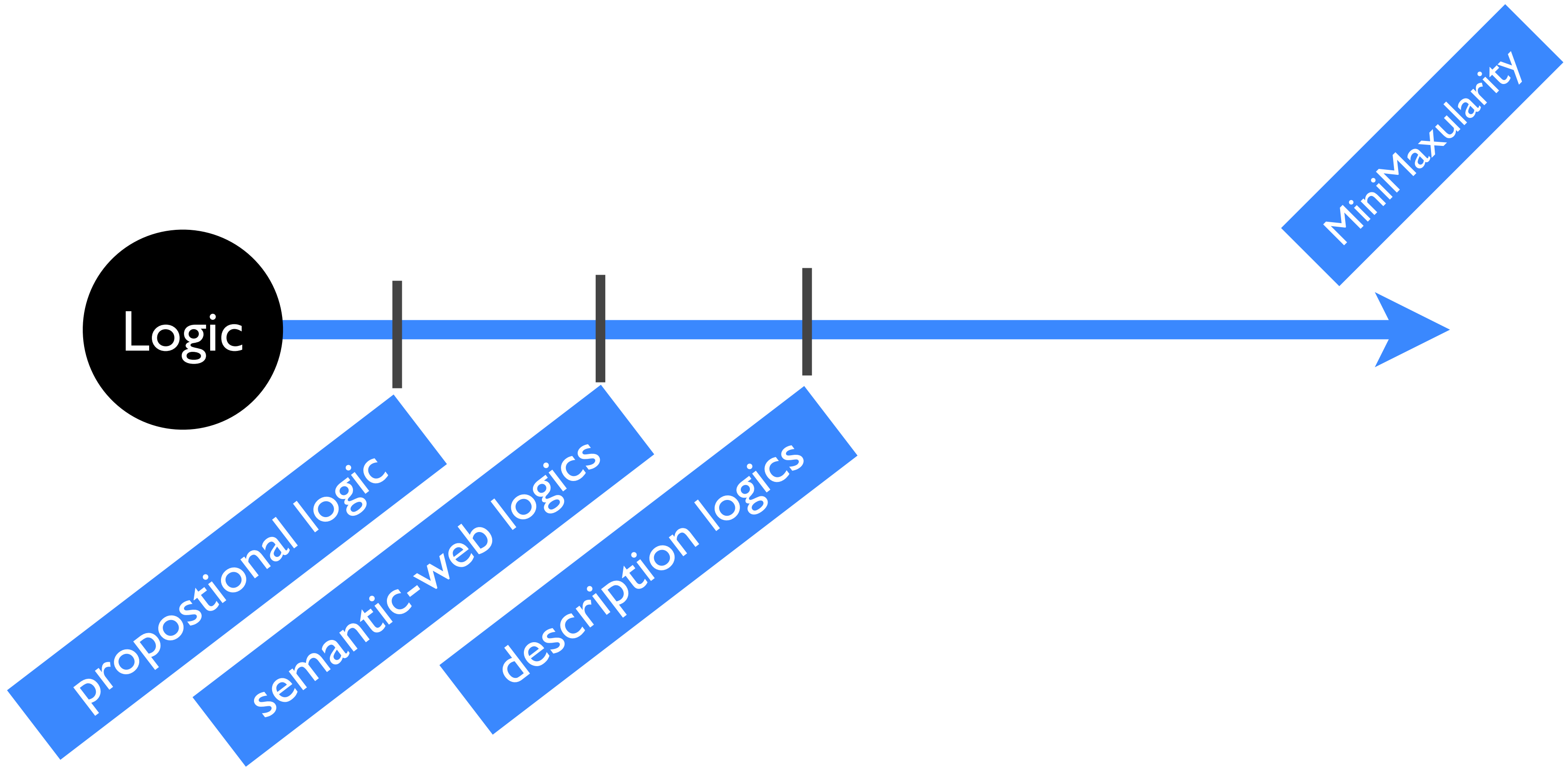

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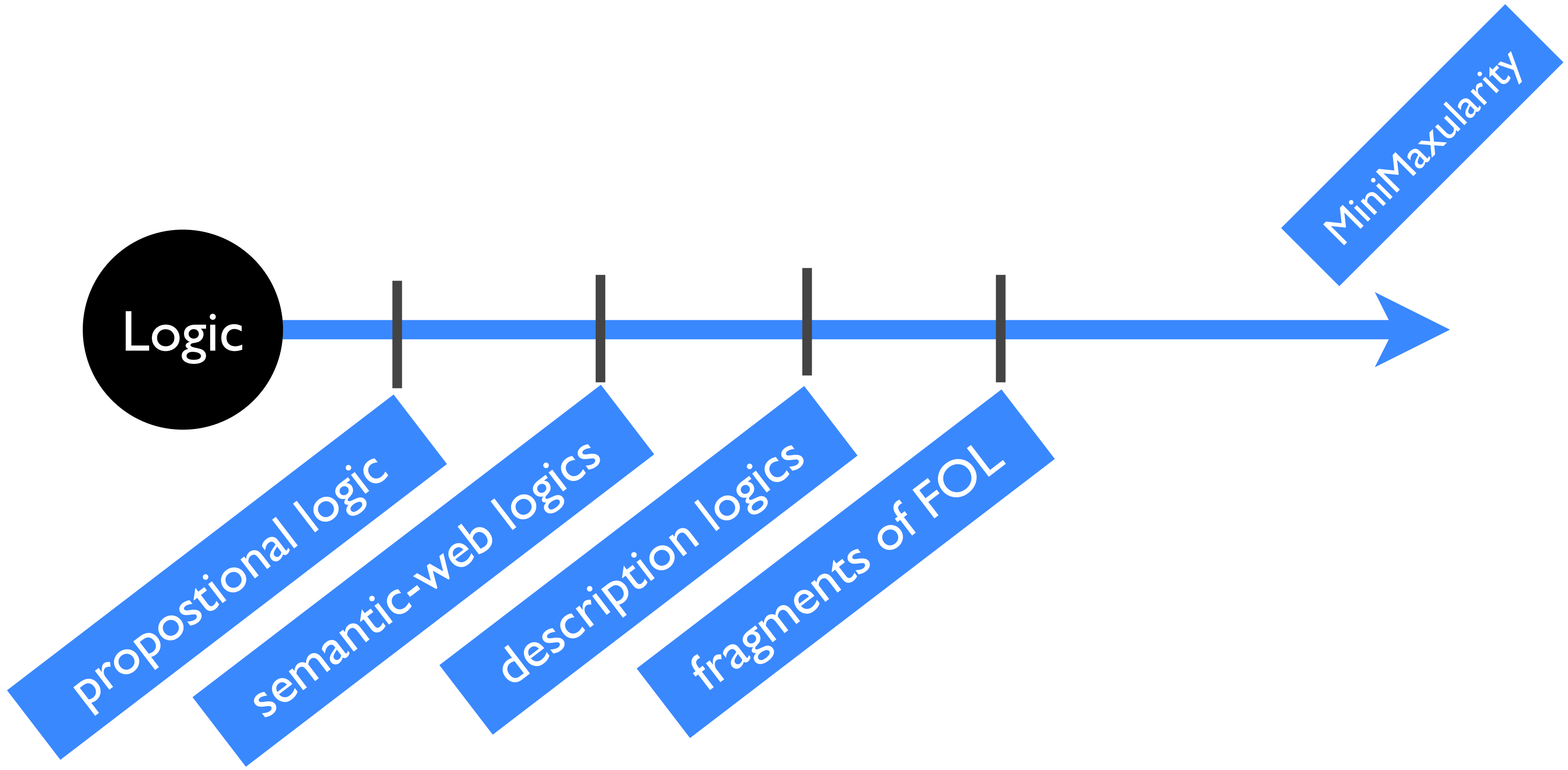
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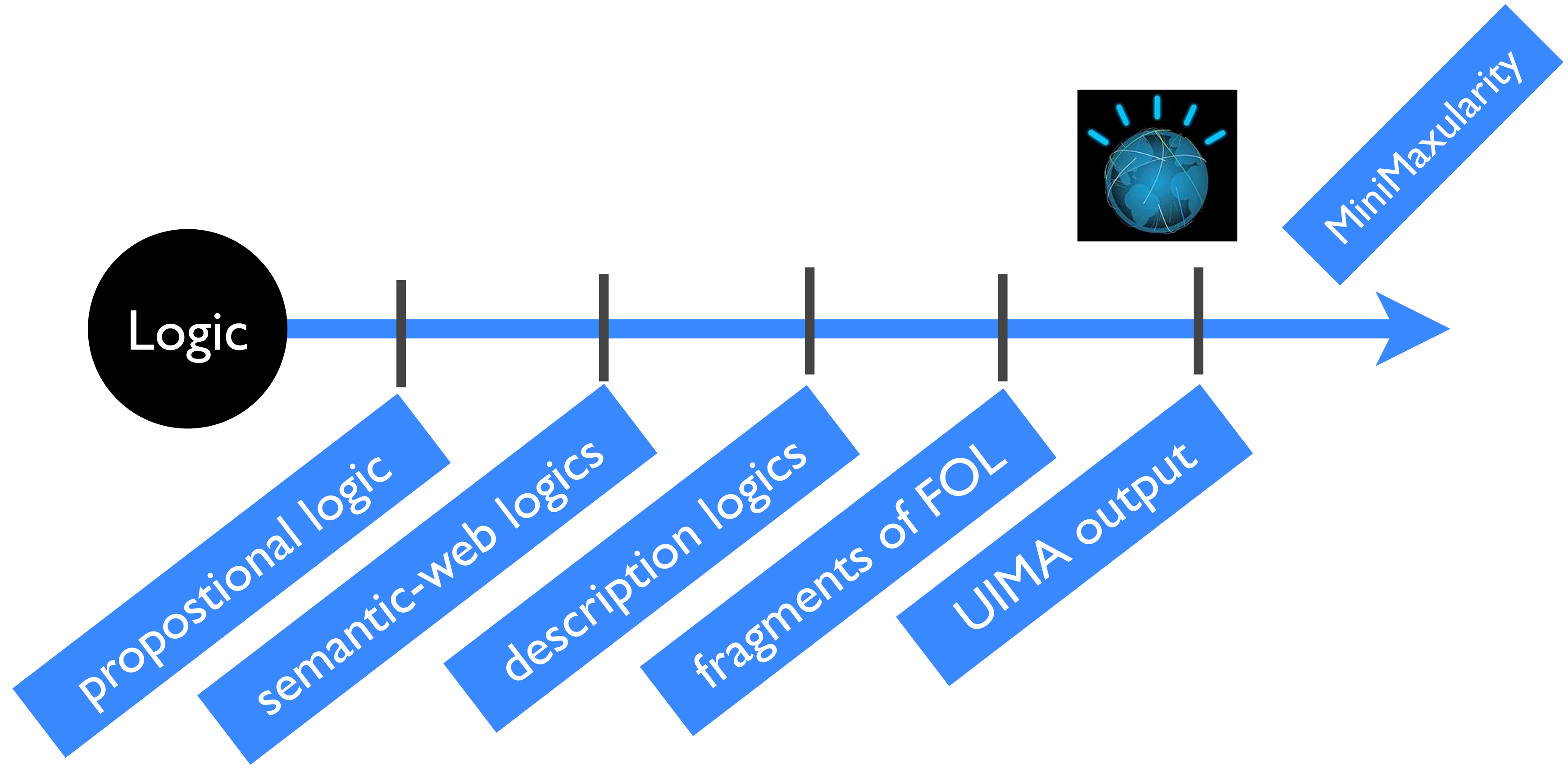
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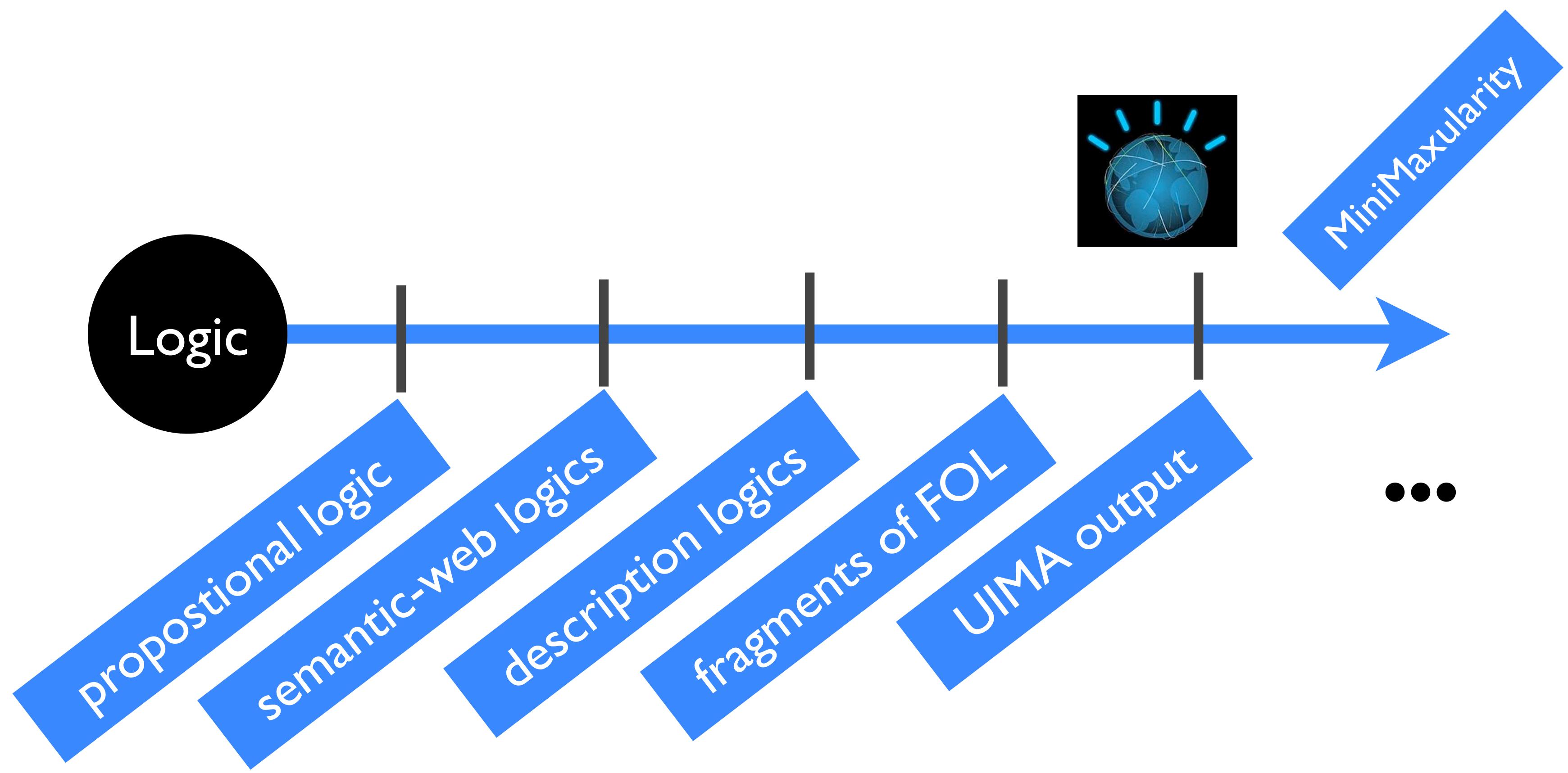
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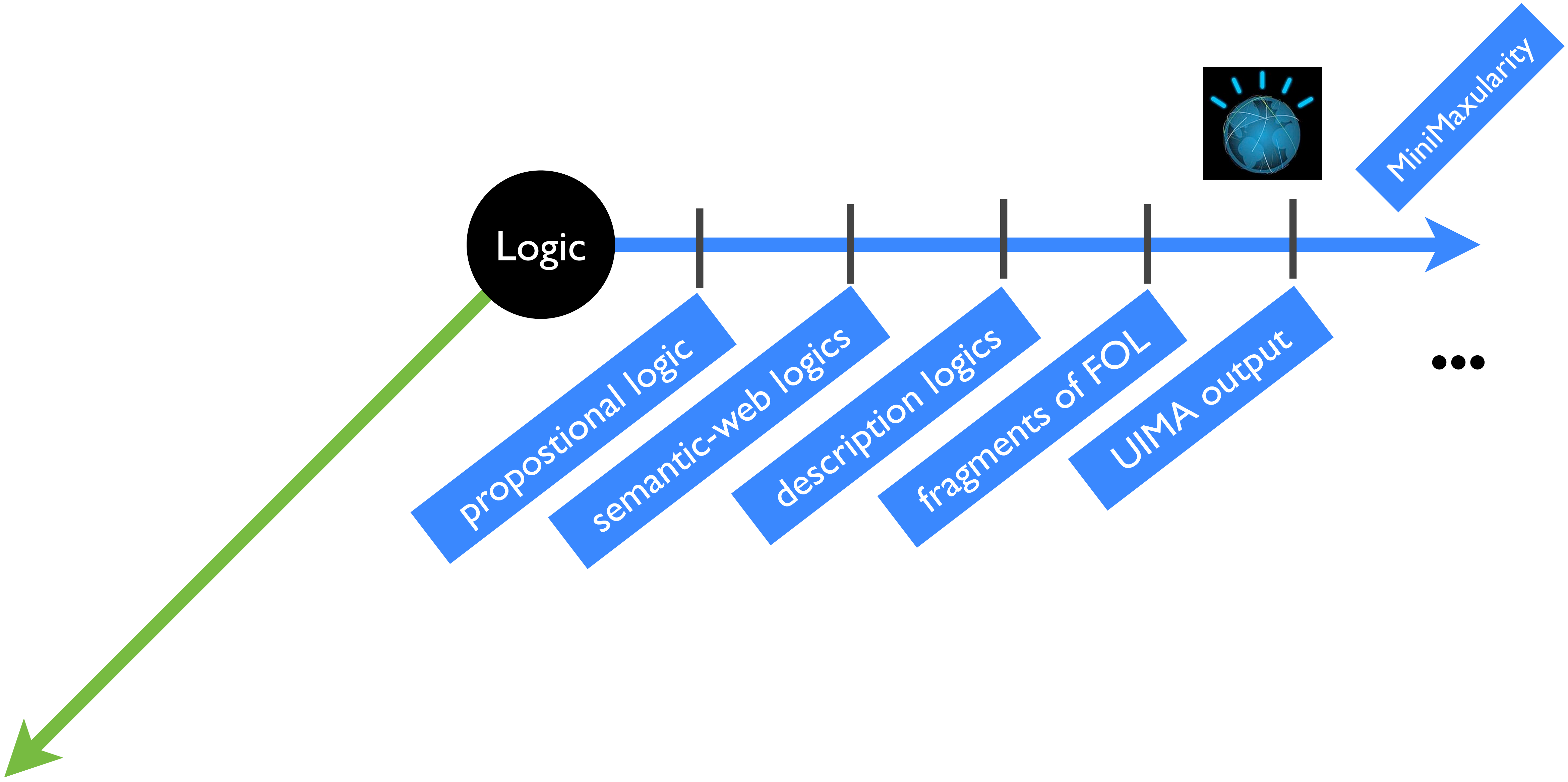
