

# The Singularity, Rationally Considered

**Mike Giancola**

Selmer Bringsjord

*Are Humans Rational?*

10/3/19

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[Selmer.Bringsjord@gmail.com](mailto:Selmer.Bringsjord@gmail.com)



# Readings

- **Next Class** Monday, Oct 7

- Bringsjord, S., Govindarajulu, N. S., Banerjee, S., and Hummel, J. (2018) “Do Machine-Learning Machines Learn?”
- Available here: [http://kryten.mm.rpi.edu/SB\\_NSG\\_SB\\_JH\\_DoMachine-LearningMachinesLearn\\_preprint.pdf](http://kryten.mm.rpi.edu/SB_NSG_SB_JH_DoMachine-LearningMachinesLearn_preprint.pdf)

- **Next Thursday** Oct 10

- Bringsjord, S. & Bringsjord, A. (2017) “The Singularity Business: Toward a Realistic, Fine-grained Economics for an AI-Infused World”
- Available here: [http://kryten.mm.rpi.edu/The\\_Singularity\\_Business.pdf](http://kryten.mm.rpi.edu/The_Singularity_Business.pdf)

The Singularity Supposedly  
Approaches because ...

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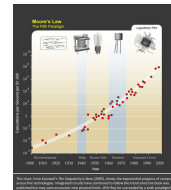
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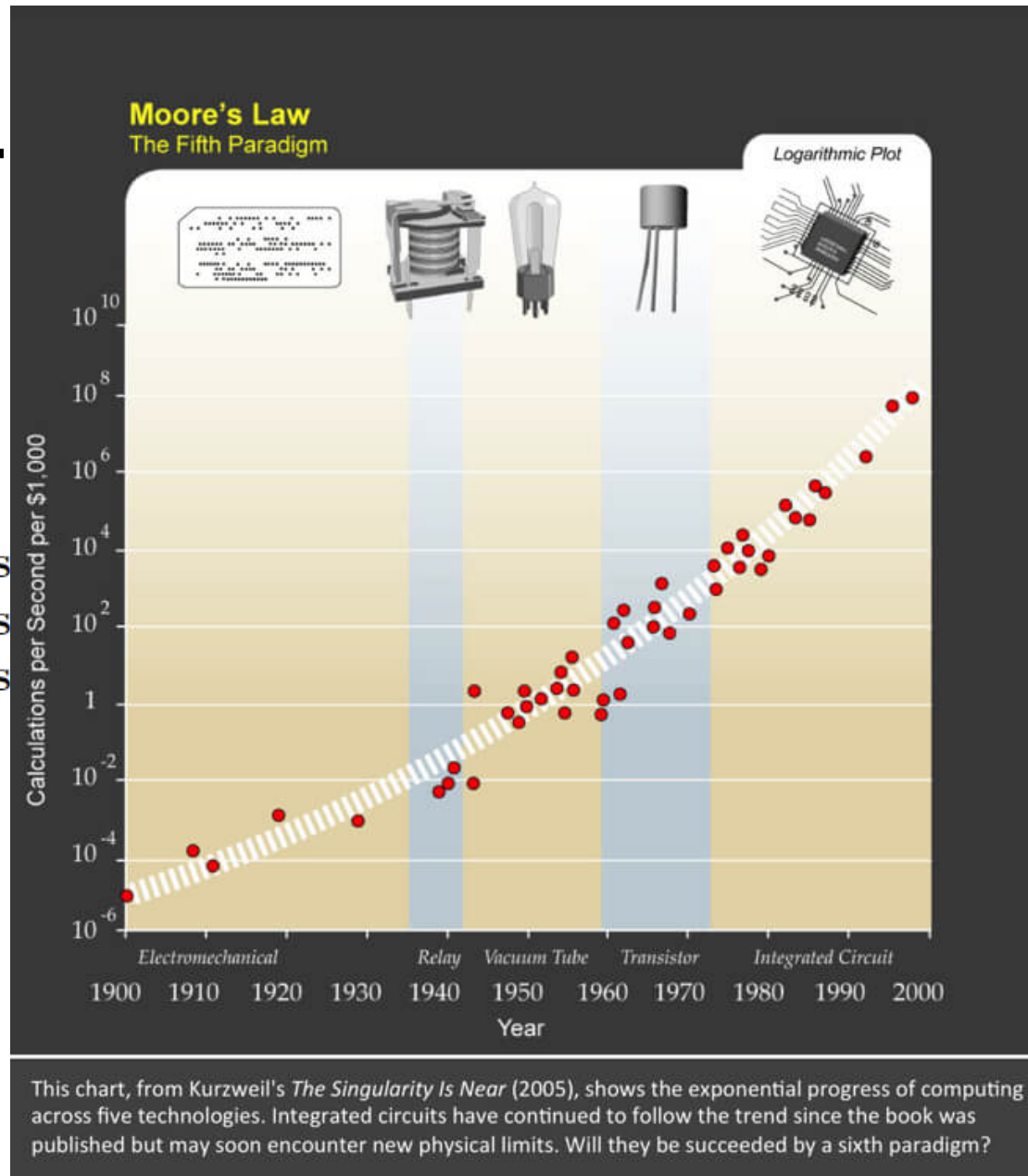
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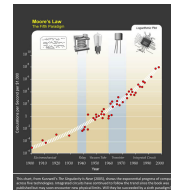
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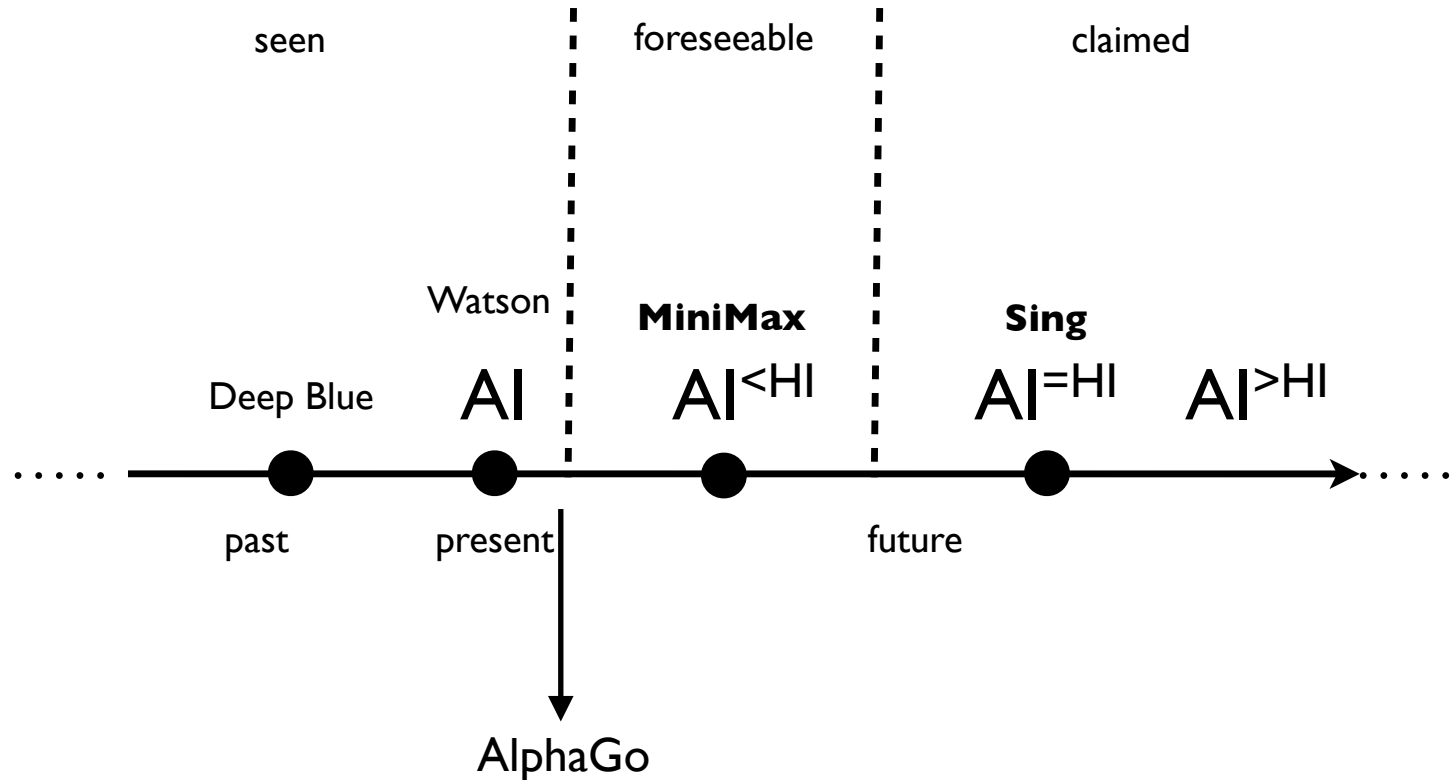
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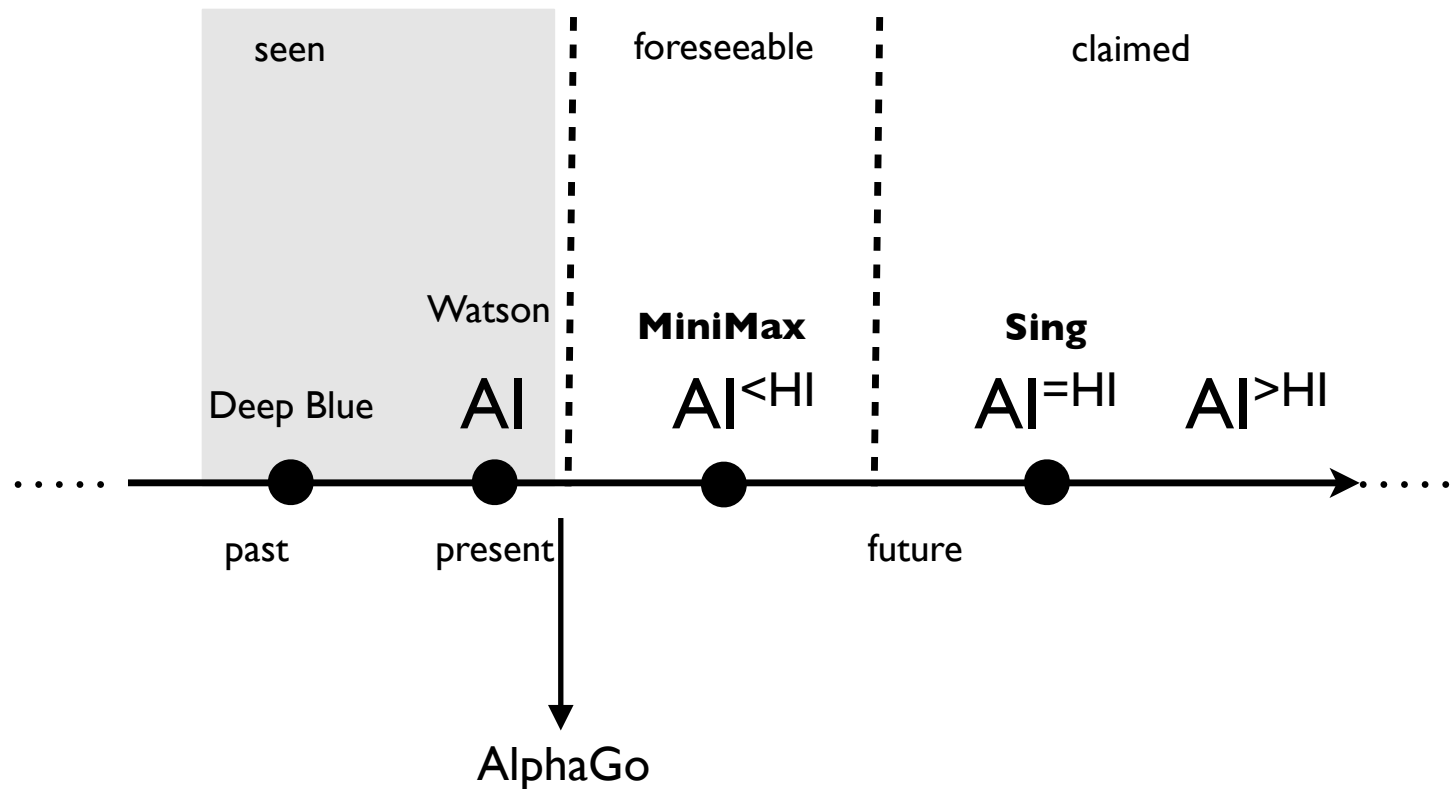
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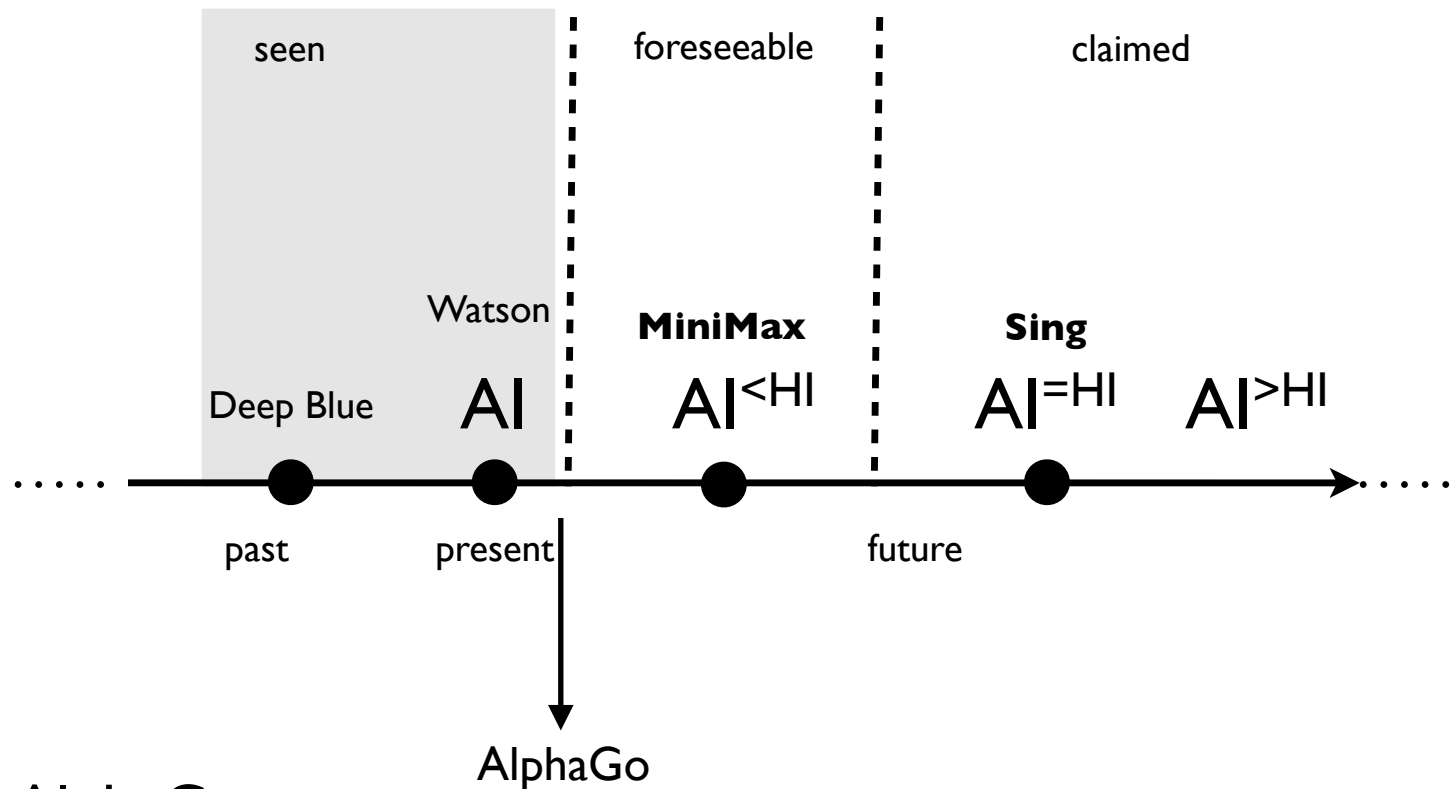
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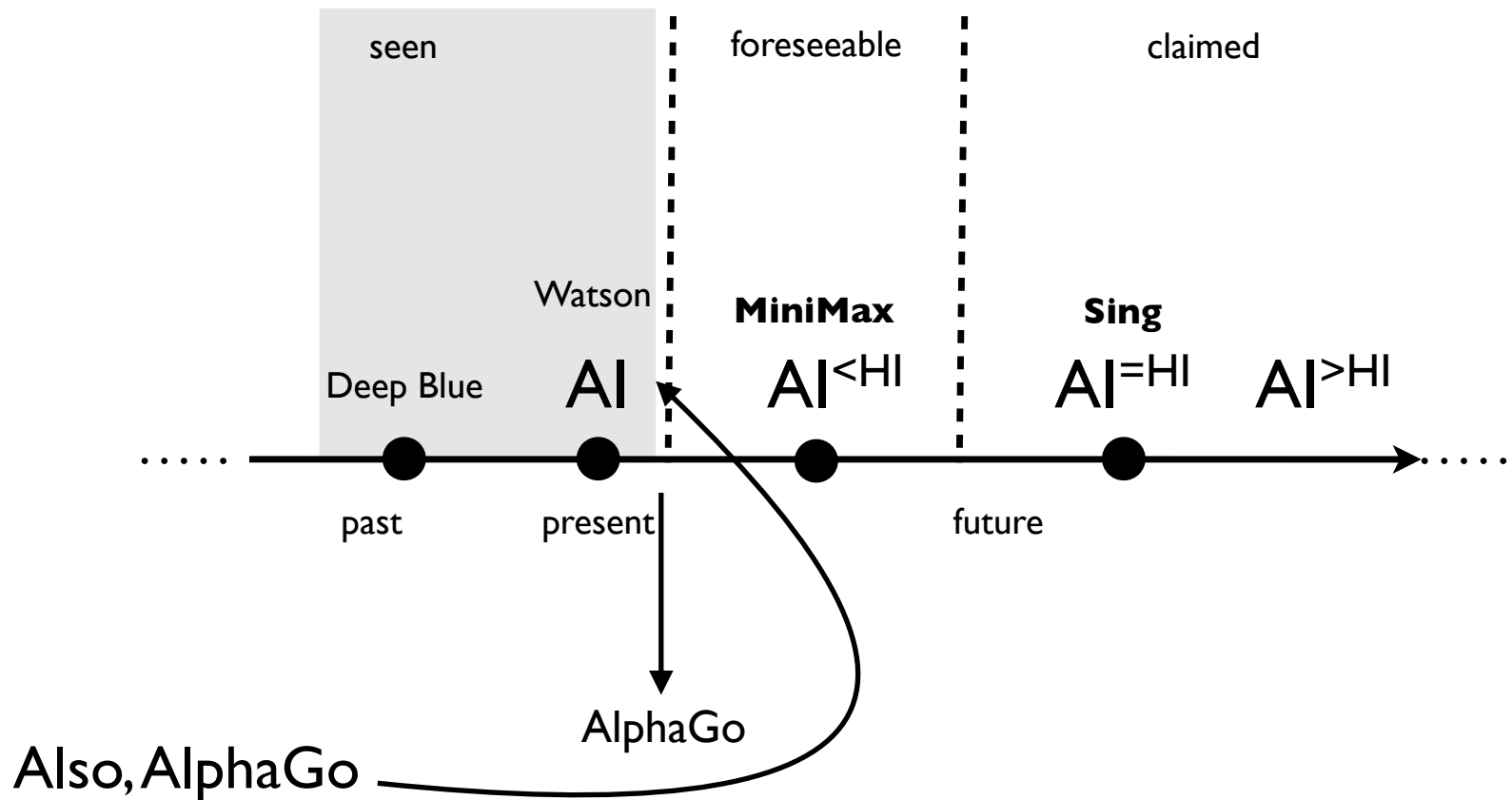
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Also, AlphaGo