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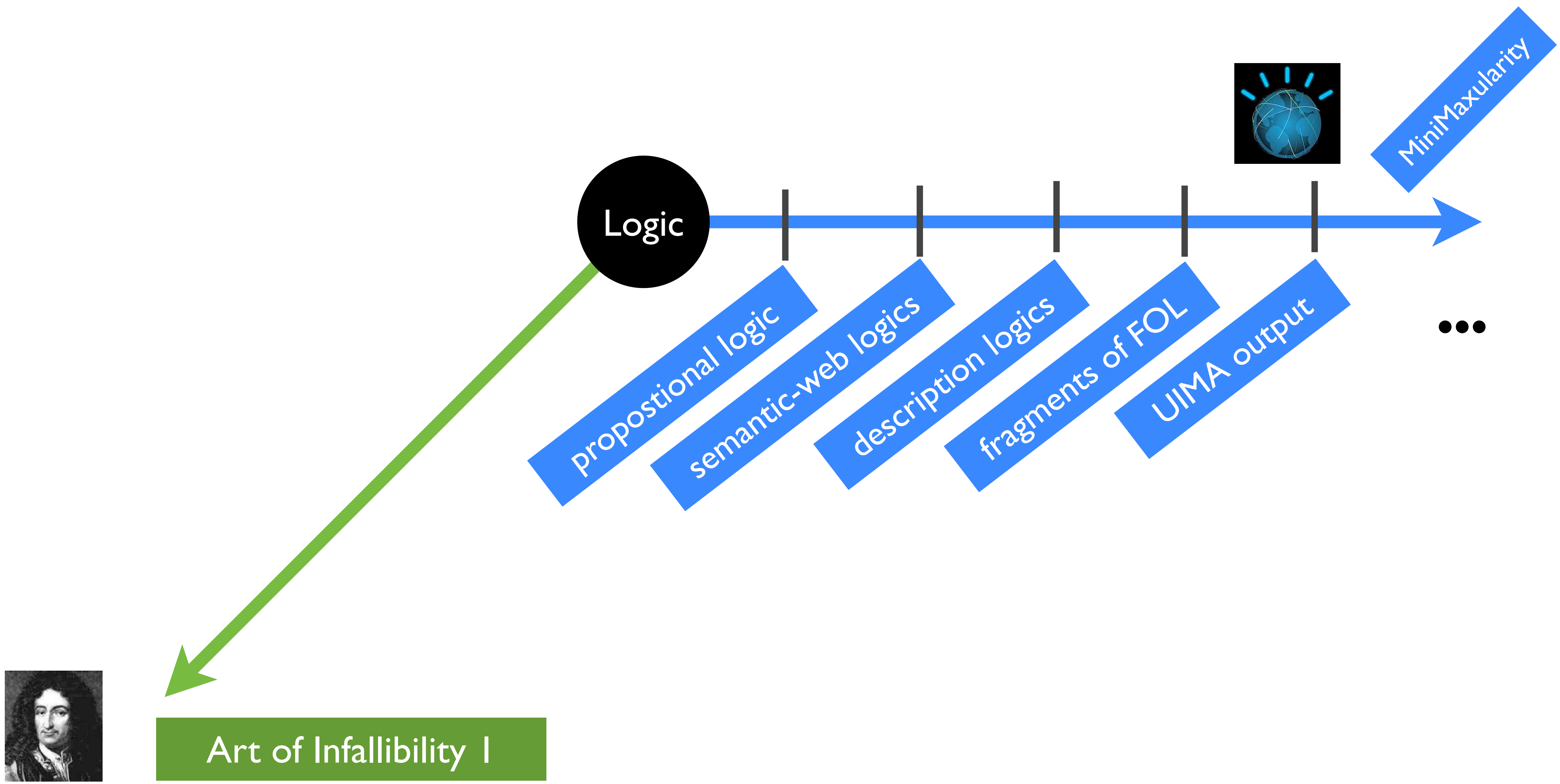
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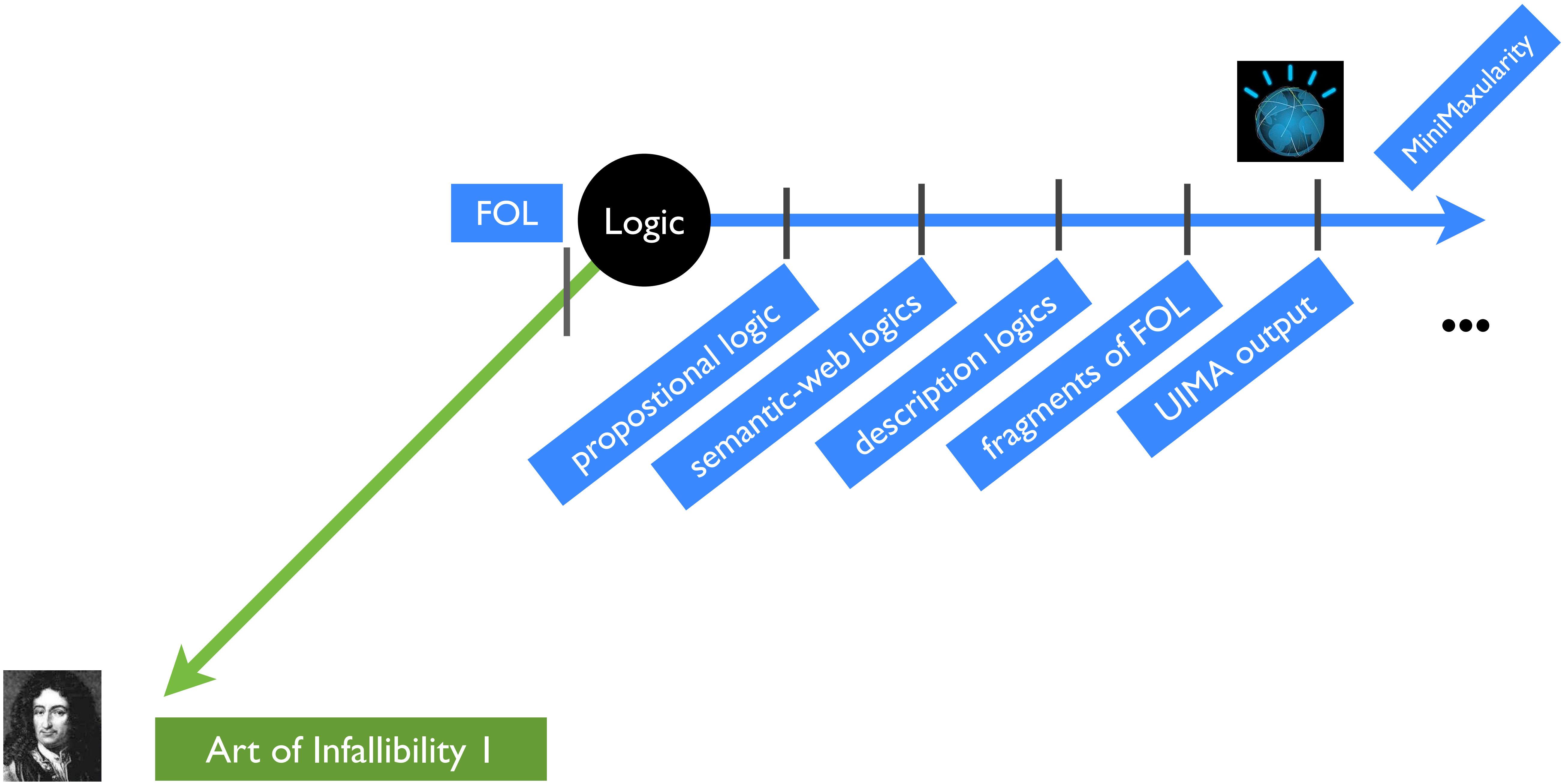
Art of Infallibility I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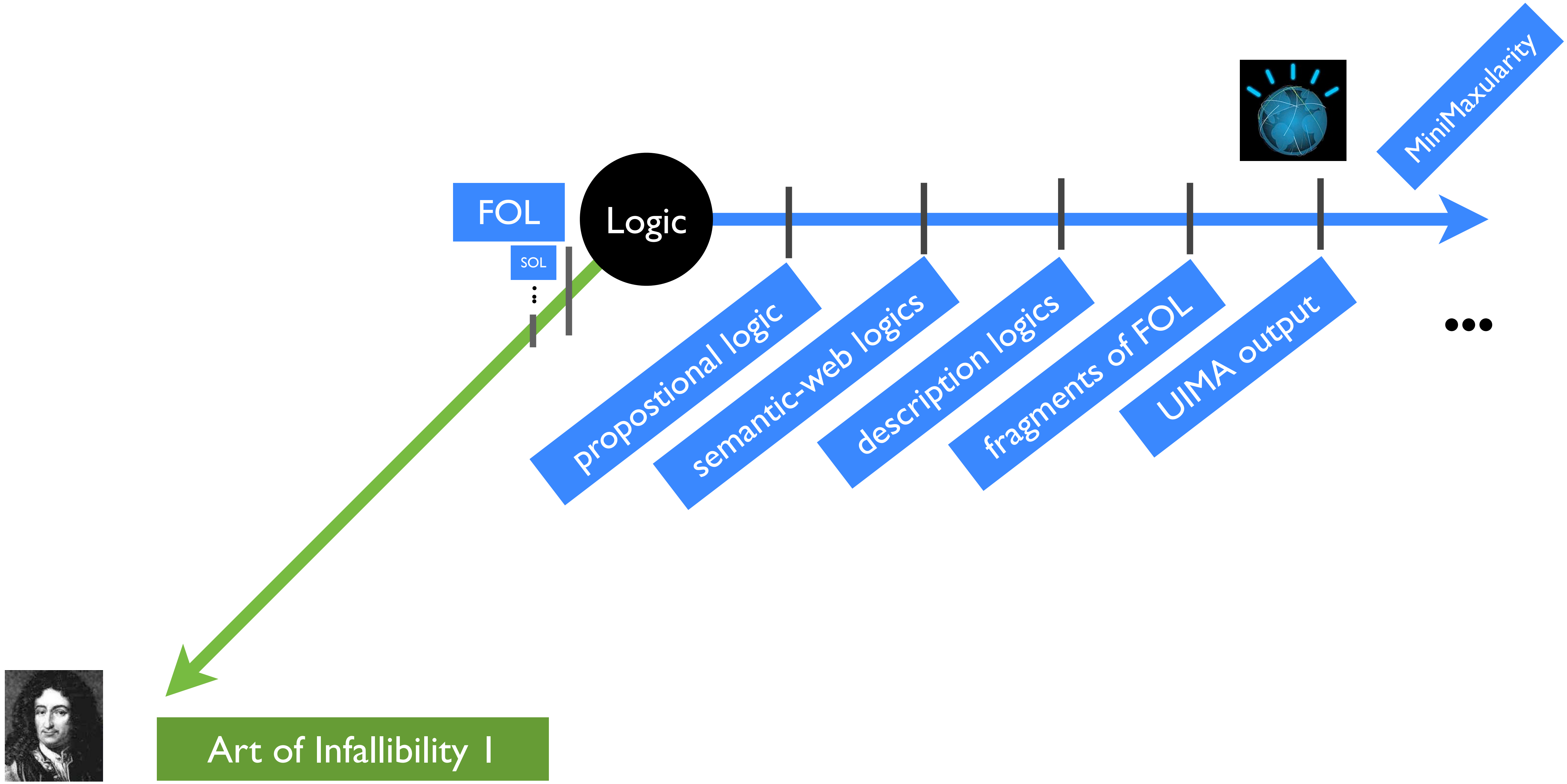
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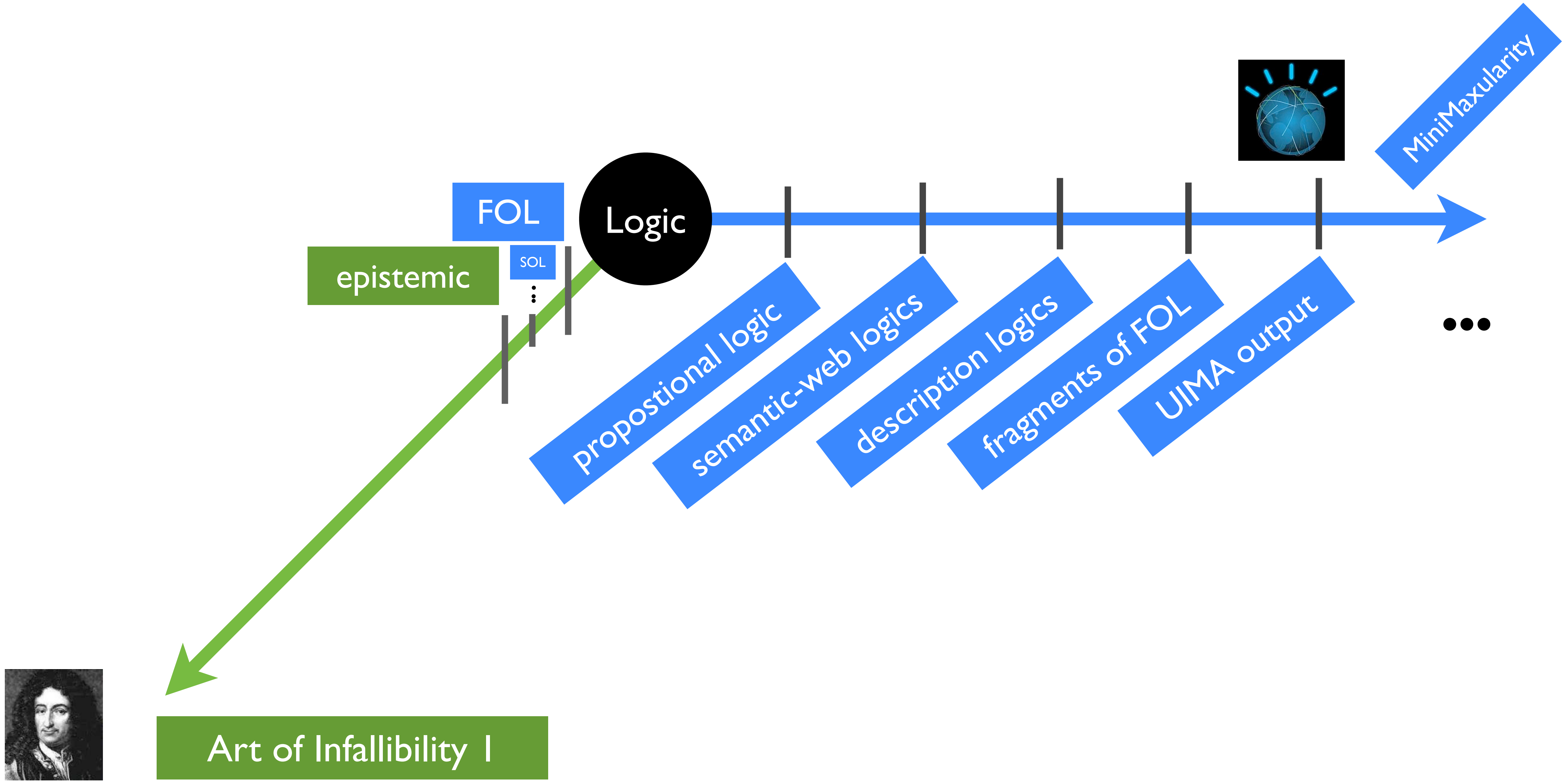

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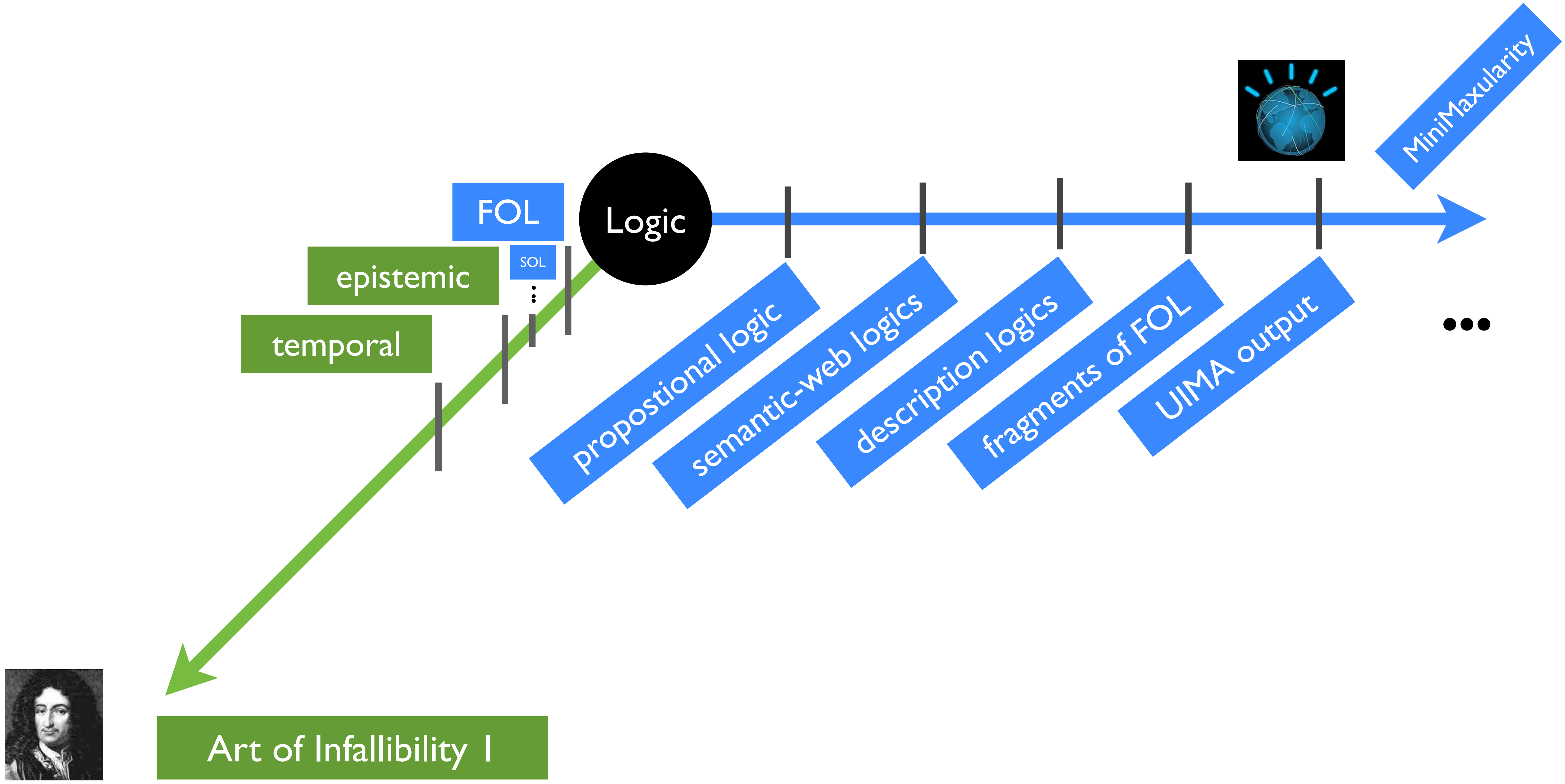

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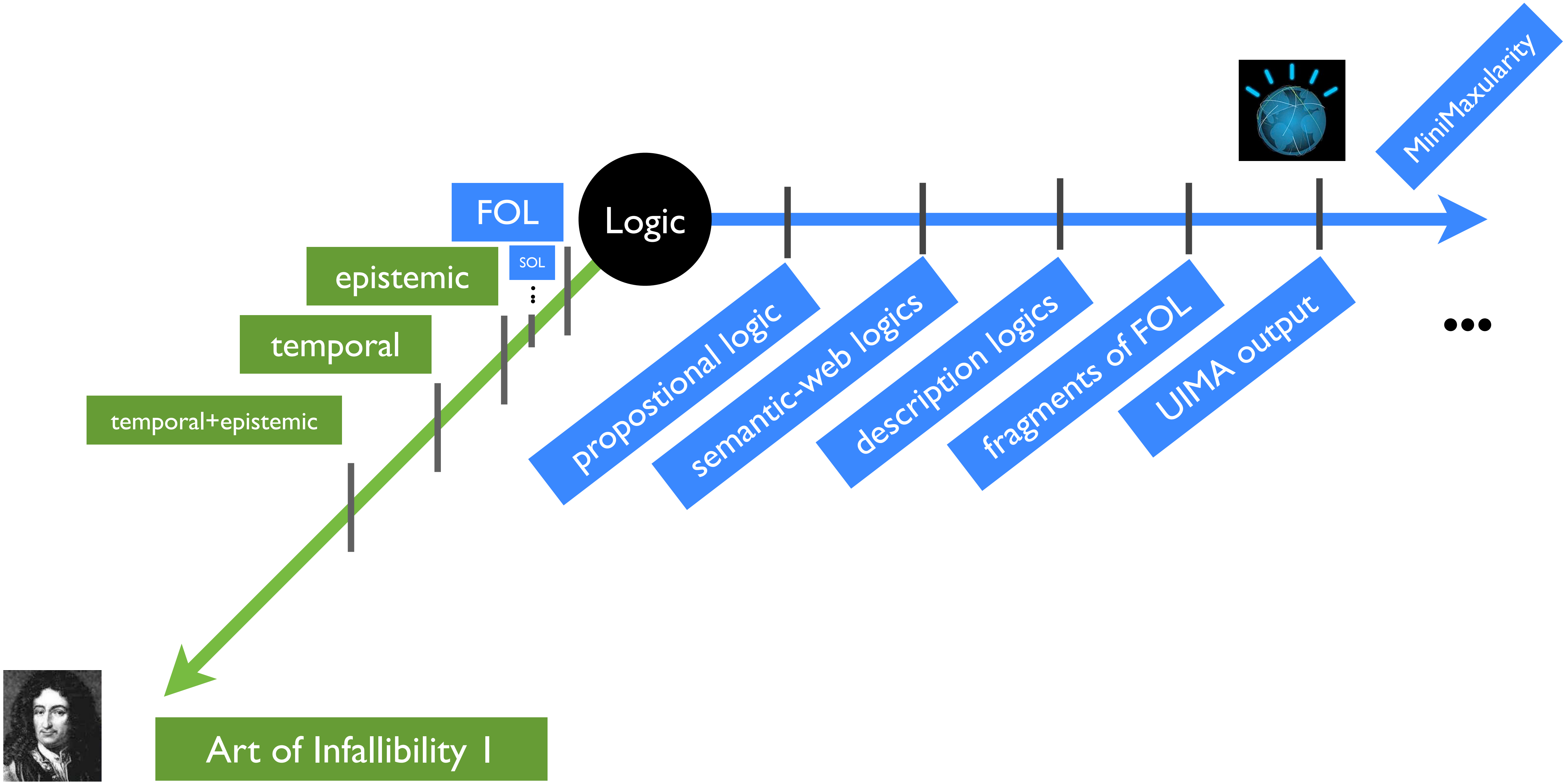
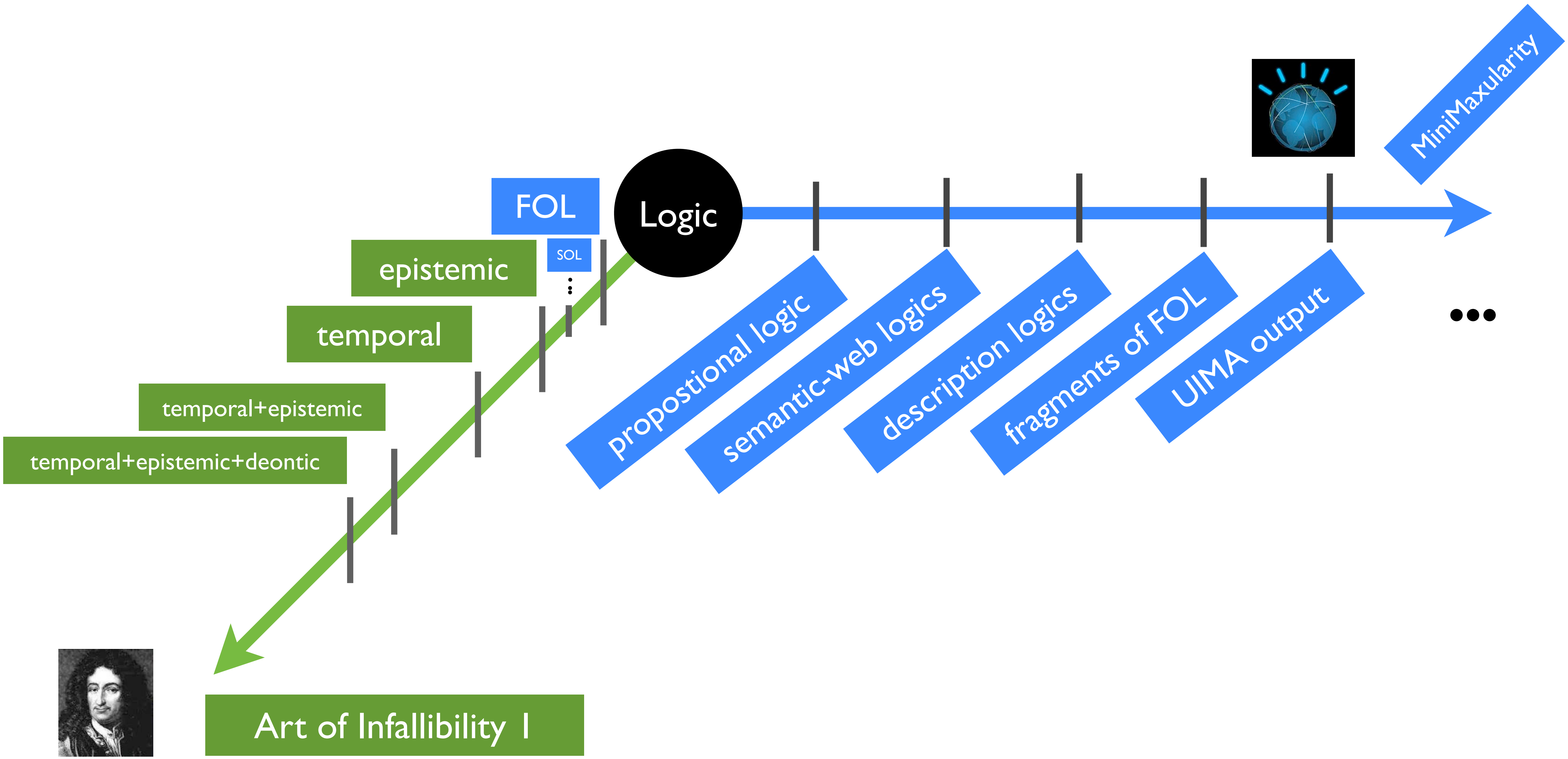
Art of Infallibility I



FOL
Logic
SOL
epistemic
temporal
temporal+epistemic
propostional logic
semantic-web logics
description logics
fragments of FOL
UIMA output
MiniMaxularity
...
Art of Infallibility I


FOL
Logic
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fragments of FOL
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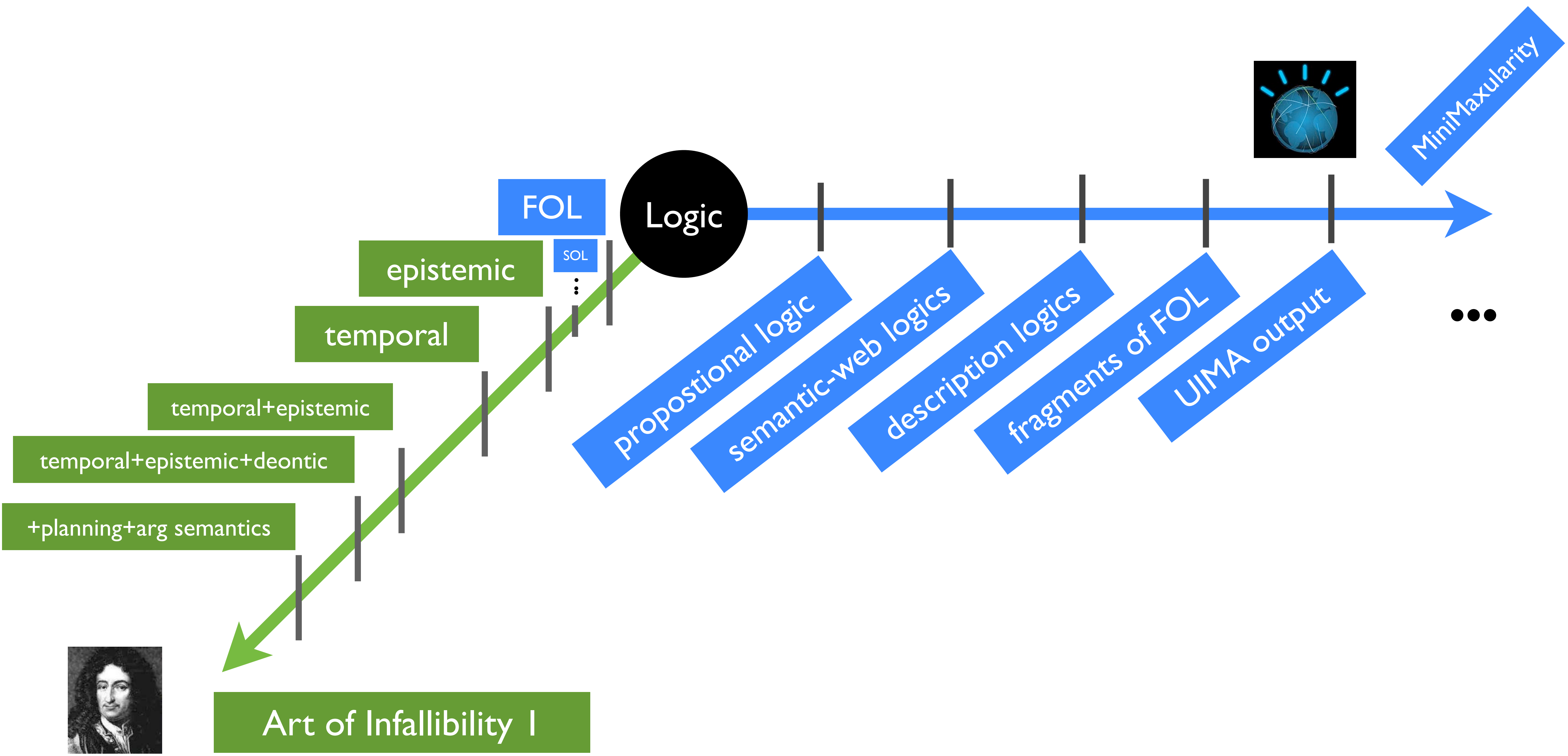
MiniMaxularity
Art of Infallibility I