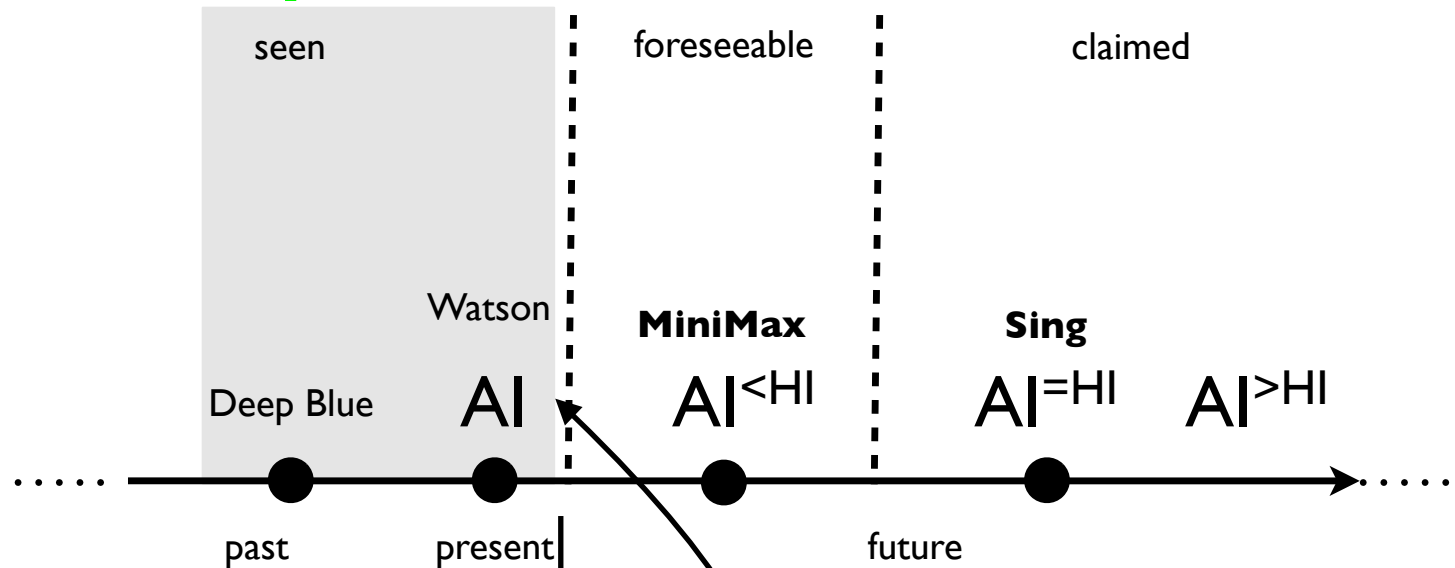


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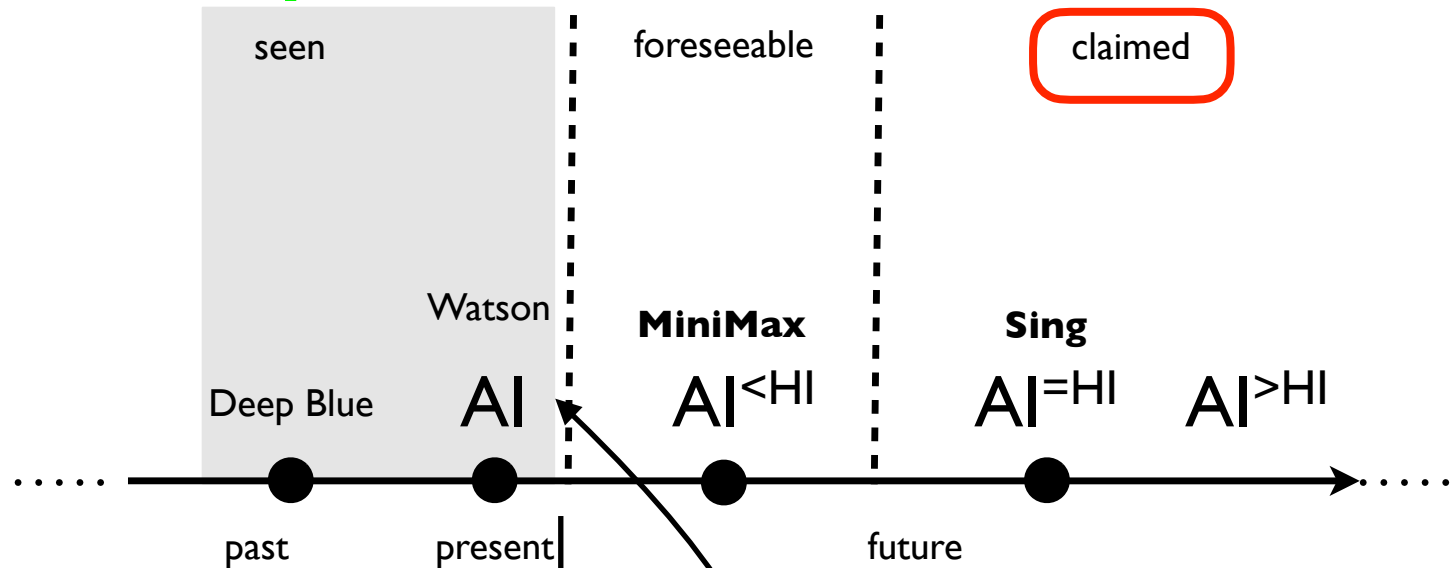
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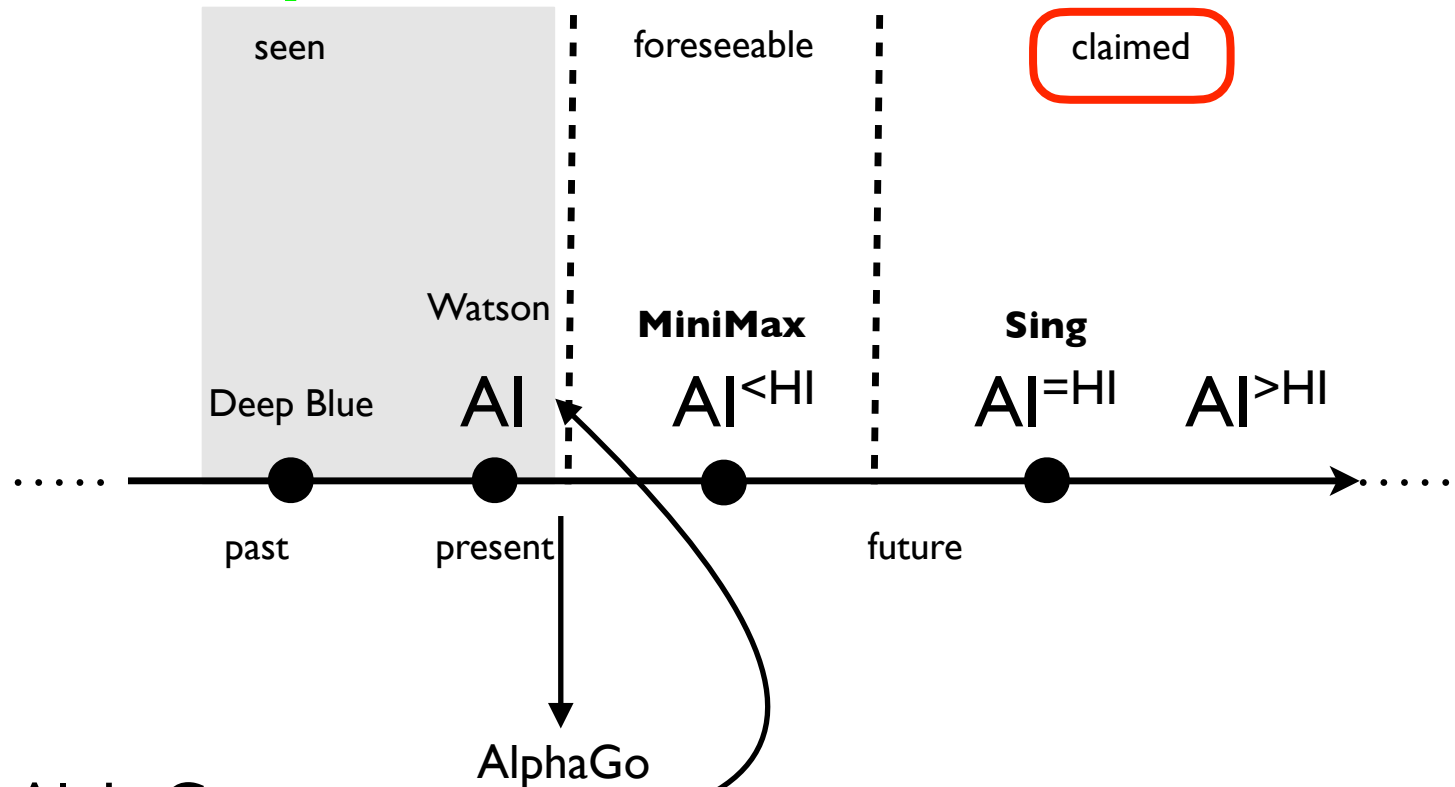