FOL
Logic
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epistemic
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+planning+arg semantics
Art of Infallibility I
propostional logic
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UIMA output
MiniMaxularity
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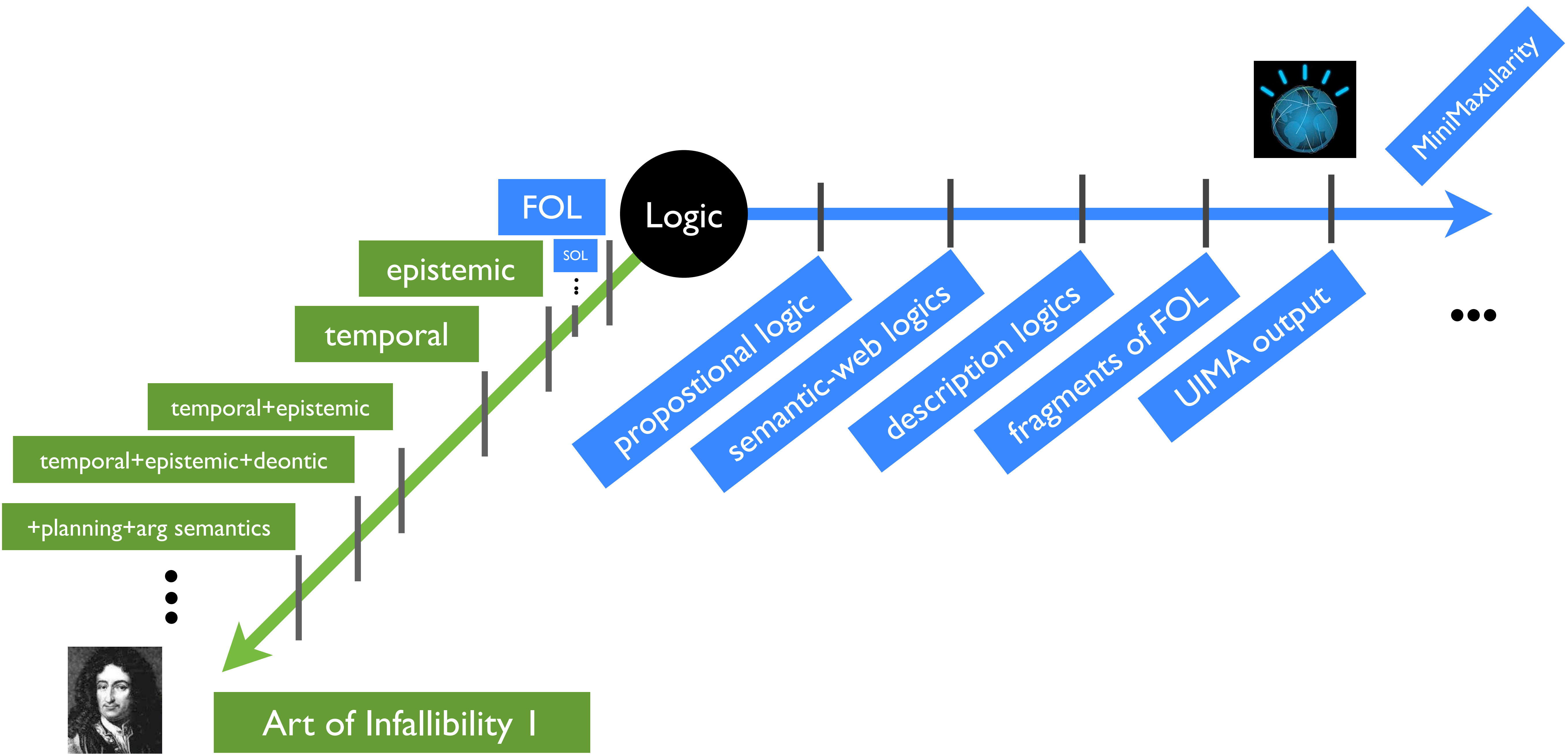
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Art of Infallibility I
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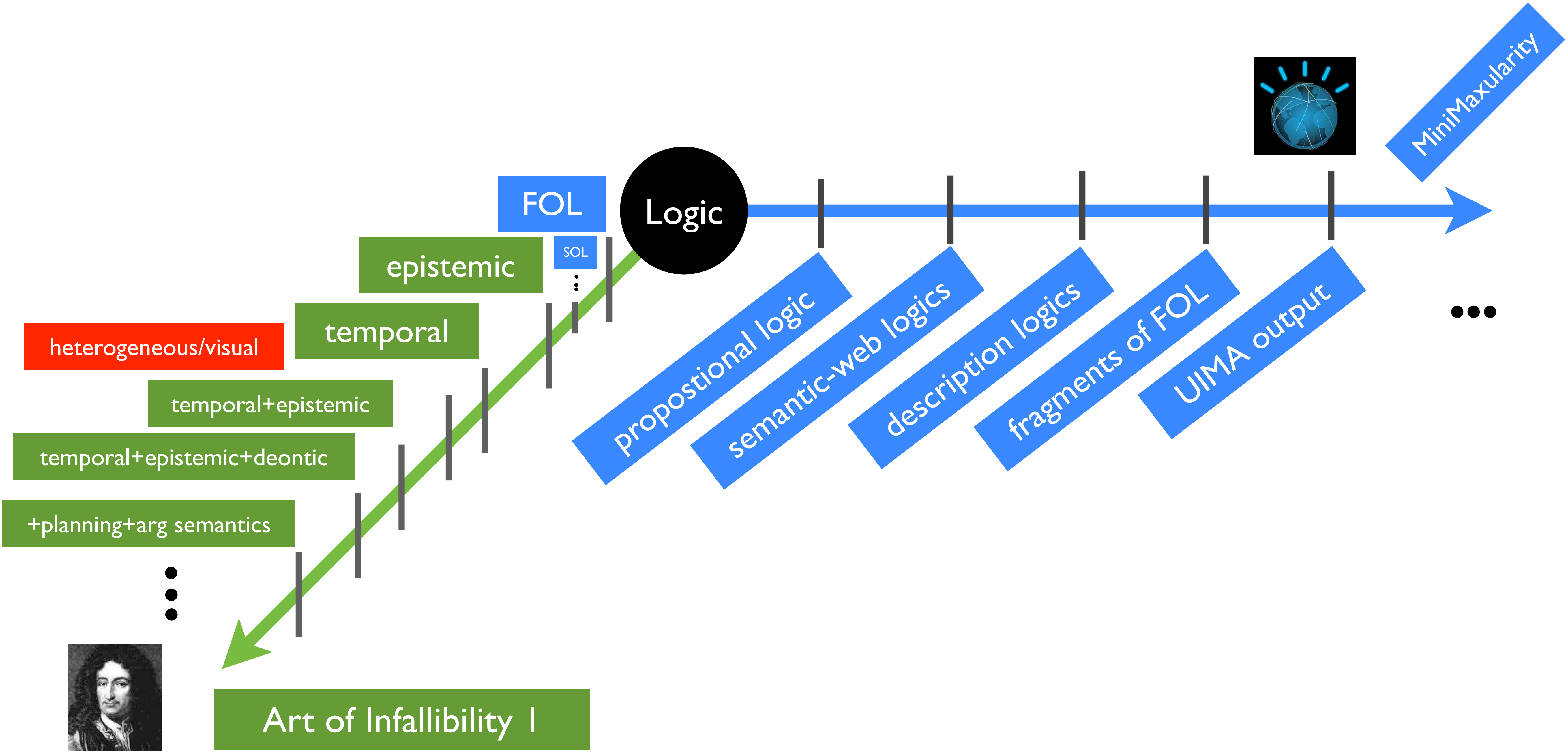
FOL
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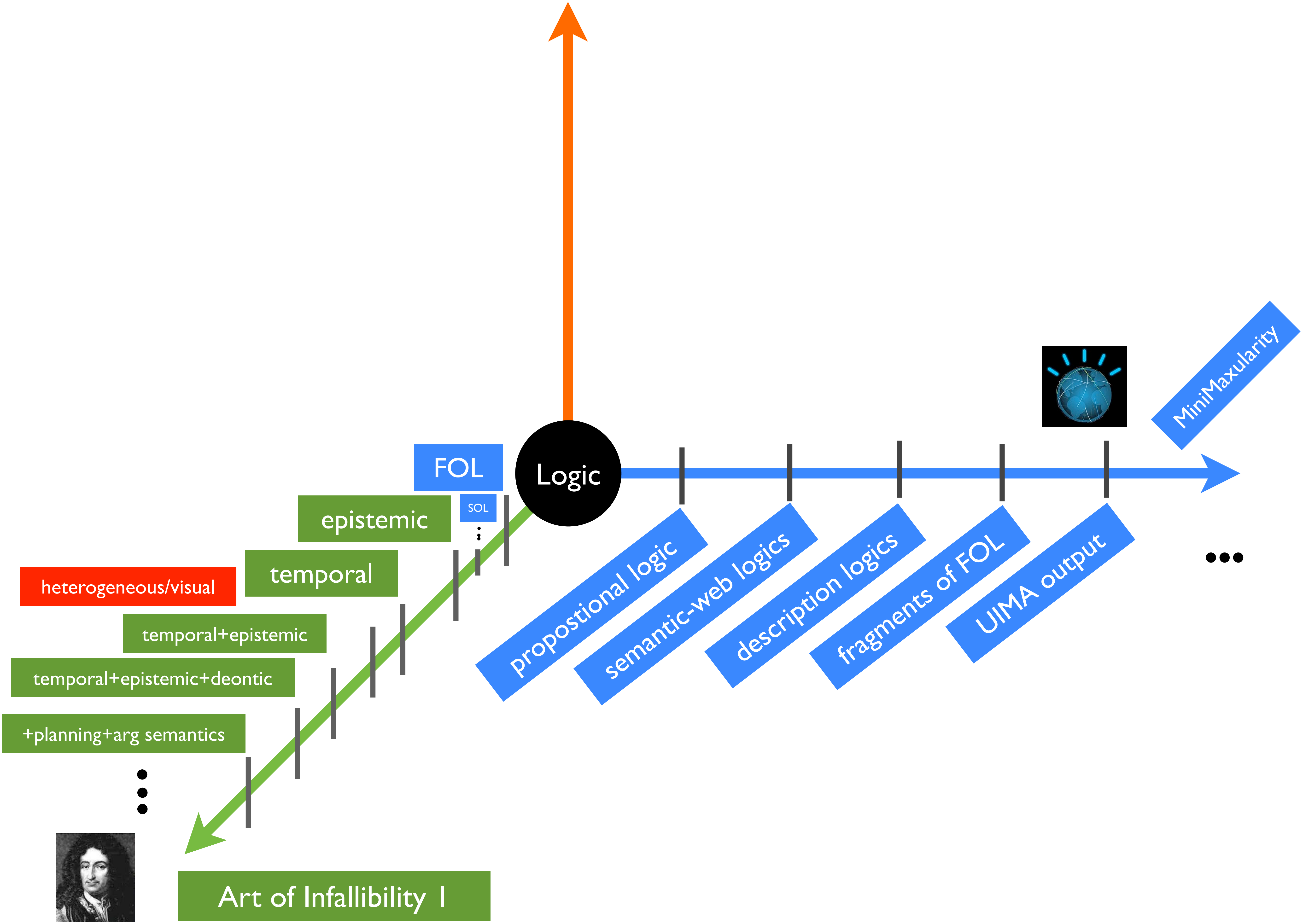

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Art of Infallibility I
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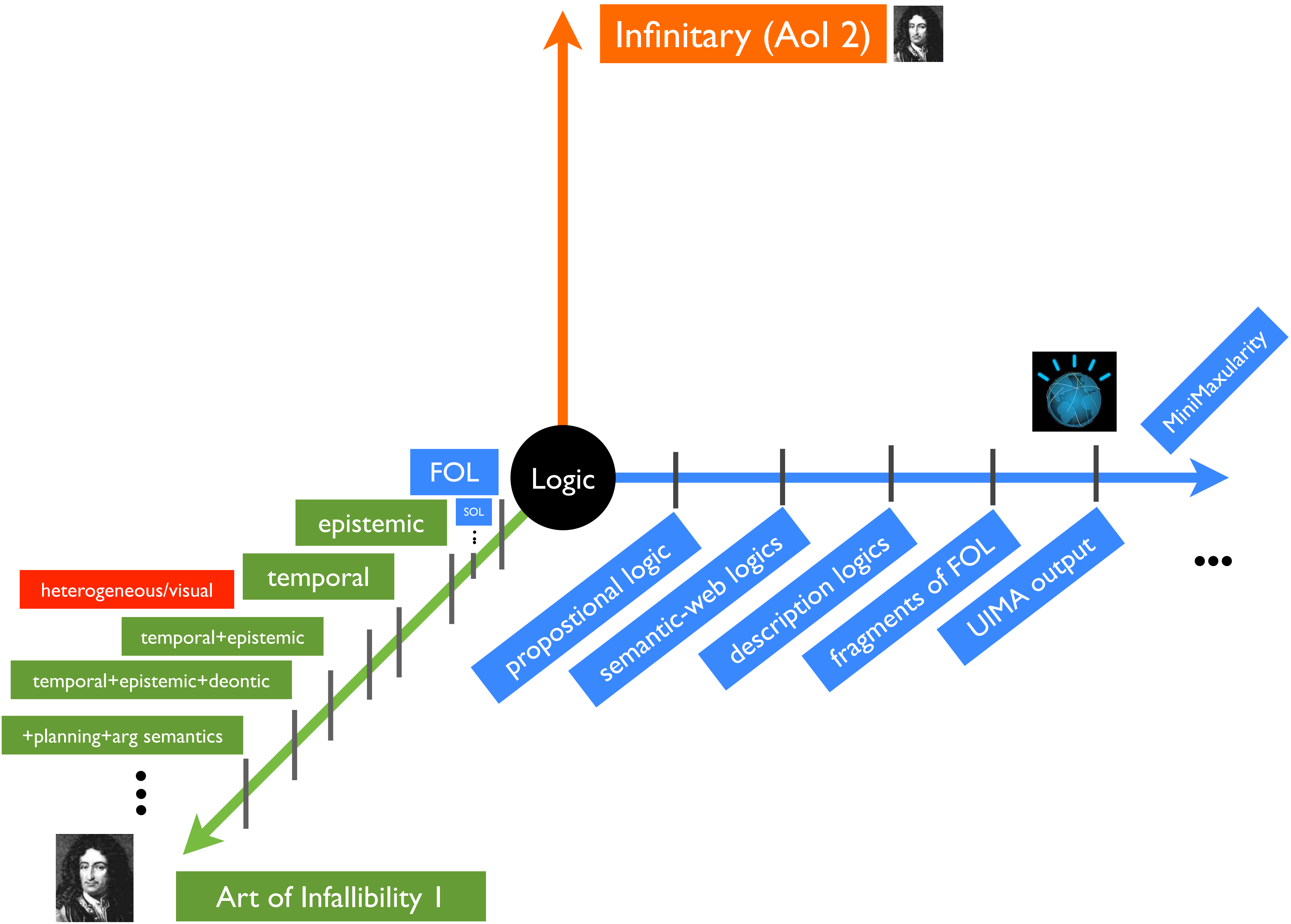
UIMA output
MiniMaxularity



Infinitary (AoI 2)
Logic
FOL
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
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Art of Infallibility I
propostional logic
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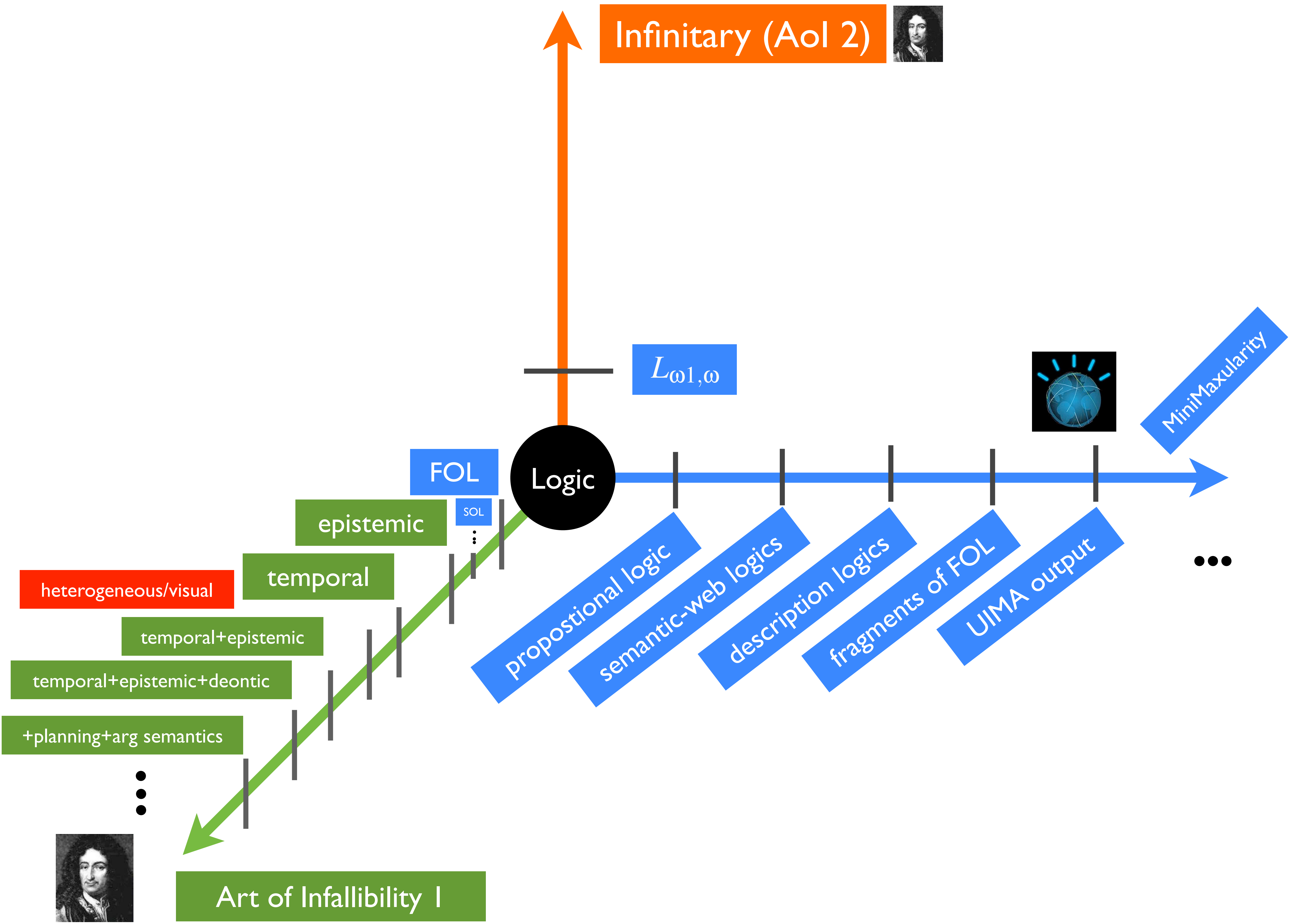
UIMA output
MiniMaxularity



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
+planning+arg semantics
propostional logic
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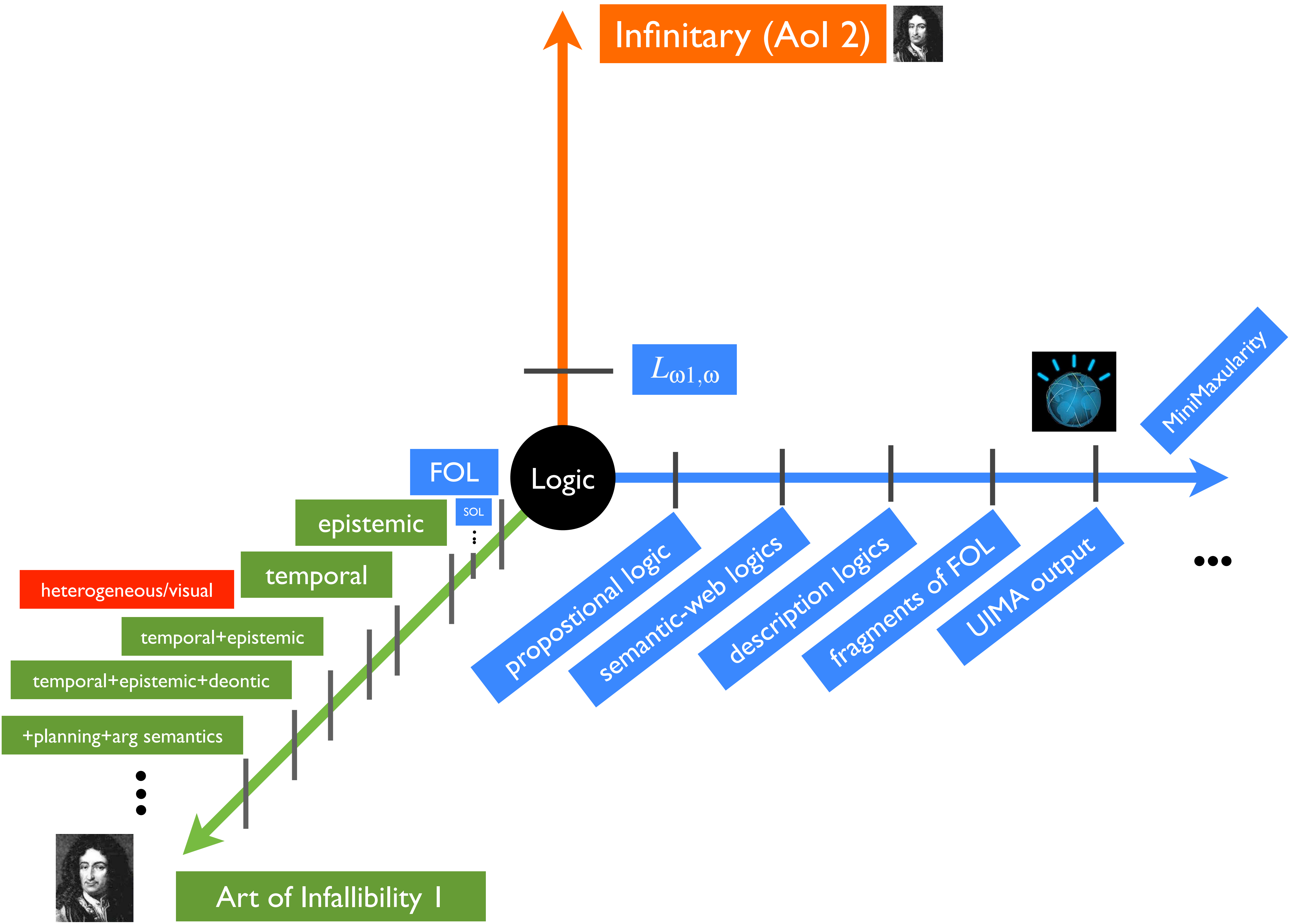
description logics
fragments of FOL
UIMA output
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
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description logics
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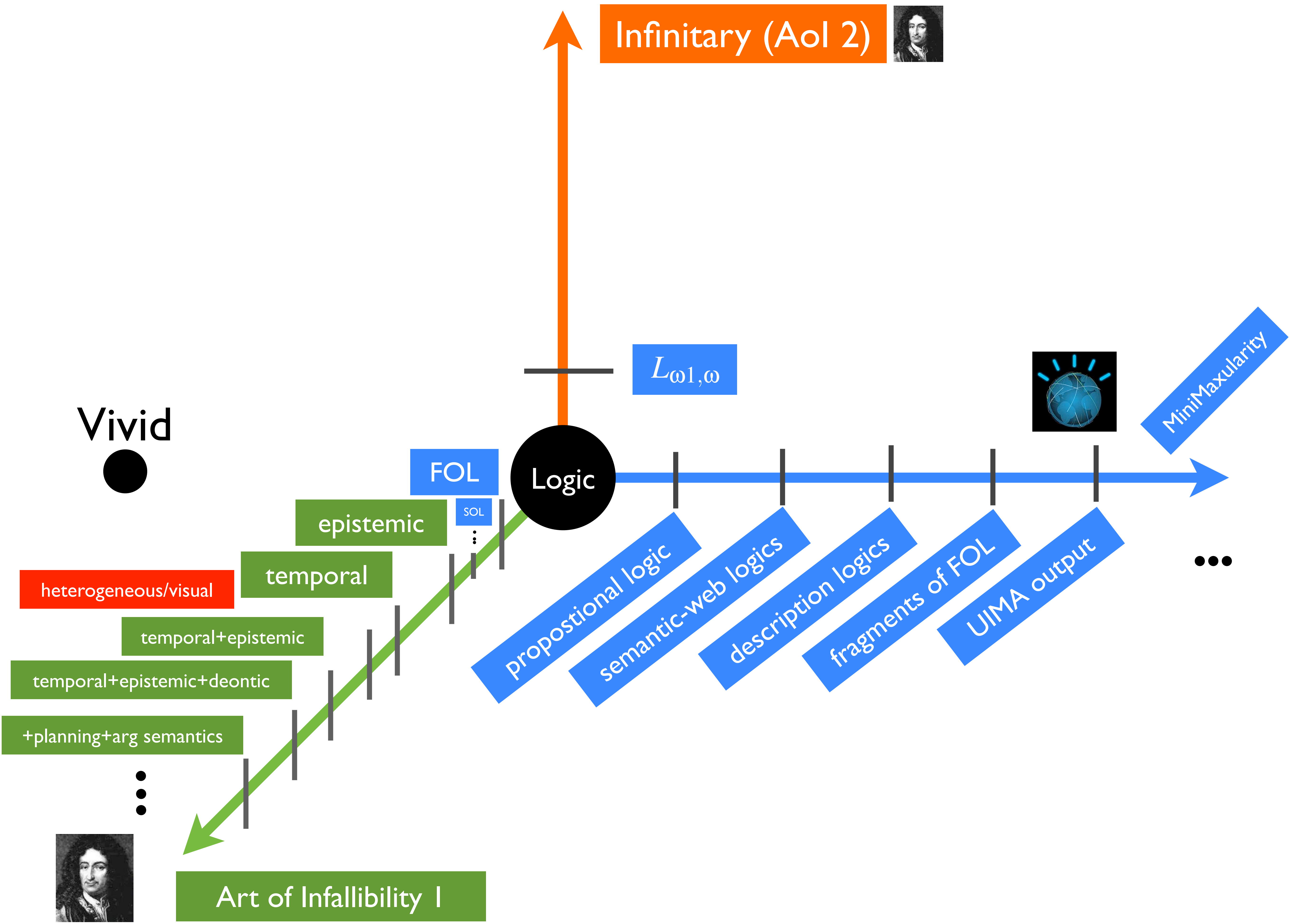
UIMA output
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
Vivid
FOL
Logic
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
+planning+arg semantics
propostional logic
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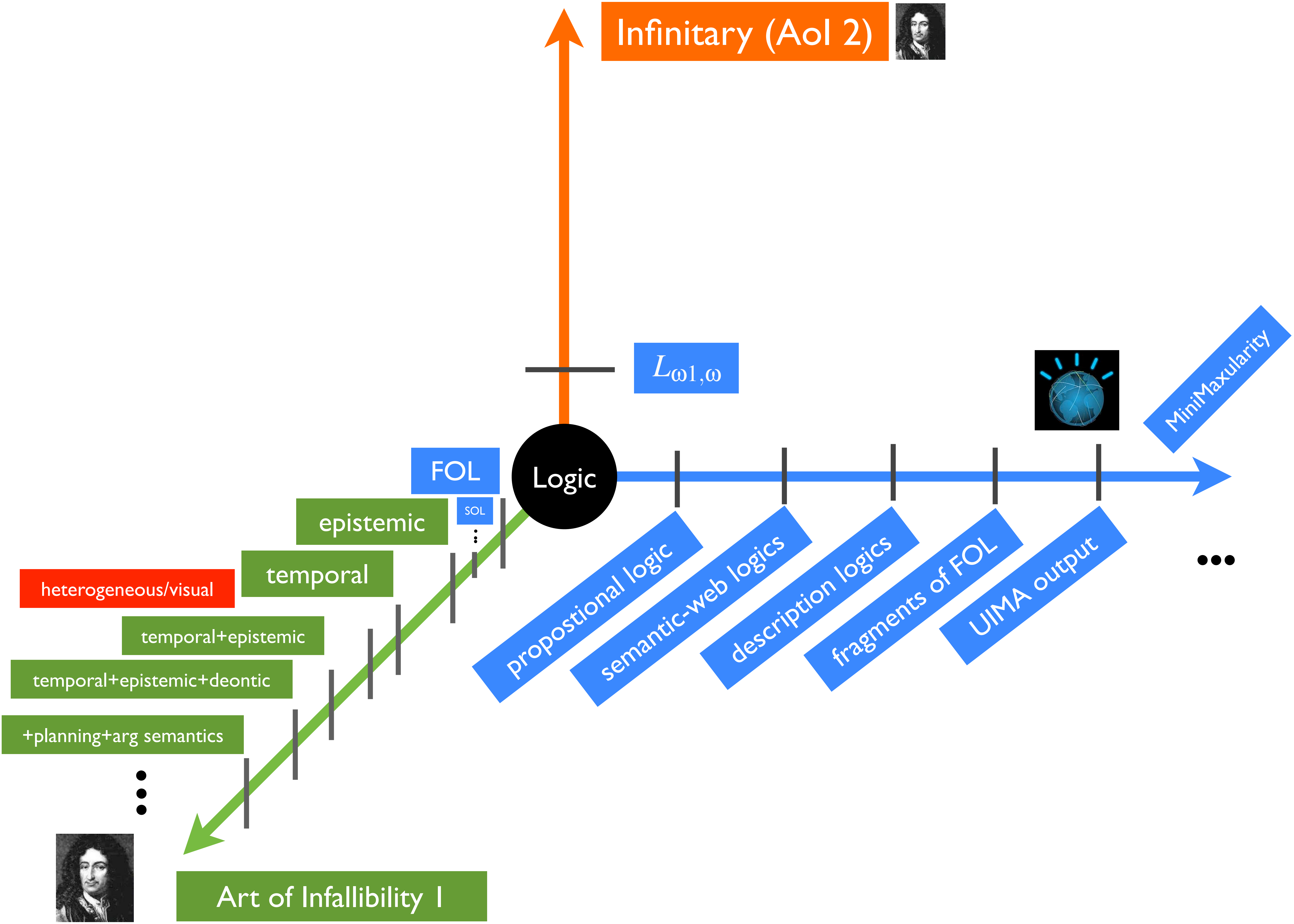
fragments of FOL
UIMA output
MiniMaxularity
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega1,\omega}$
MiniMaxularity
FOL
Logic
SOL
epistemic
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heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
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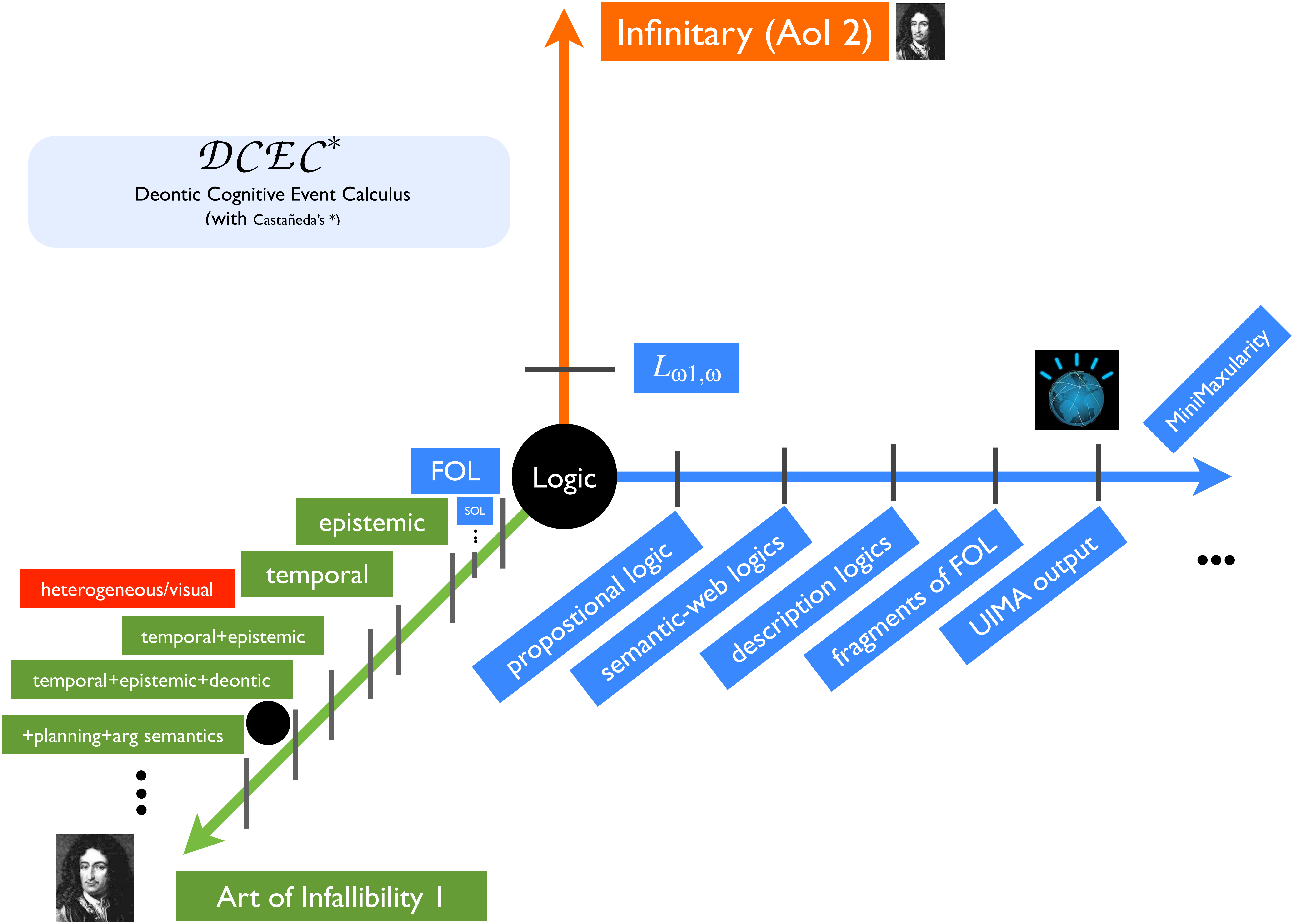
Art of Infallibility I
propostional logic
semantic-web logics
description logics
fragments of FOL
UIMA output


Infinitary (AoI 2)
$\mathcal{DCEC}^*$
Deontic Cognitive Event Calculus
(with Castañeda's *)
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
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temporal+epistemic
temporal+epistemic+deontic
+planning+arg semantics
propostional logic
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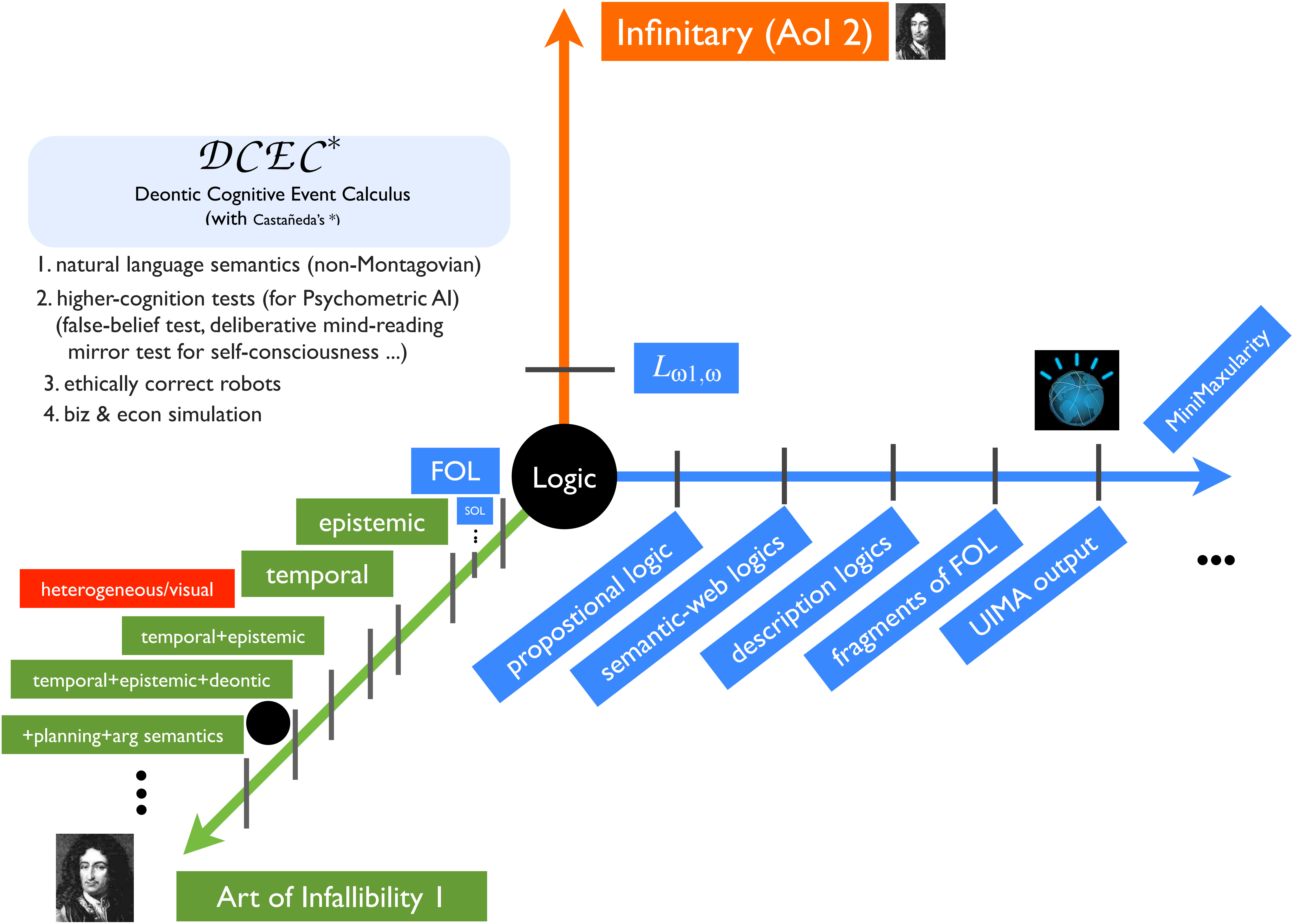
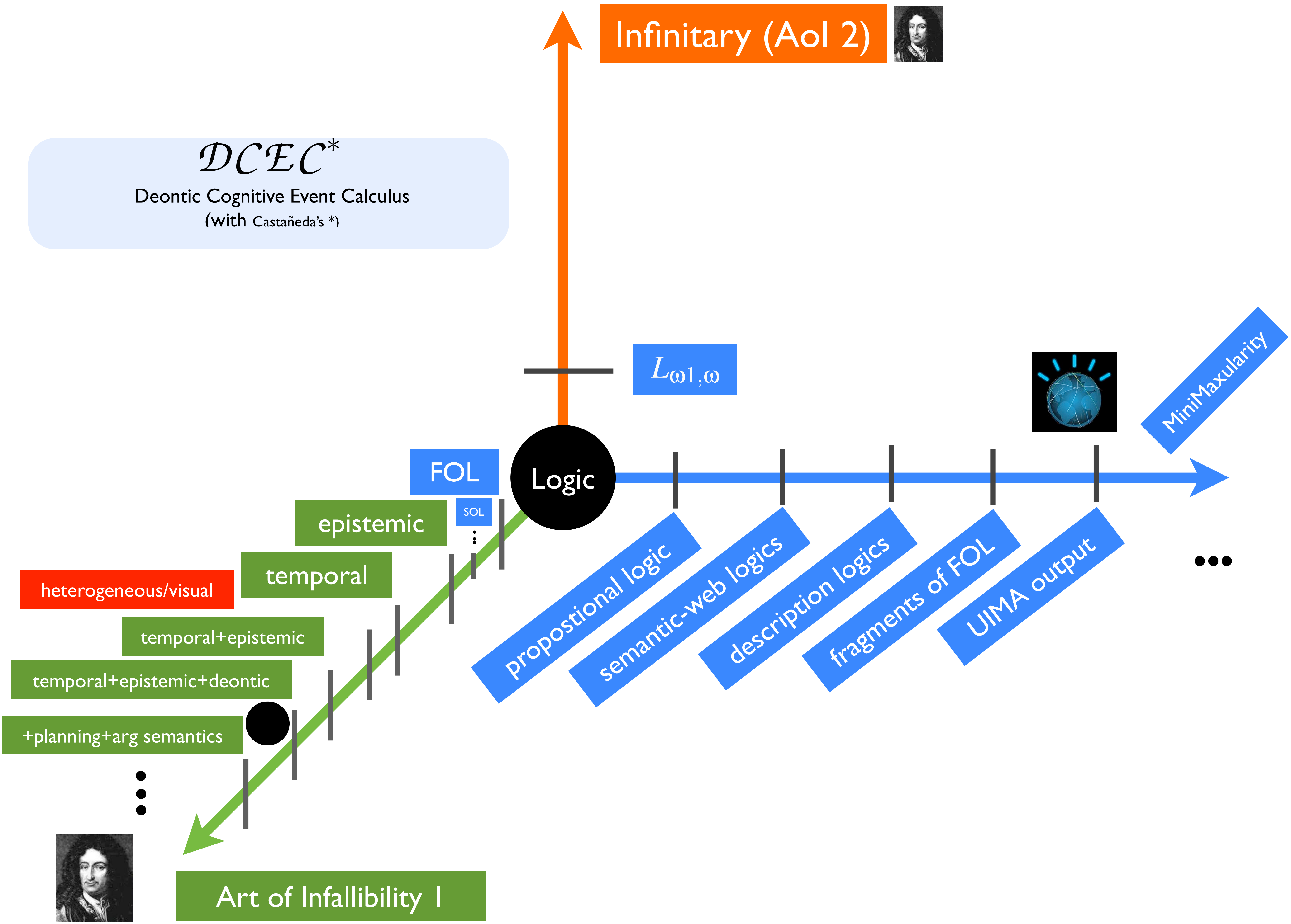
fragments of FOL
UIMA output
Art of Infallibility I