Also, AlphaGo

# A Realistic Timeline

**No problem!**

**Big problem!**



Also, AlphaGo



# The Problem: We're Ignoring the Mathematics!

*Super-Serious* Human Cognitive Power

*Serious* Human Cognitive Power

Mere Calculative Cognitive Power



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*Jeopardy!:*



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Chess: Deep Blue



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Checkers: Chinook



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Today's "Machine Learning"



Checkers: Chinook



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# The Problem: We're Ignoring the Mathematics!

## Analytical Hierarchy

*Serious* Human Cognitive Power

Today's "Machine Learning"



Checkers: Chinook



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Arithmetical Hierarchy

Today's "Machine Learning"



Checkers: Chinook



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*Jeopardy!*:



Polynomial Hierarchy



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$P \subseteq NP \subseteq PSPACE = NPSPACE \subseteq EXPTIME \subseteq NEXPTIME \subseteq EXPSPACE$



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**Entscheidungsproblem**

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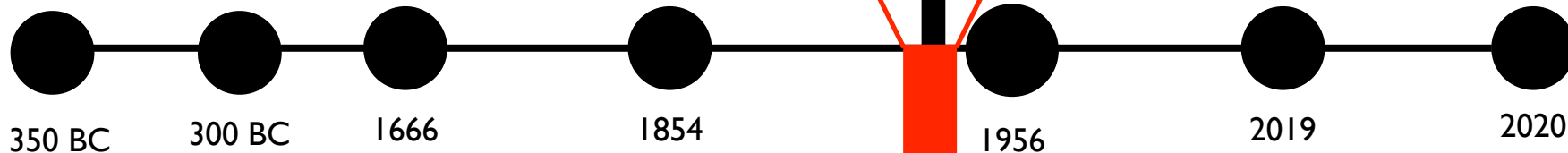
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# Entscheidungsproblem

“Universal Computational Logic”



Logic Theorist  
(birth of modern logicist AI)



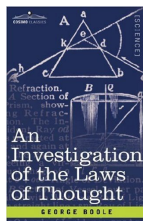
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*Organon*



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Frege

Exceeds Leibniz & de-mystifies Euclid: the “compellingness” of these proofs consists in their being, at bottom, formal proofs in first-order logic (FOL).



Church



Turing



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AHR? @ RPI

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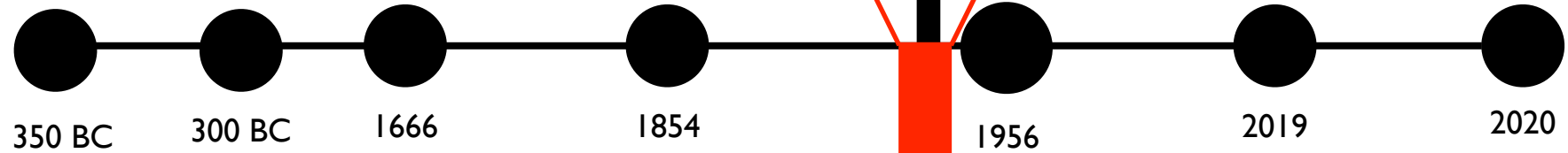
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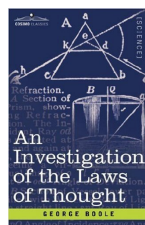


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Here’s what a computer is, and given that, sorry, the *Entscheidungsproblem* can’t be solved by such a machine!



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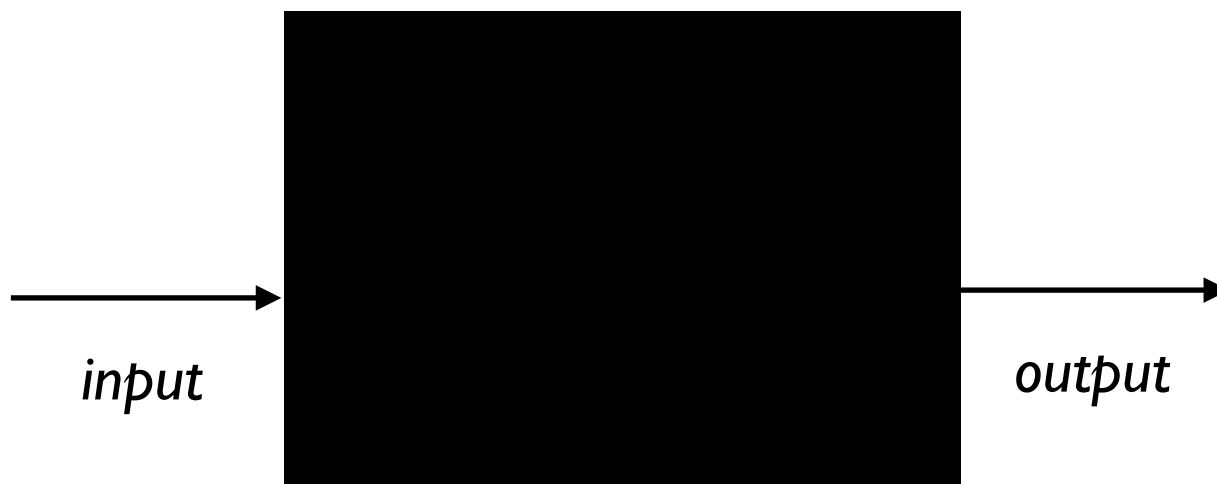
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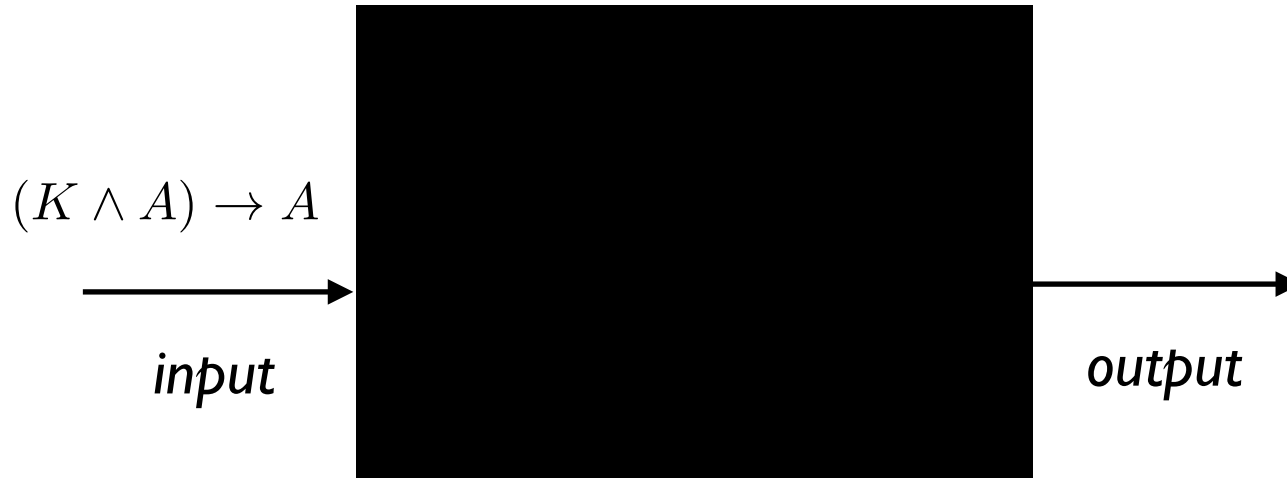
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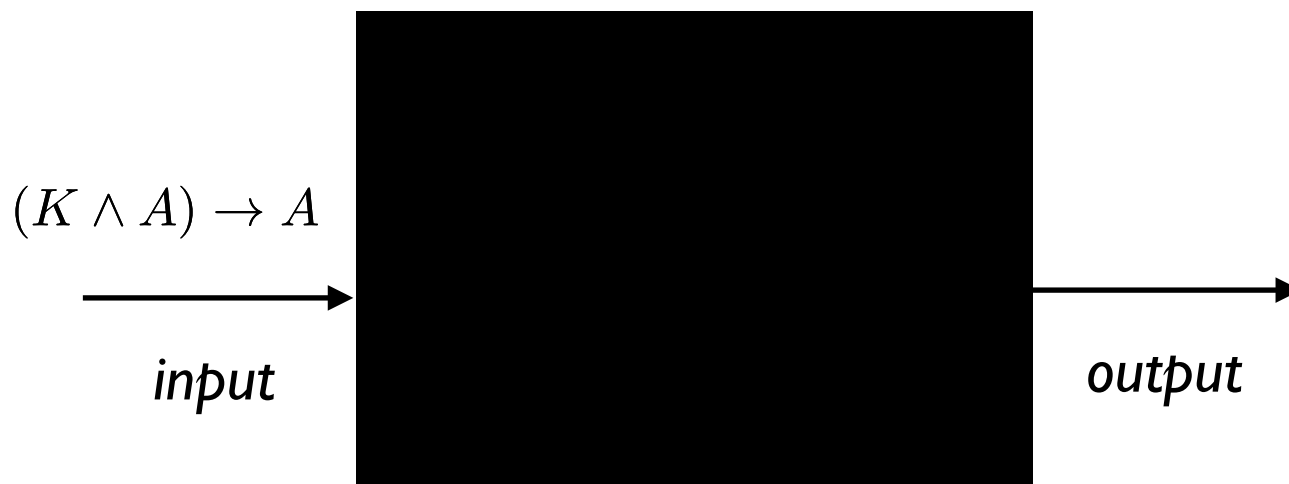
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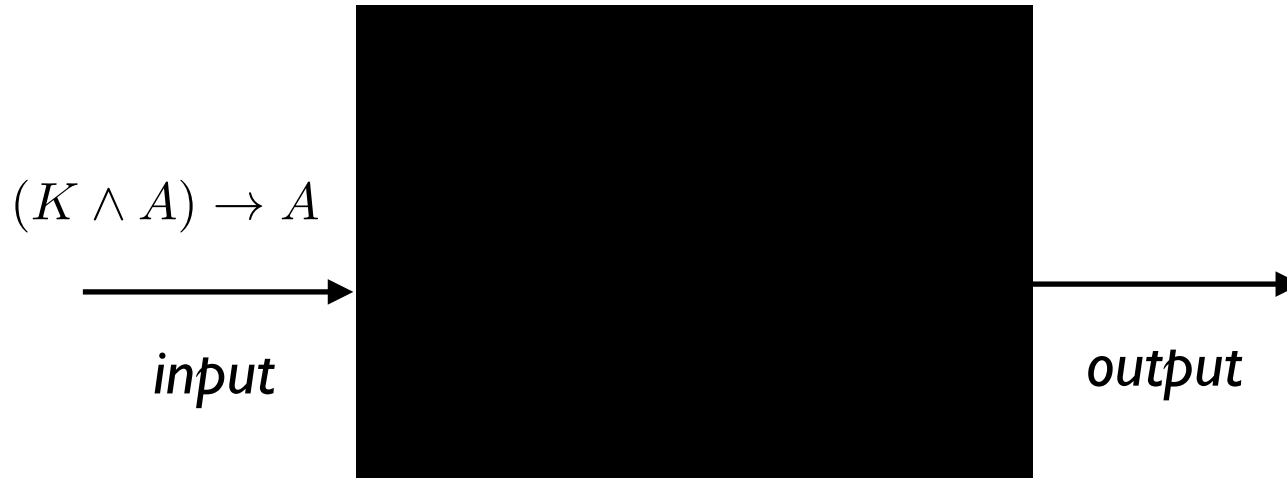
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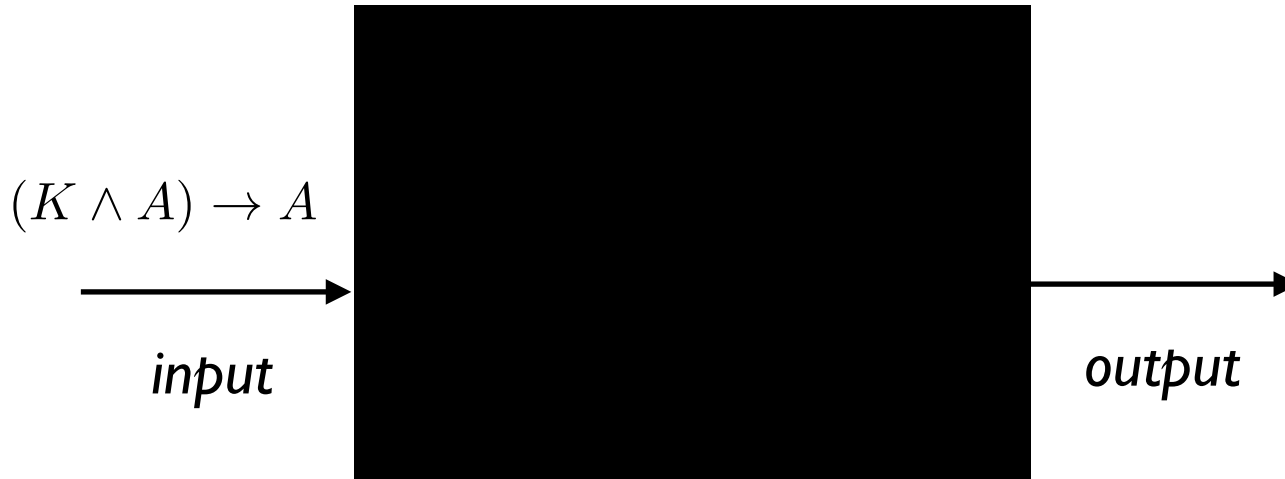