Infinitary (AoI 2)
$\mathcal{DCEC}^*$
Deontic Cognitive Event Calculus
(with Castañeda's *)
1. natural language semantics (non-Montagovian)
2. higher-cognition tests (for Psychometric AI)
(false-belief test, deliberative mind-reading
mirror test for self-consciousness ...)
3. ethically correct robots
4. biz & econ simulation
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
+planning+arg semantics
propostional logic
semantic-web logics
description logics
fragments of FOL
UIMA output
...
Art of Infallibility I


Infinitary (AoI 2)
DCEC*
Deontic Cognitive Event Calculus
(with Castañeda's *)
Lω1,ω
MiniMaxularity
FOL
Logic
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
+planning+arg semantics
propostional logic
semantic-web logics
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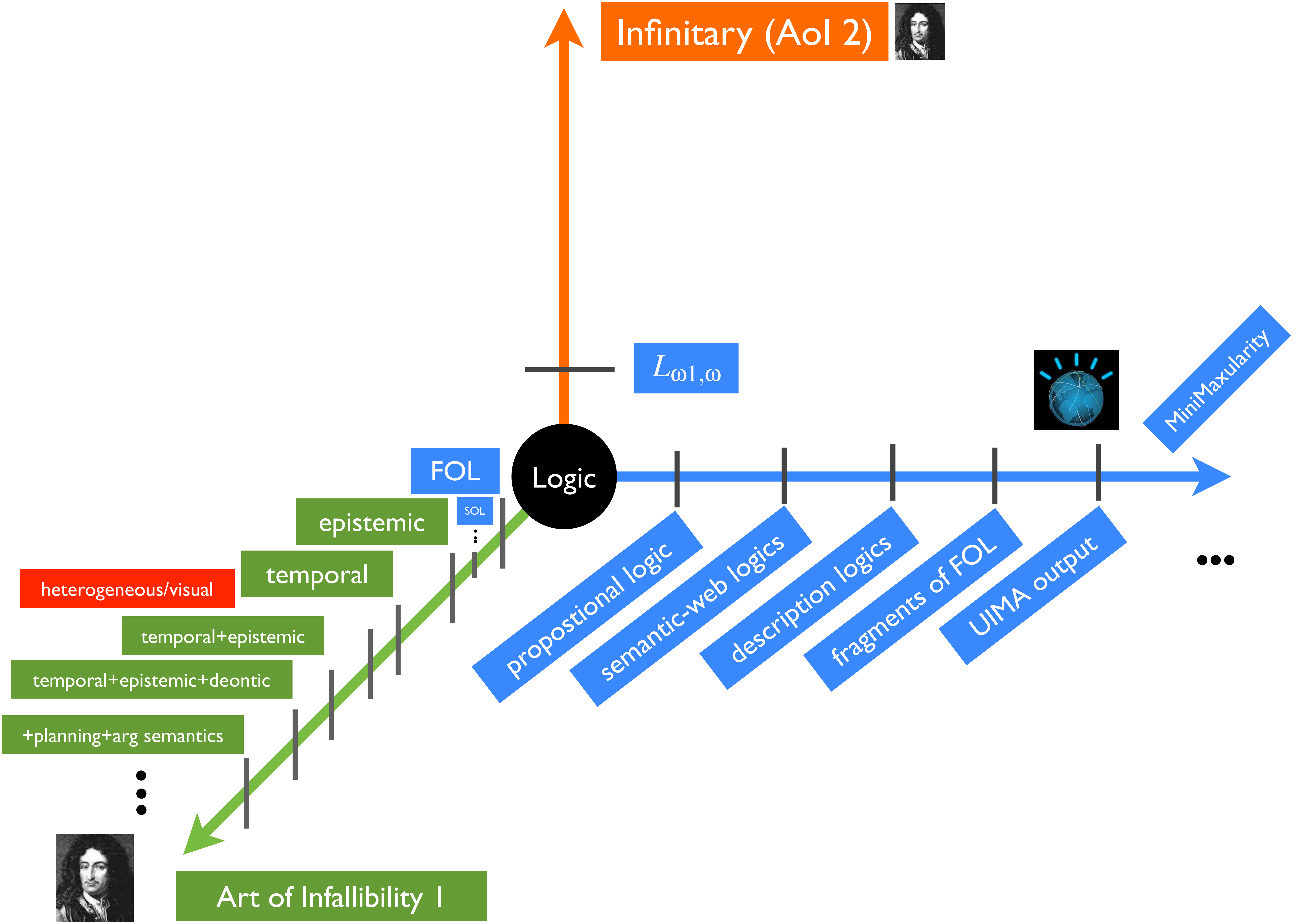
fragments of FOL
UIMA output
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
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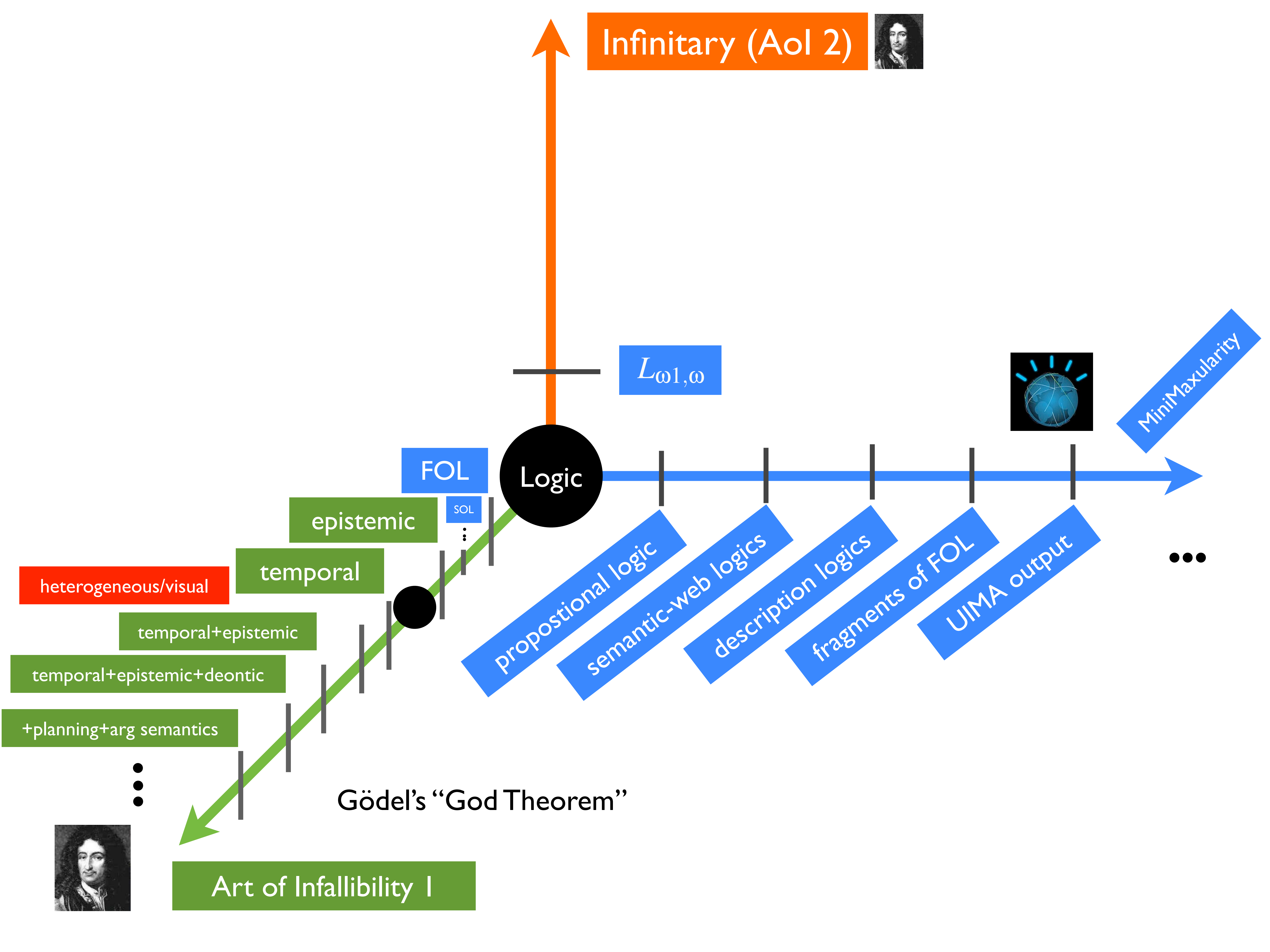
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
+planning+arg semantics
propostional logic
semantic-web logics
description logics
fragments of FOL
UIMA output
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
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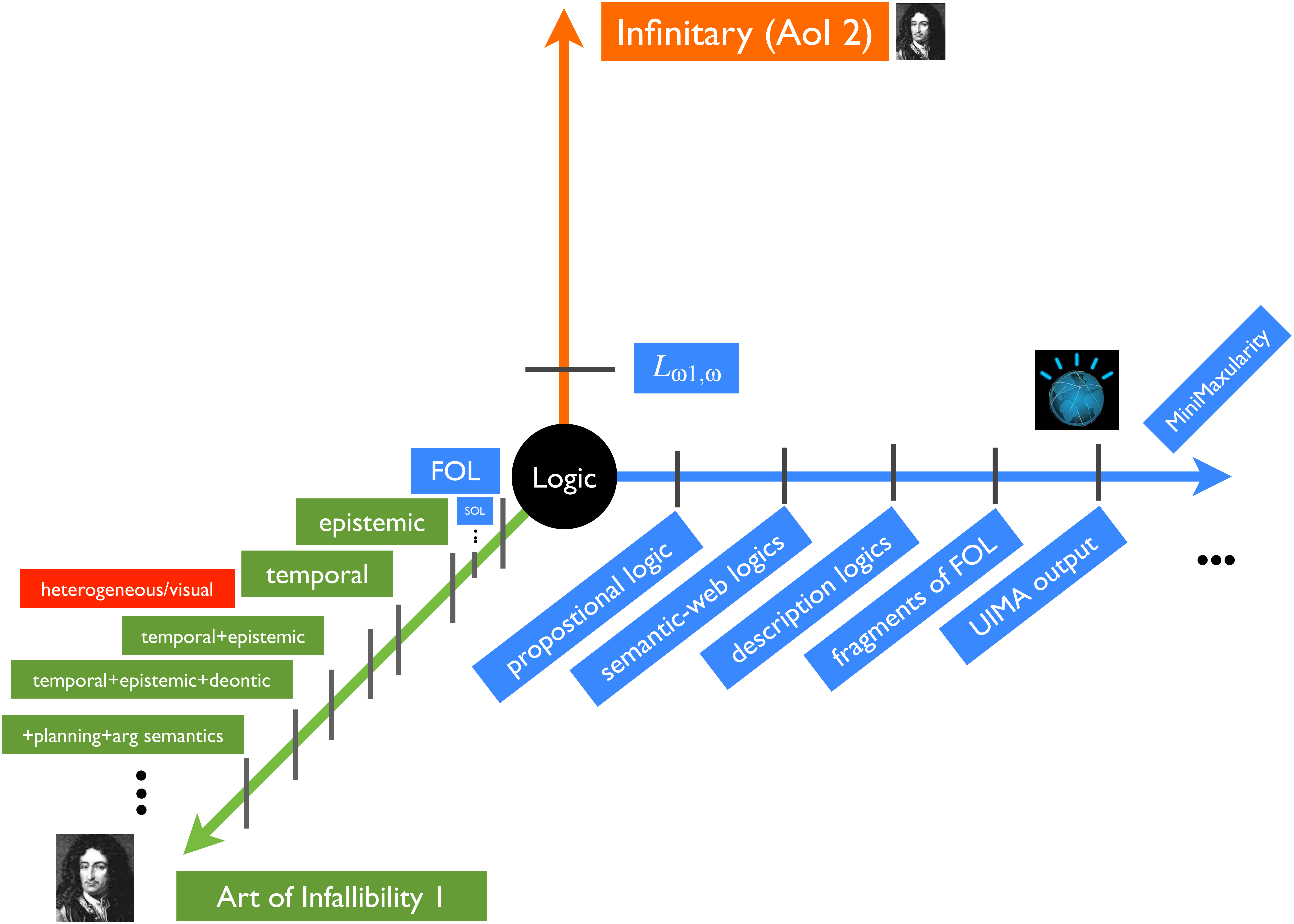
propostional logic
semantic-web logics
description logics
fragments of FOL
UIMA output
Gödel's "God Theorem"
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
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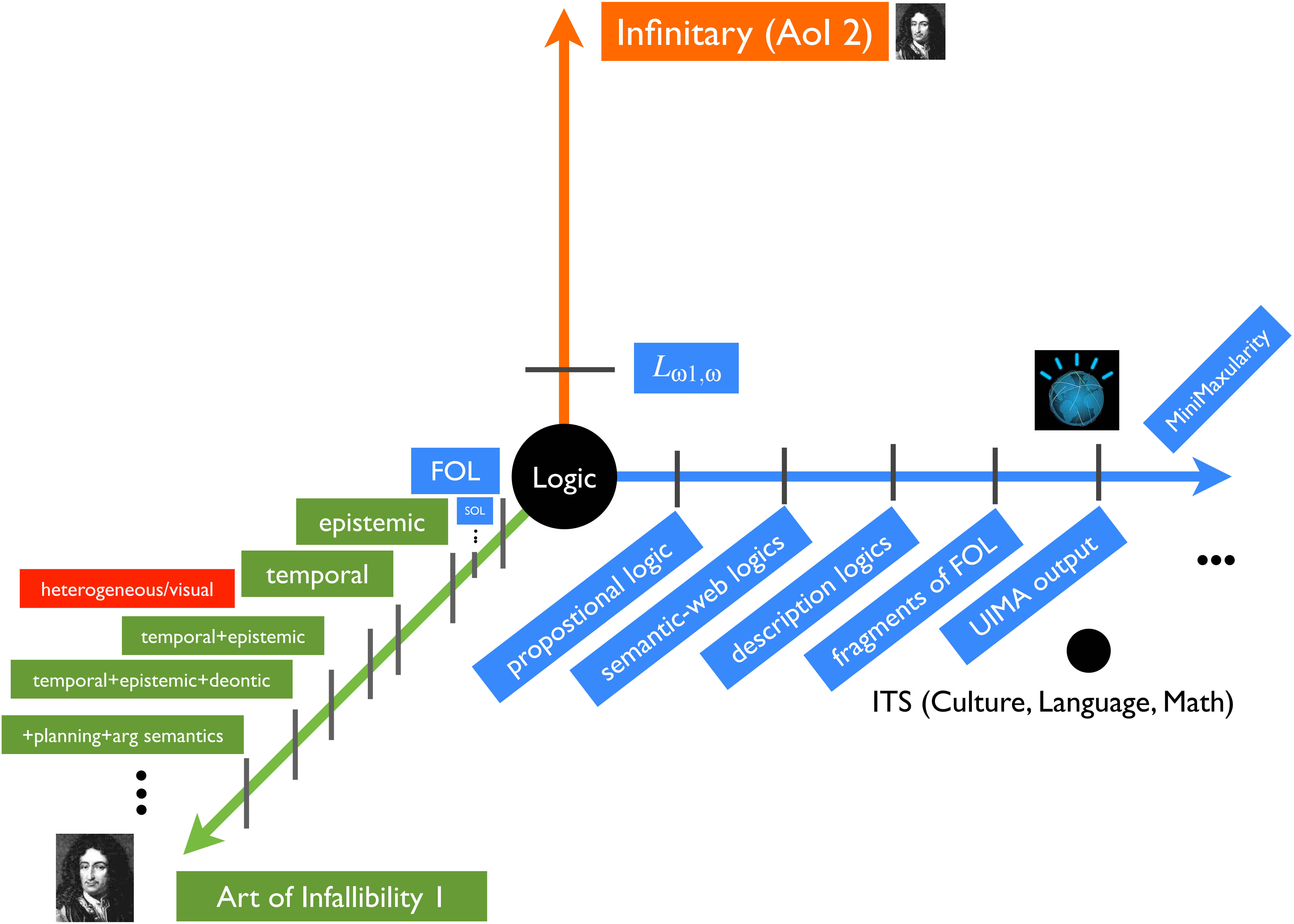
UIMA output
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
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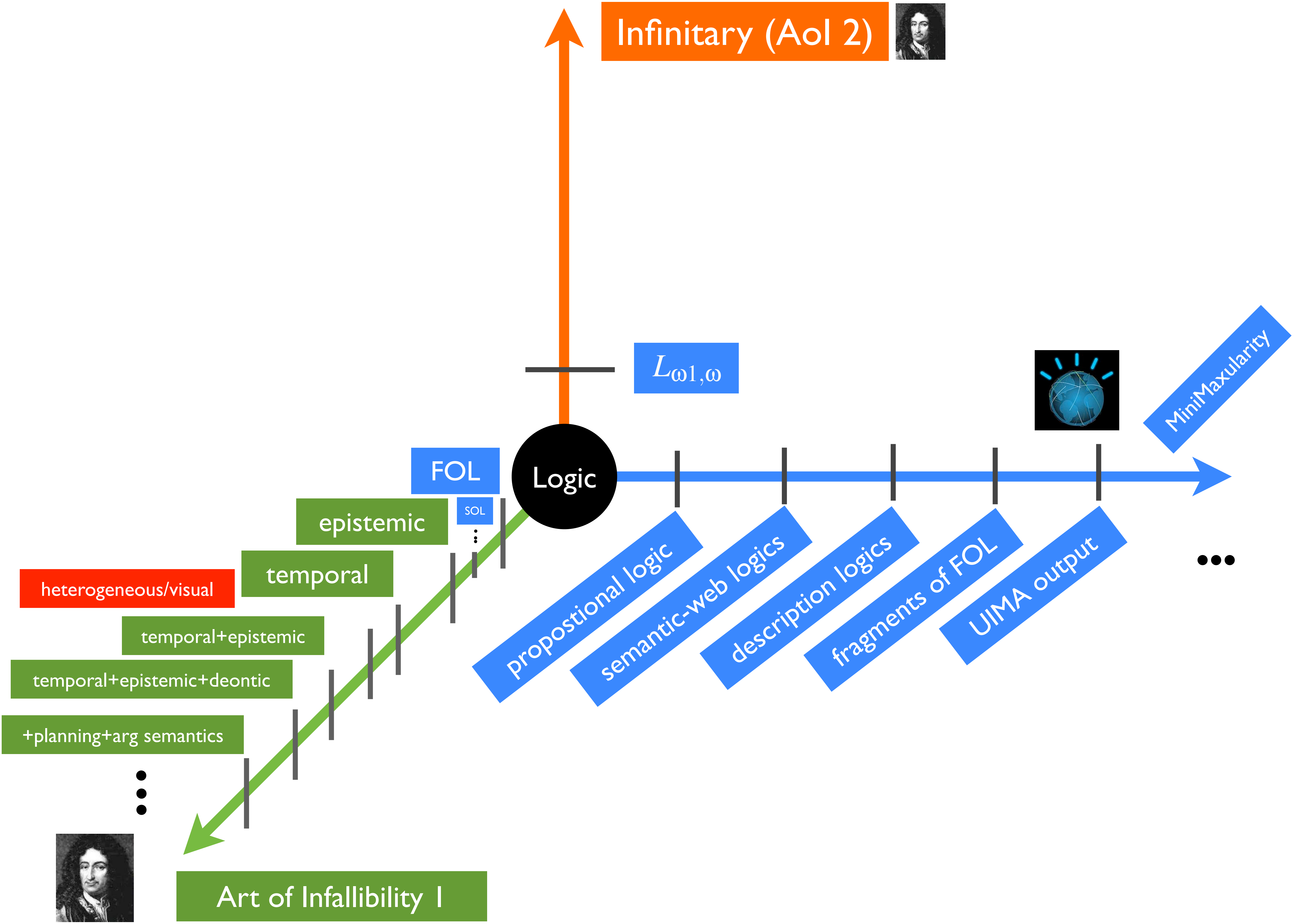
description logics
fragments of FOL
UIMA output
ITS (Culture, Language, Math)
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
Logic
FOL
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temporal+epistemic+deontic
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Art of Infallibility I
propostional logic
semantic-web logics
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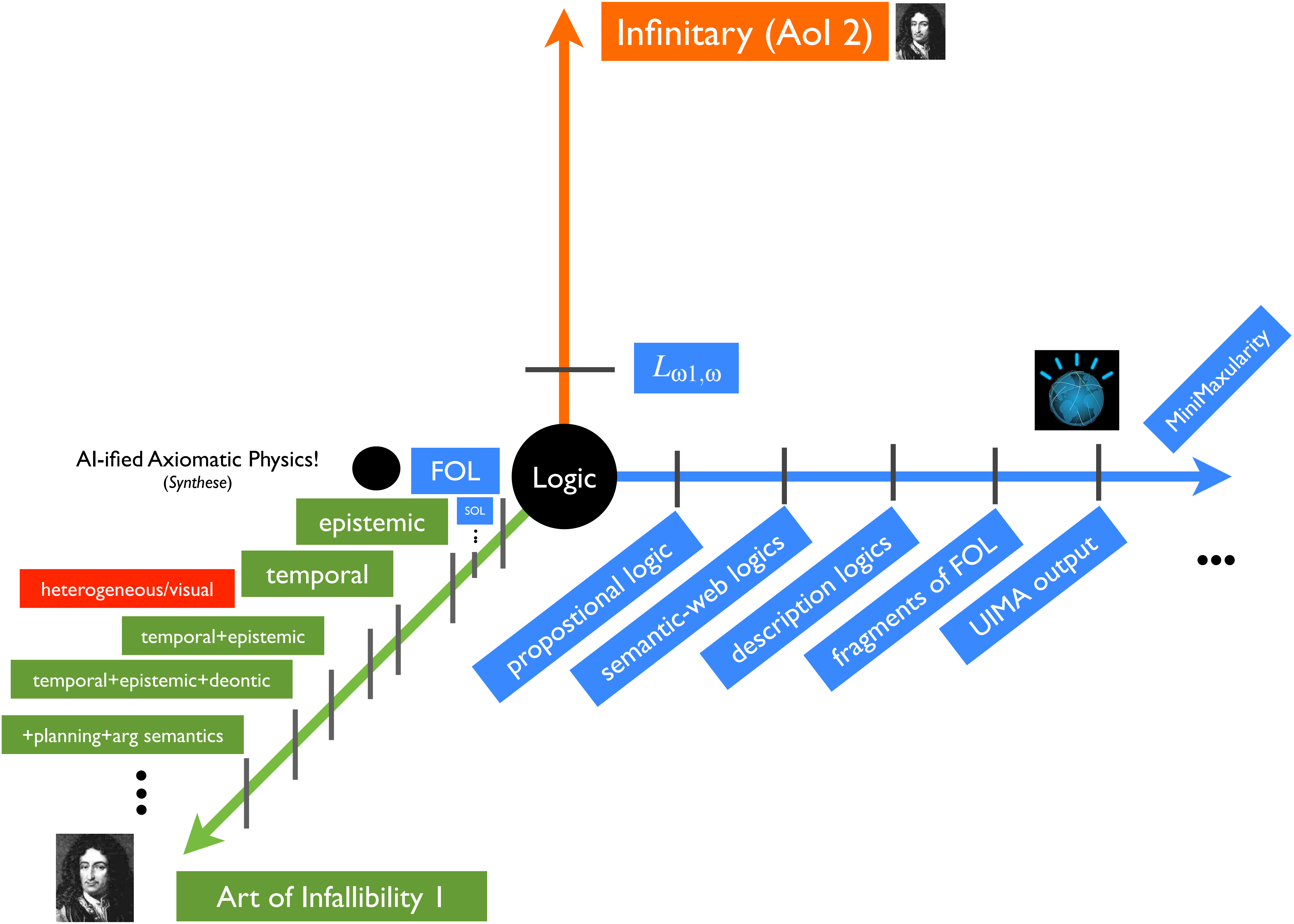
UIMA output
MiniMaxularity