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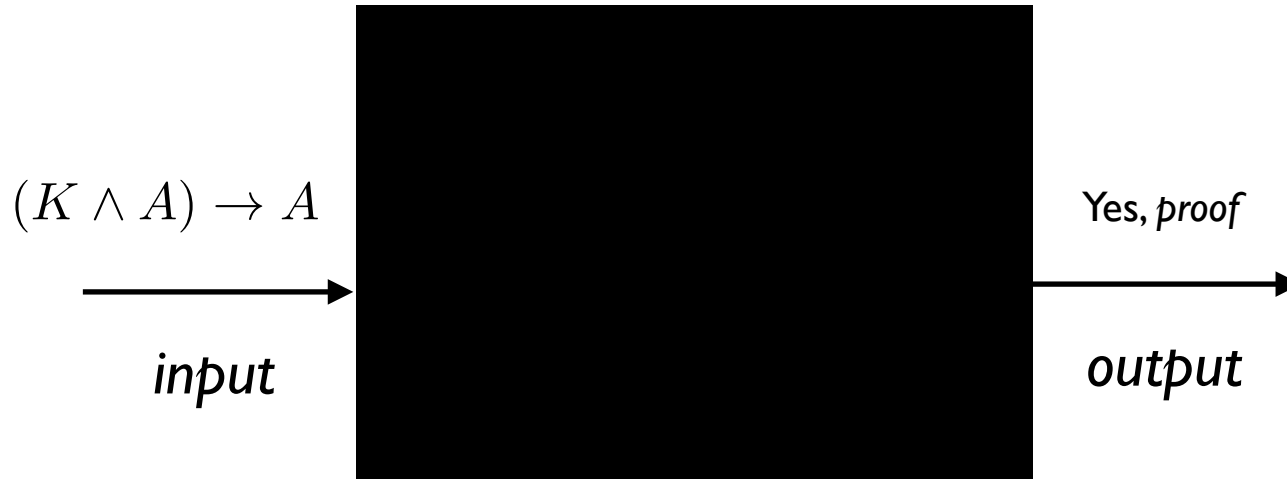
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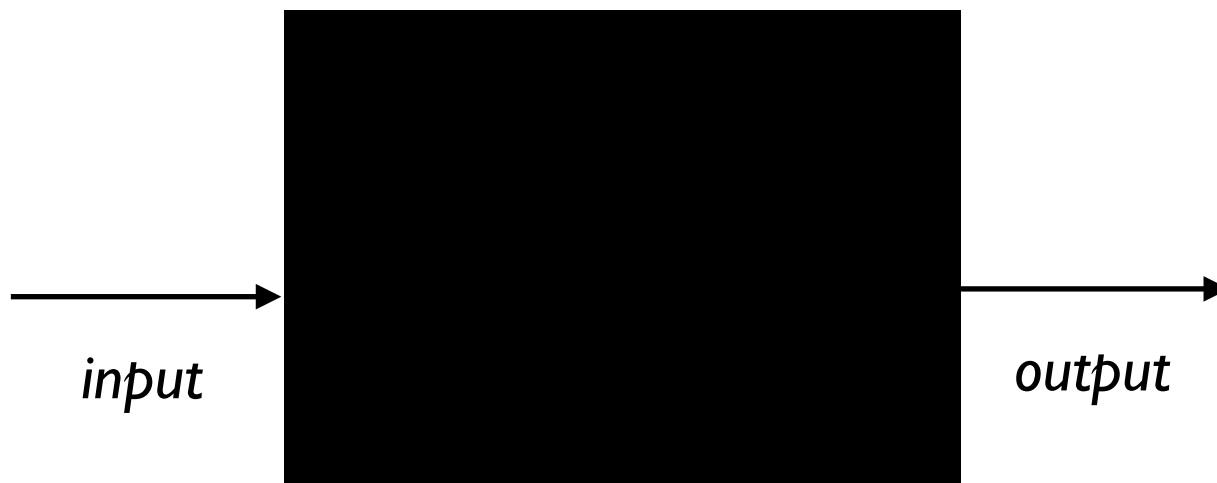
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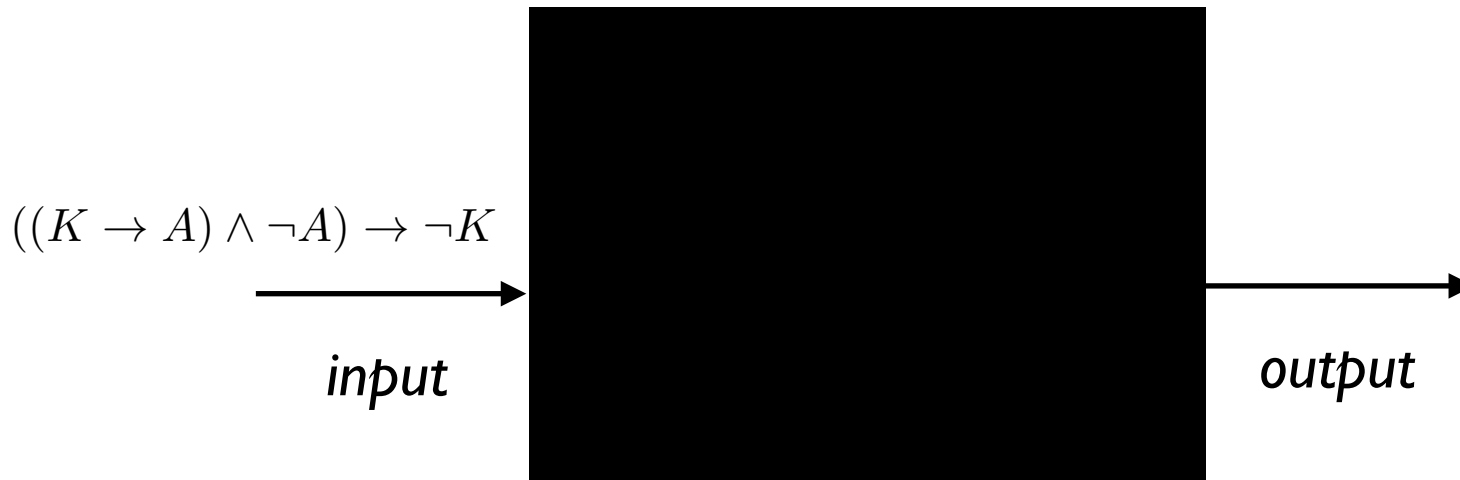
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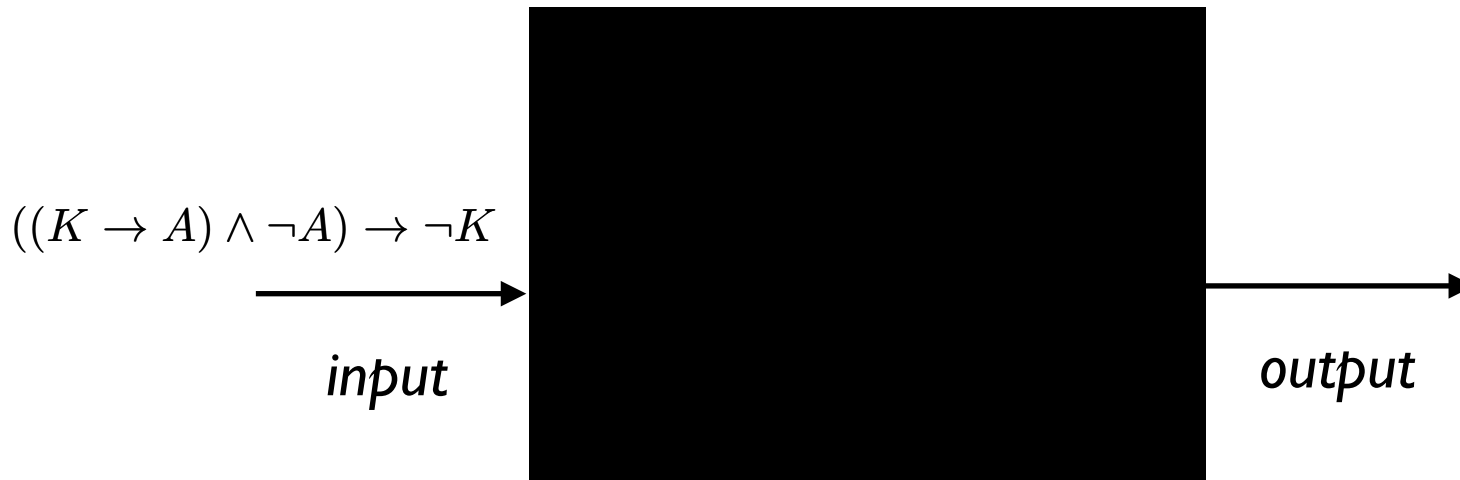
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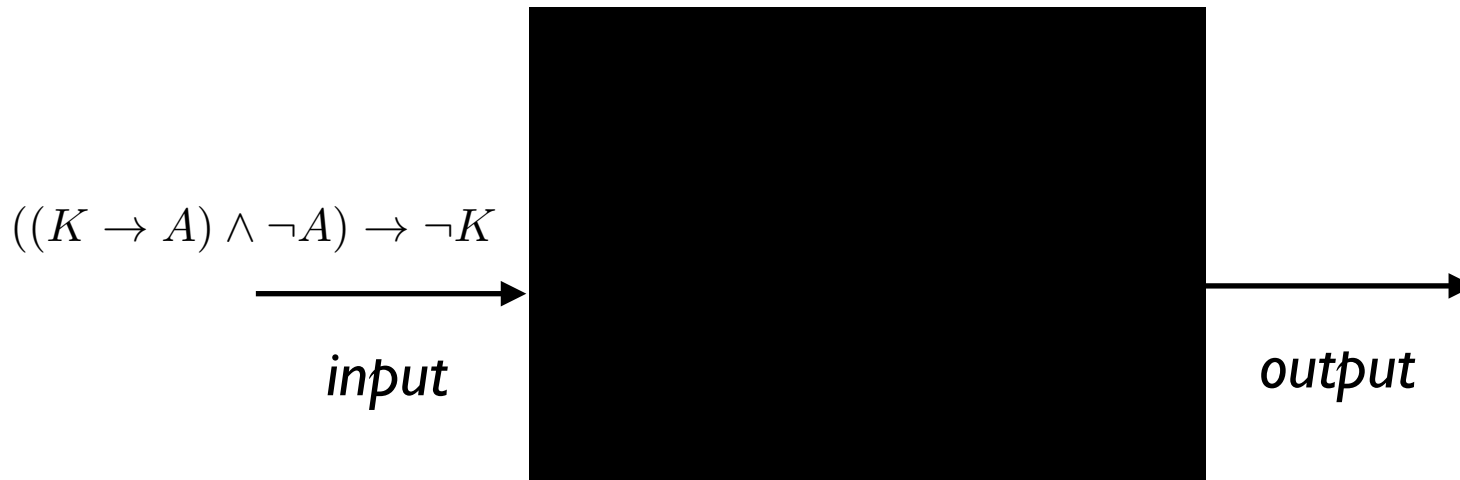
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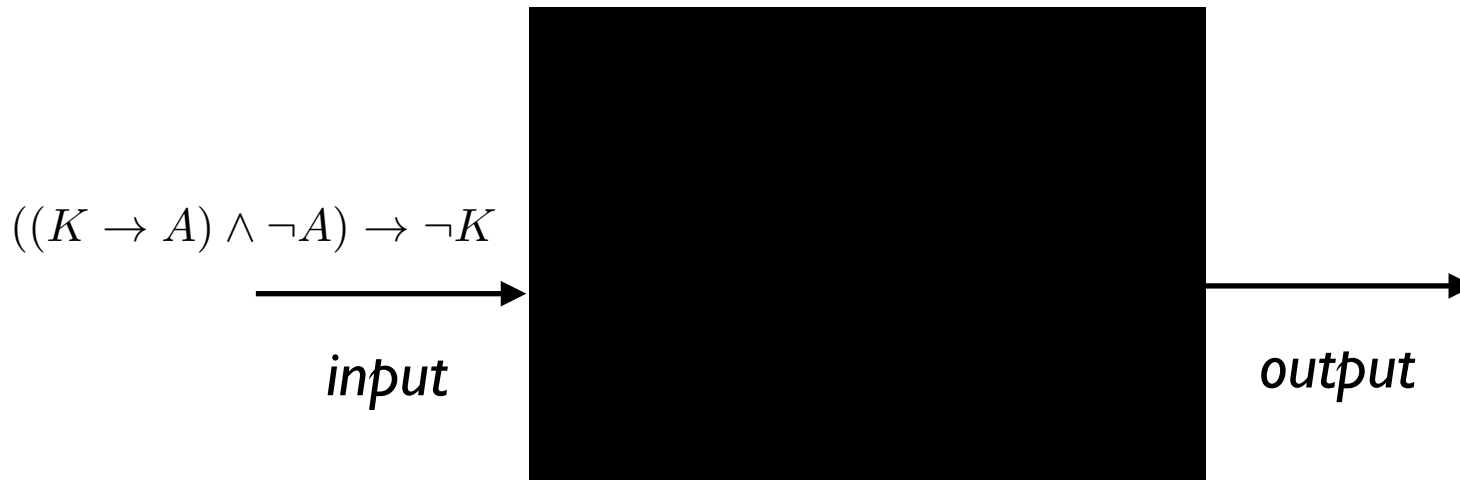
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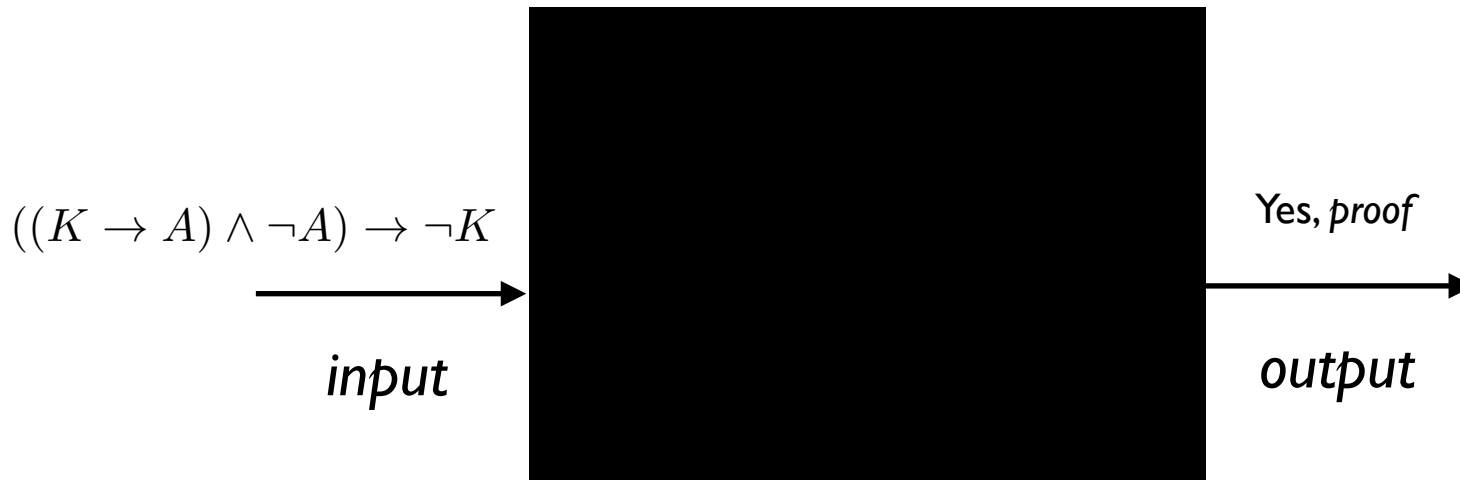
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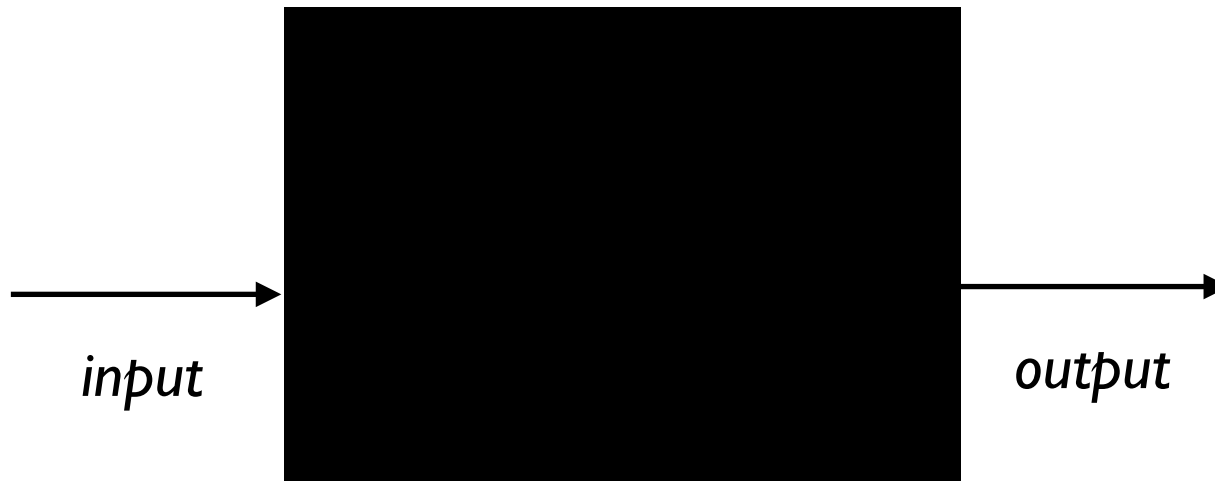