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
AI-ified Axiomatic Physics!
(Synthese)
FOL
Logic
SOL
epistemic
temporal
heterogeneous/visual
temporal+epistemic
temporal+epistemic+deontic
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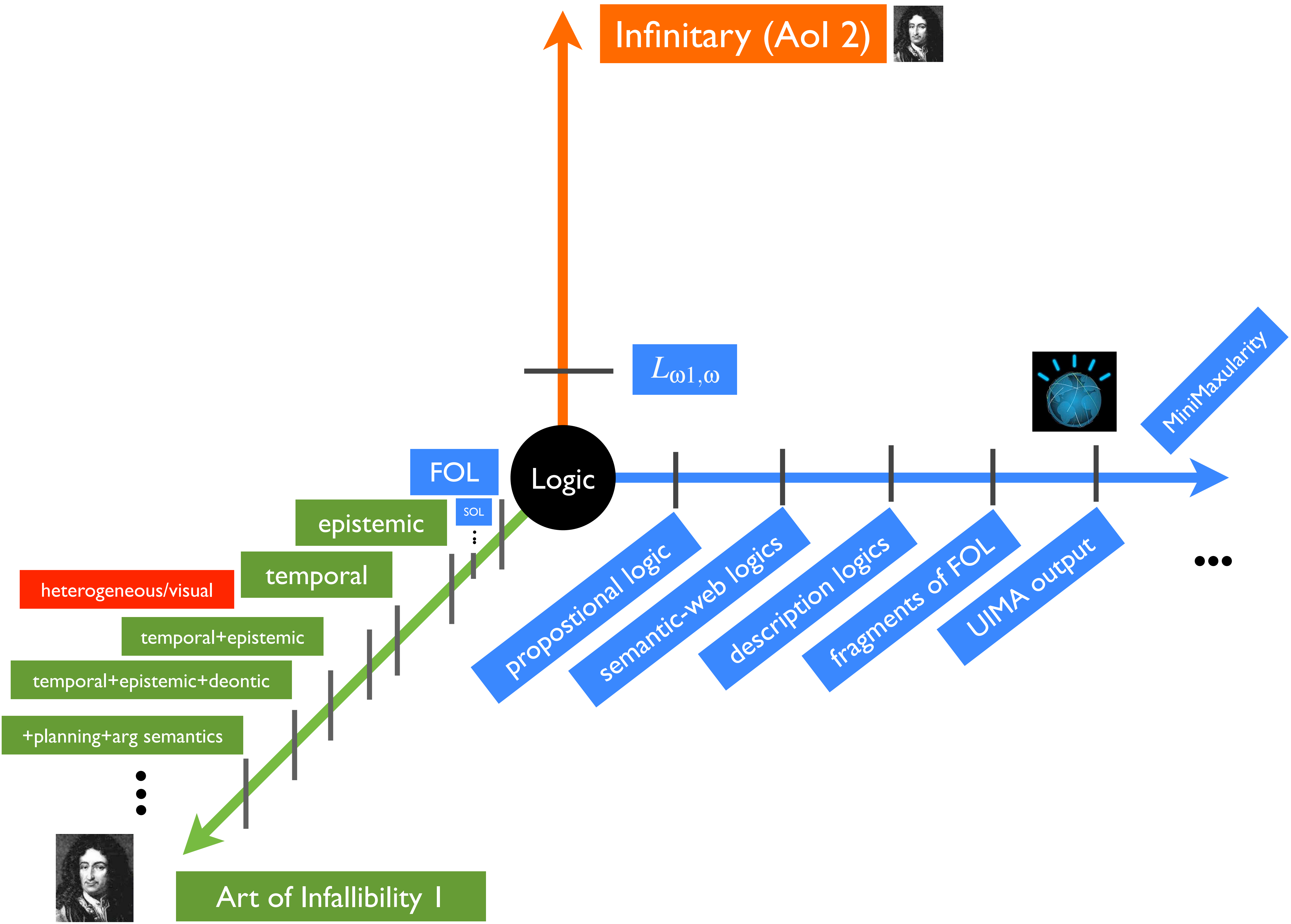
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega 1,\omega}$
MiniMaxularity
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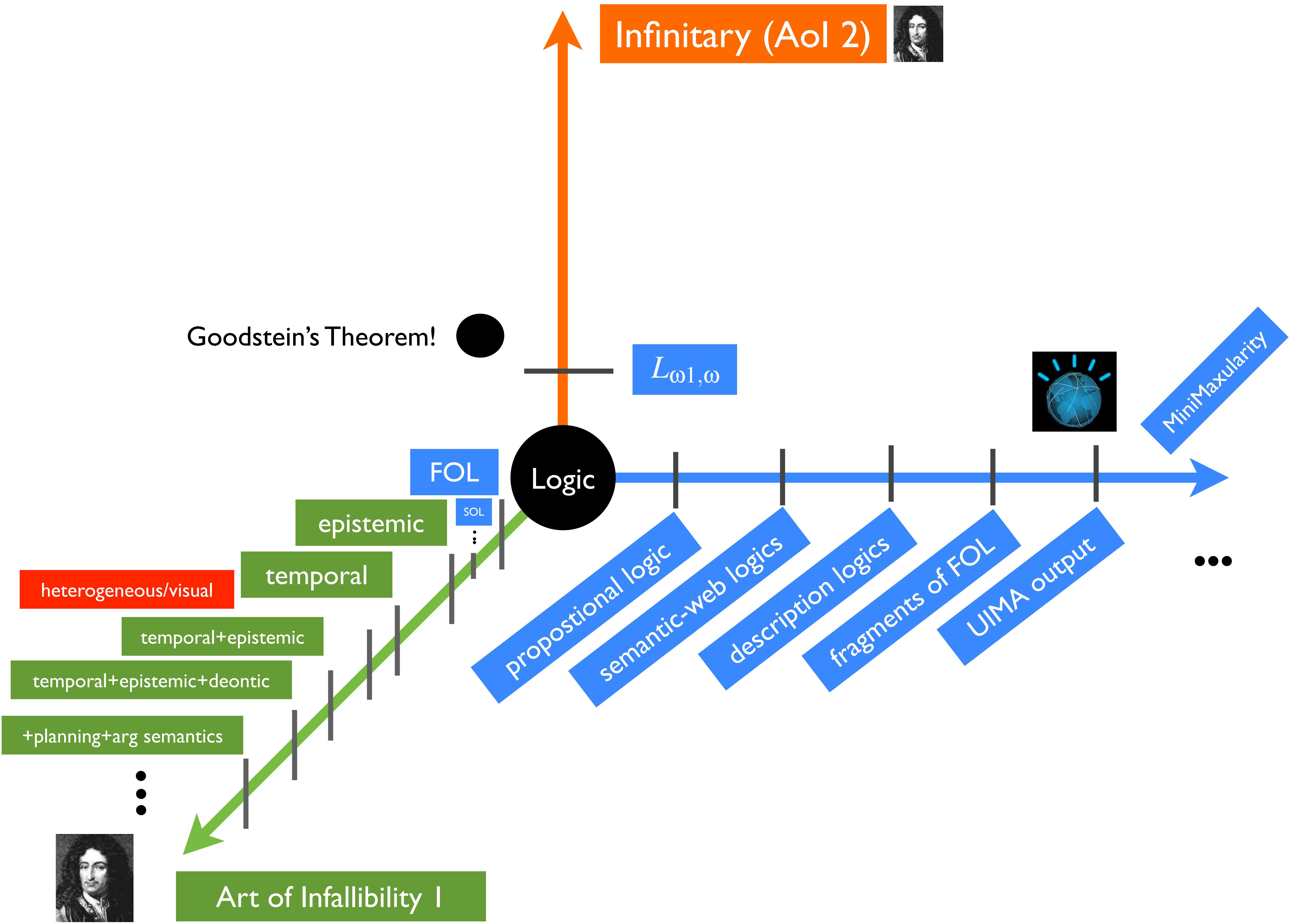
UIMA output
Art of Infallibility I


Infinitary (AoI 2)
Goodstein's Theorem!
$L_{\omega 1,\omega}$
MiniMaxularity
FOL
Logic
SOL
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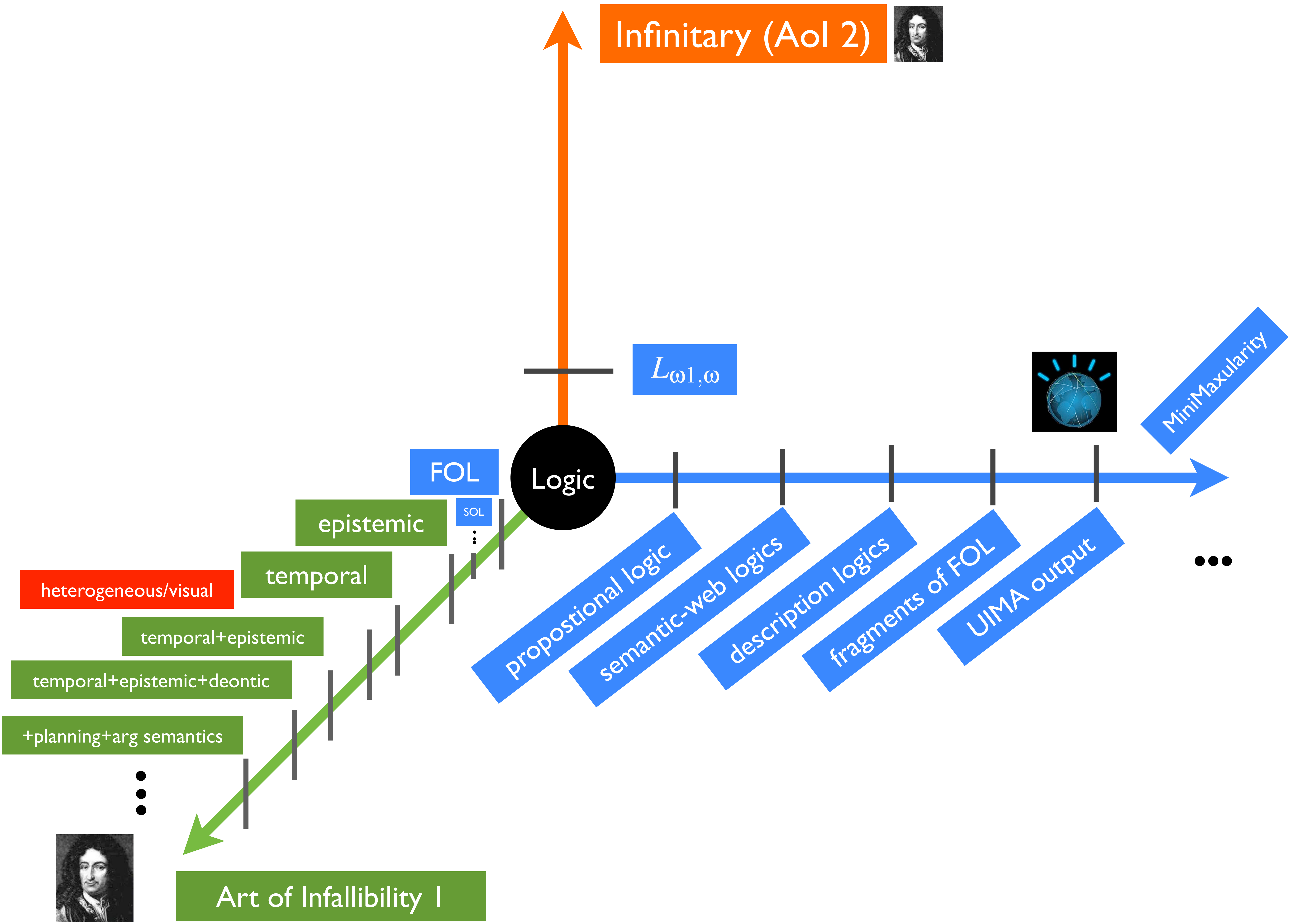
Art of Infallibility I