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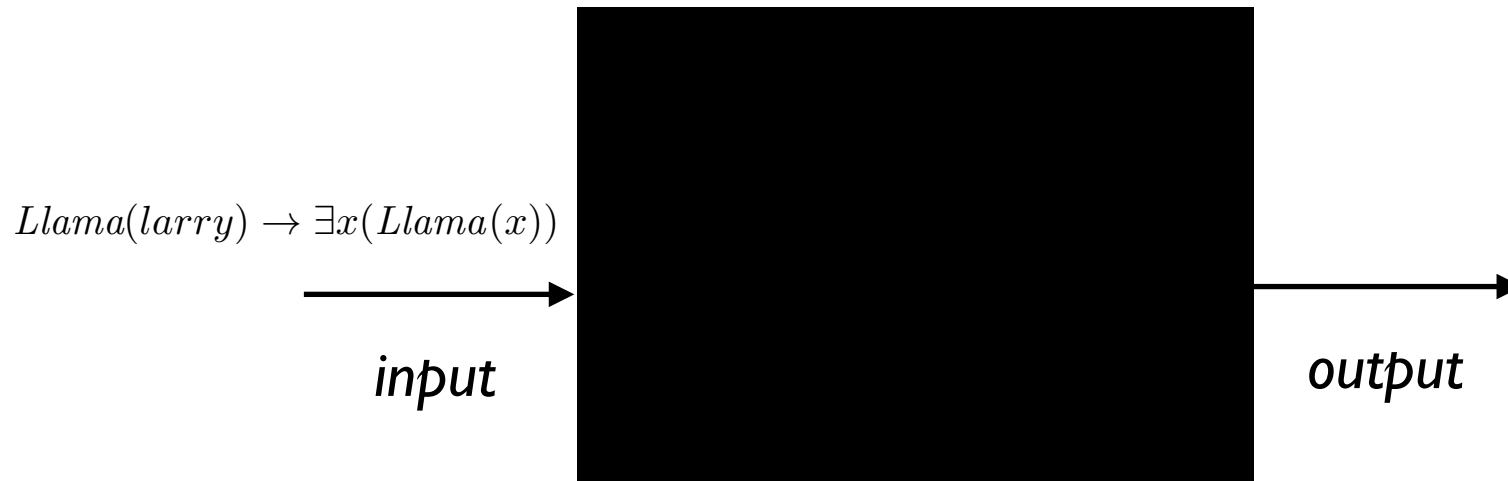