Infinitary (AoI 2)
$L_{\omega_1,\omega}$
MiniMaxularity
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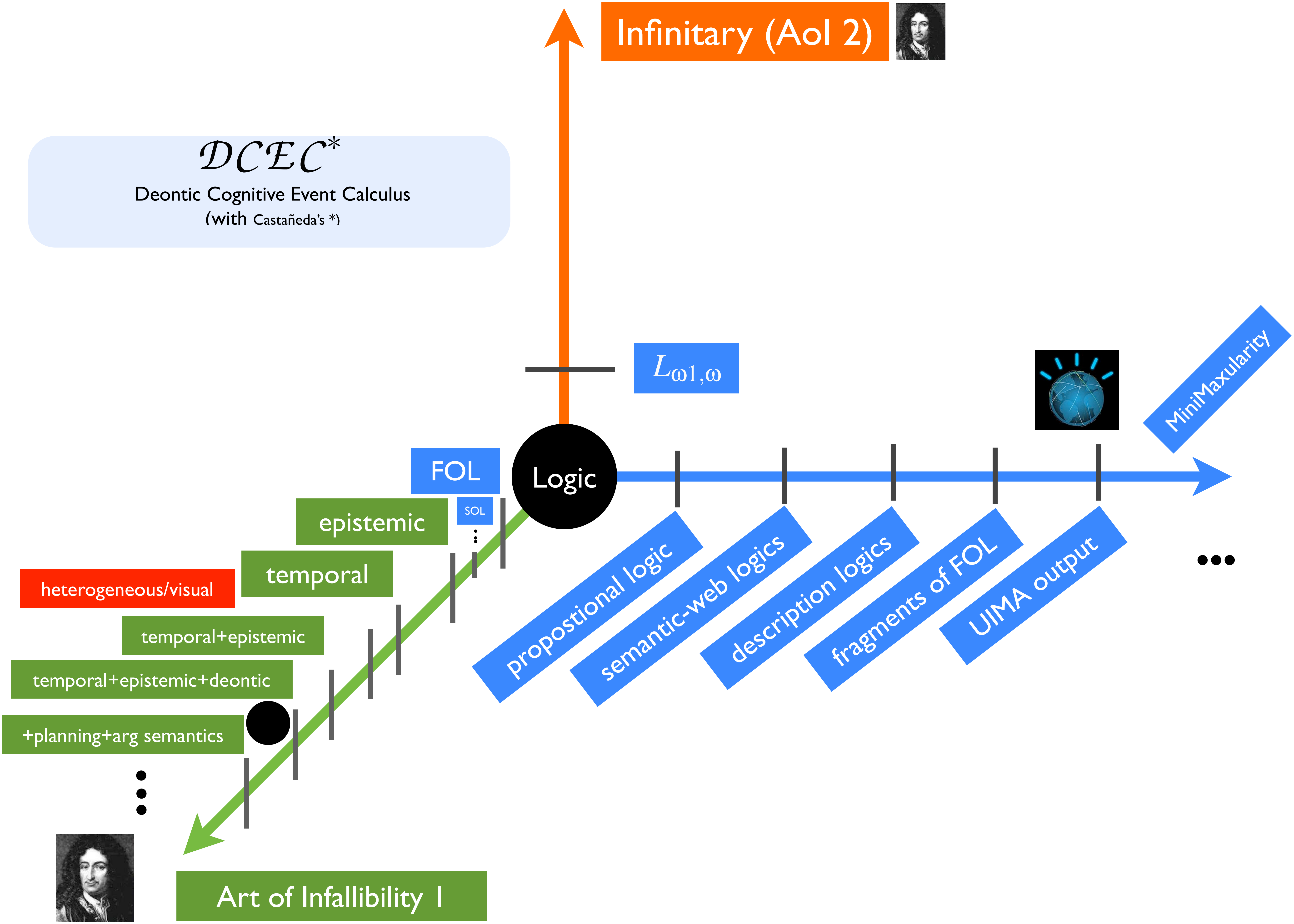

Infinitary (AoI 2)
DCEC*
Deontic Cognitive Event Calculus
(with Castañeda's *)
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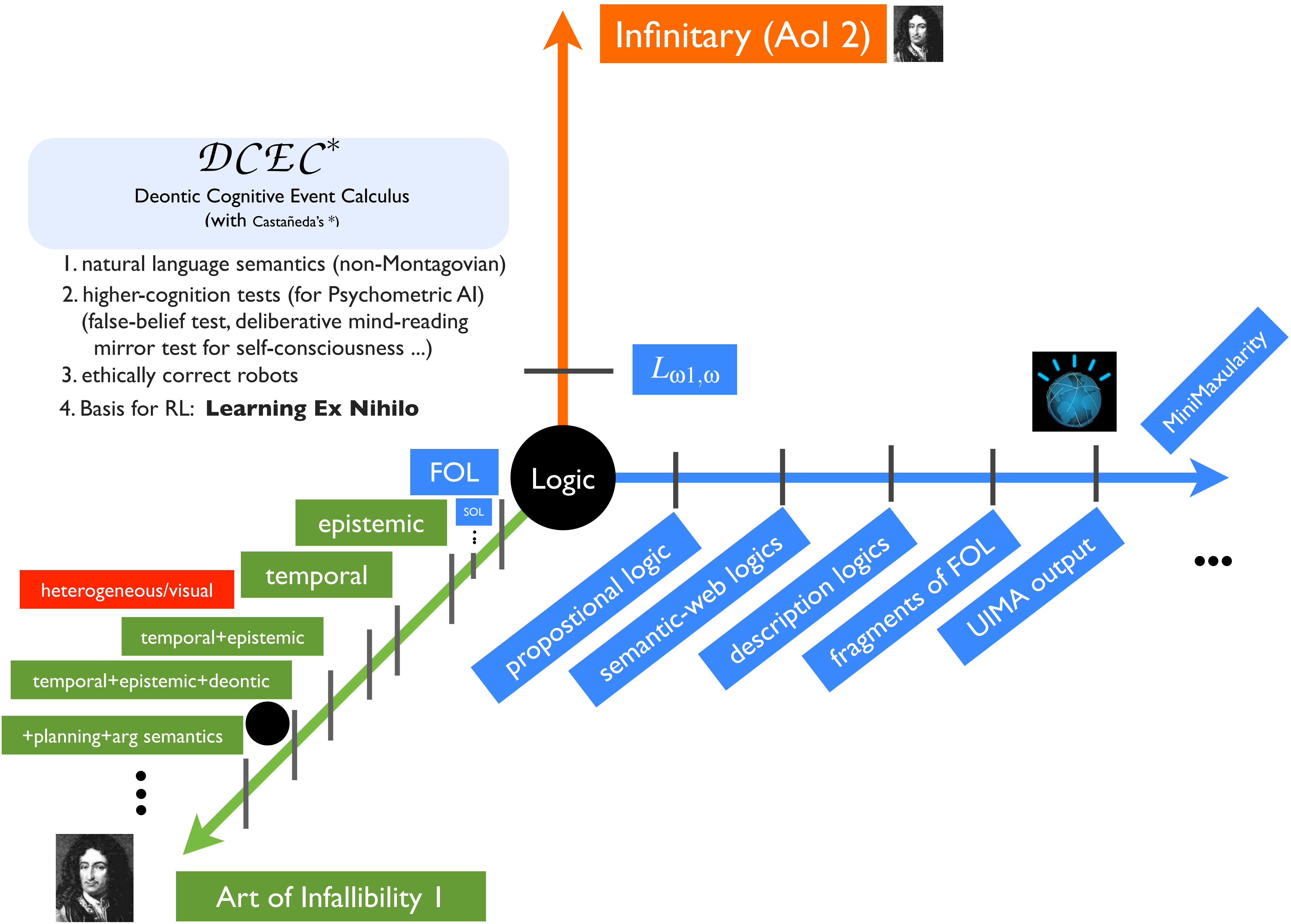
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4. Basis for RL: Learning Ex Nihilo
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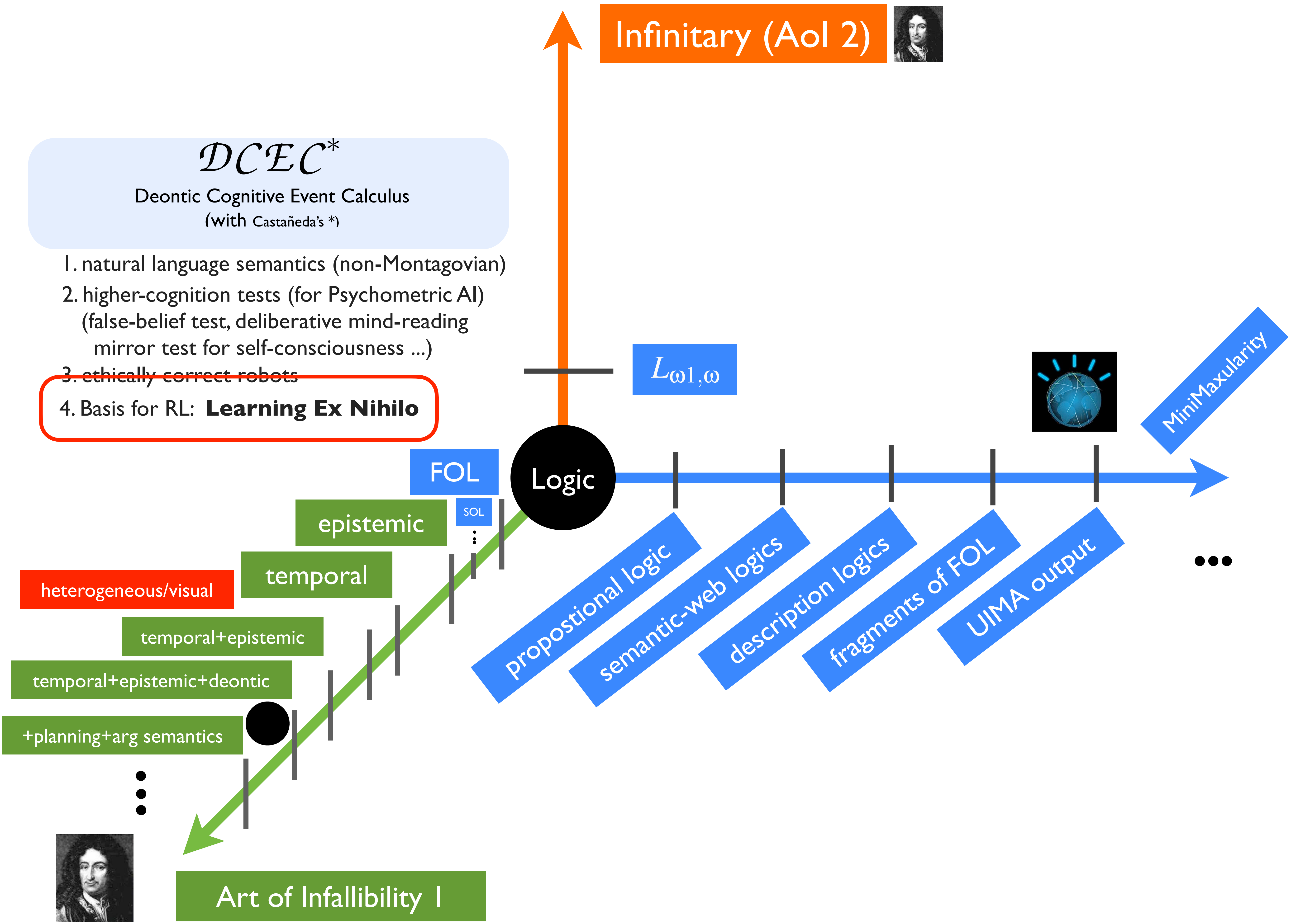
Art of Infallibility I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Art of Infallibility I

What about (oft vaunted) quantum computers?

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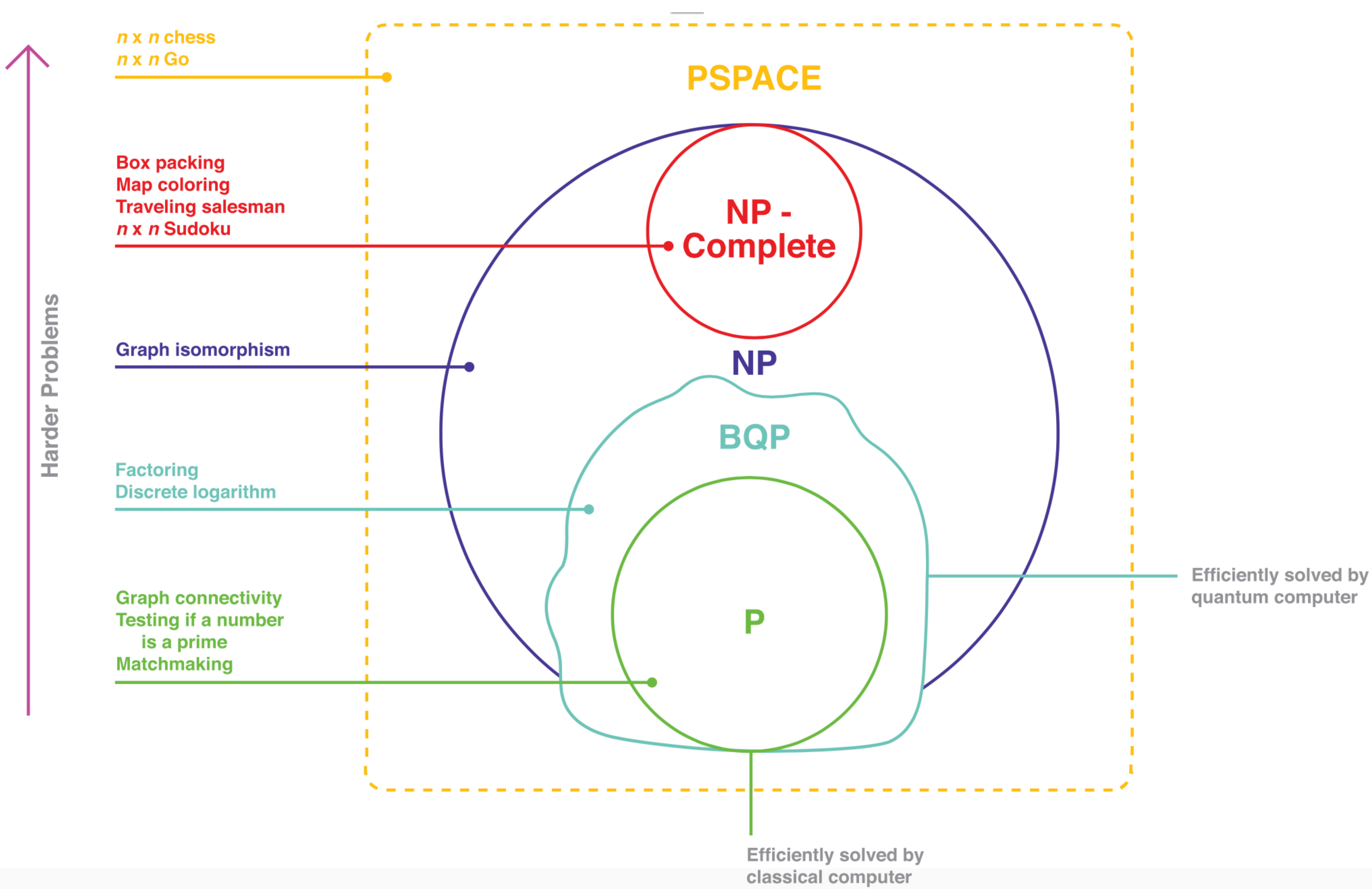
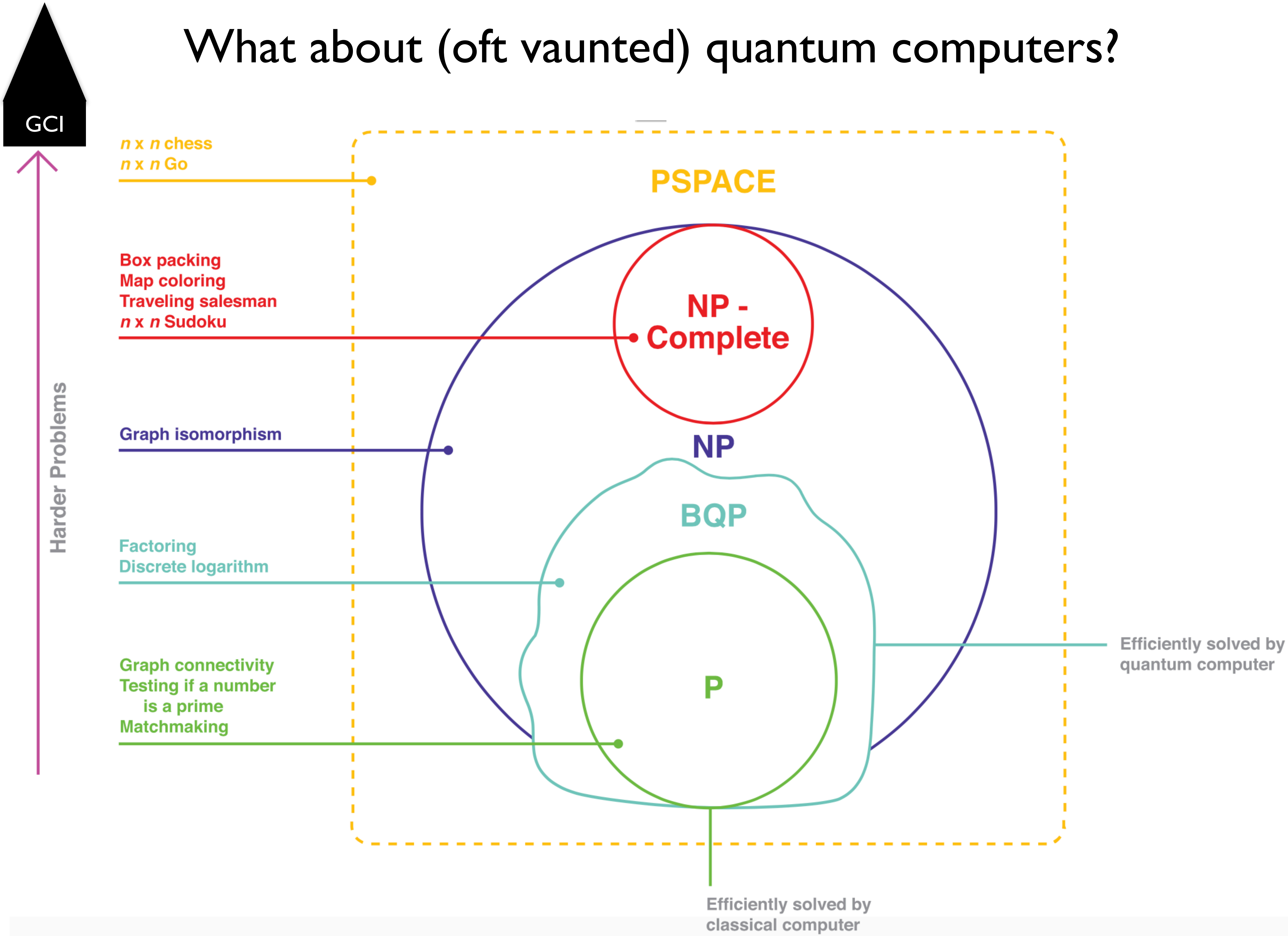


What about (oft vaunted) quantum computers?



Ulogiske agenter er ikke barre uintelligente — de er ikke bevisste.