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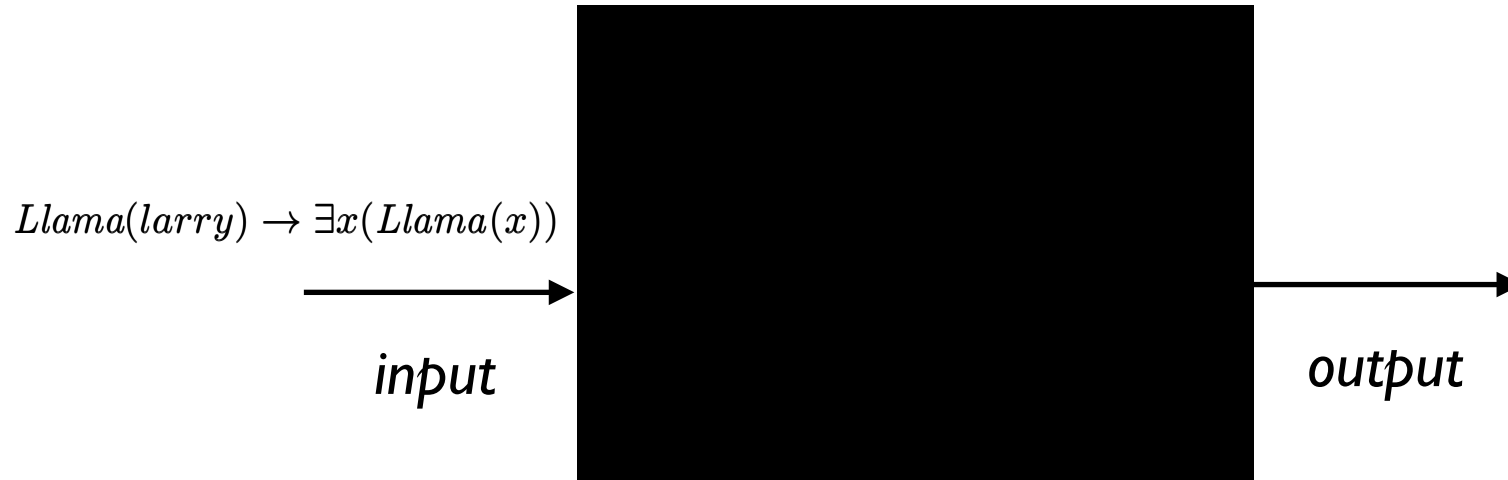
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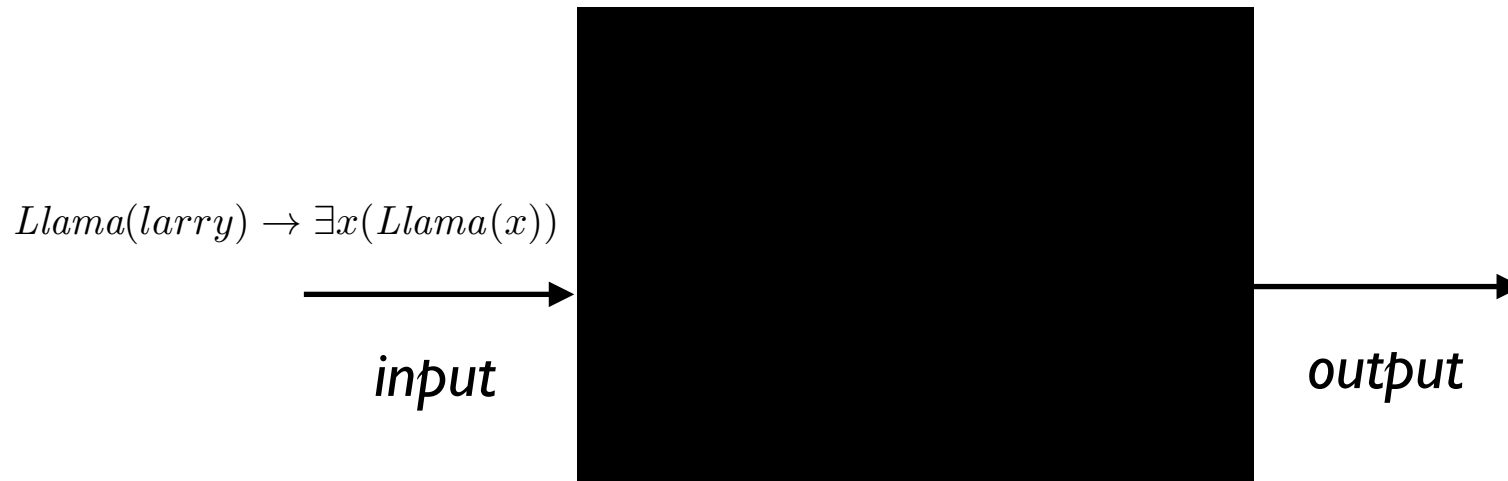
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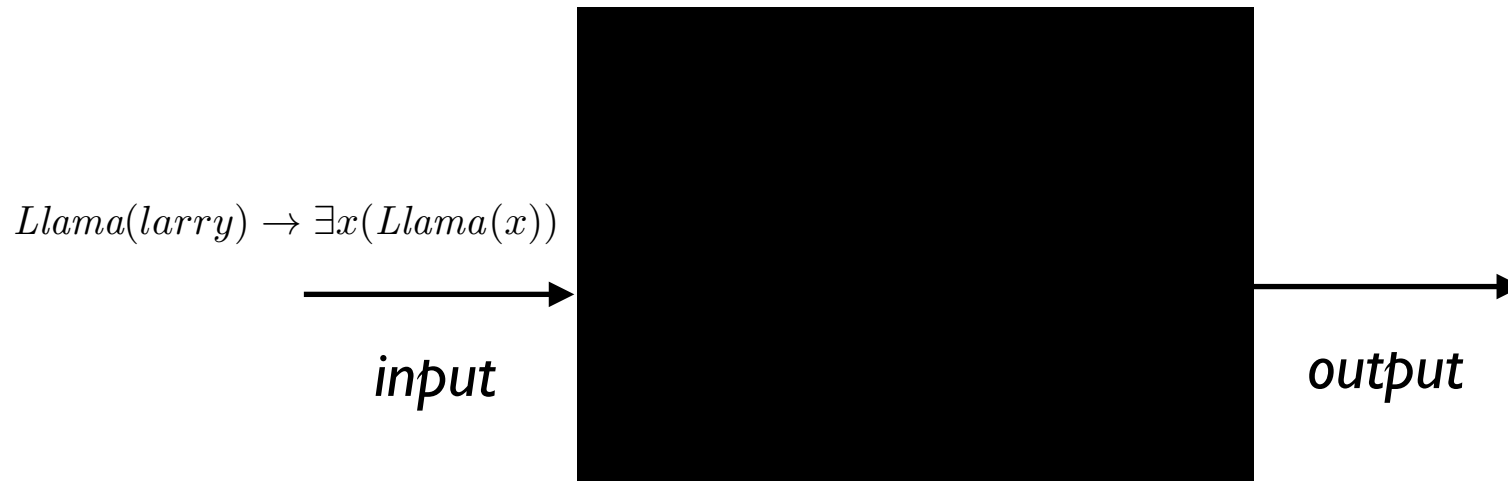
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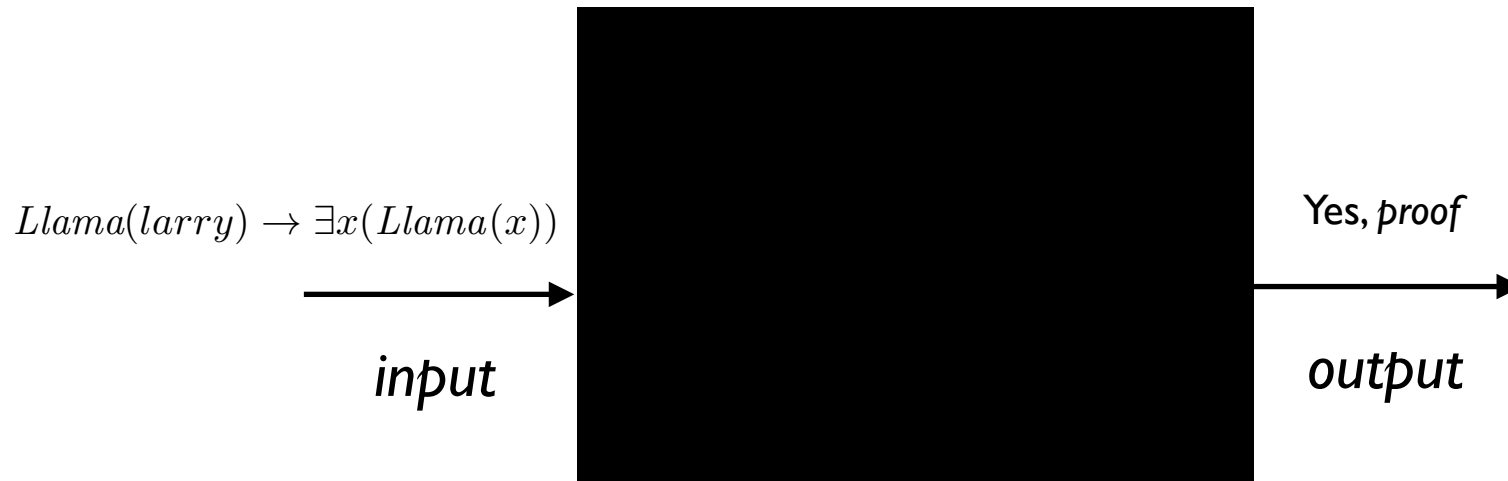
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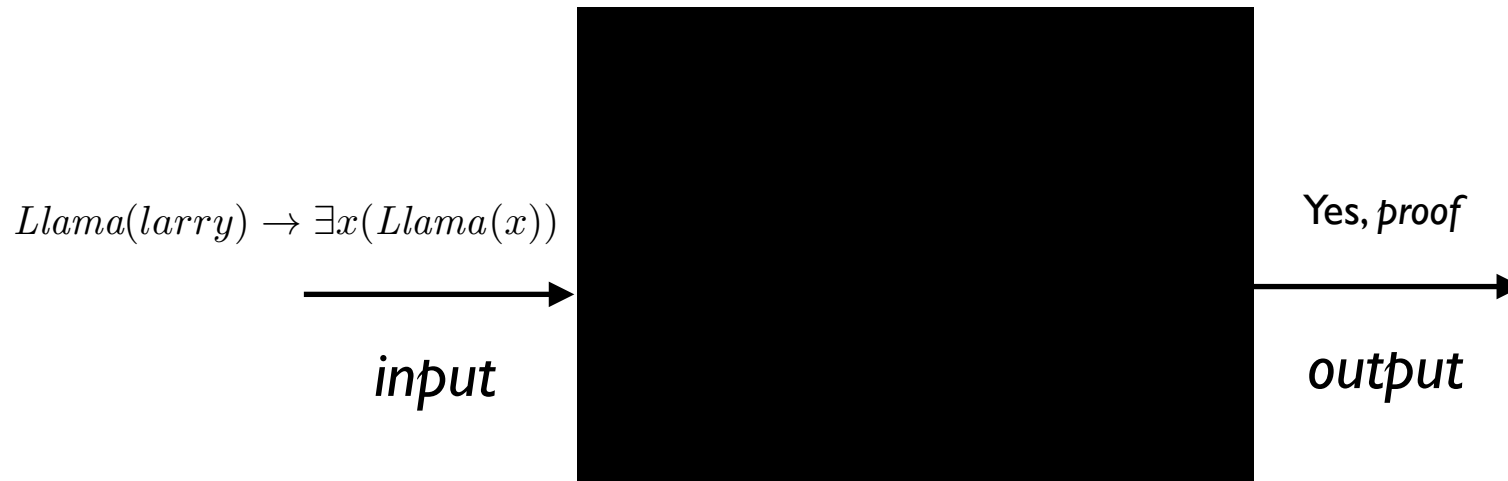
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**Not just hard: *impossible, in the general case, for a (and this needed to be *invented* in the course of clarifying and solving the problem) standard computing machine.***



# The Good-Chalmers Argument

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**Theorem:** No computing machine  $M$   
can create a computing machine  $M'$   
genuinely more powerful than  $M$ .

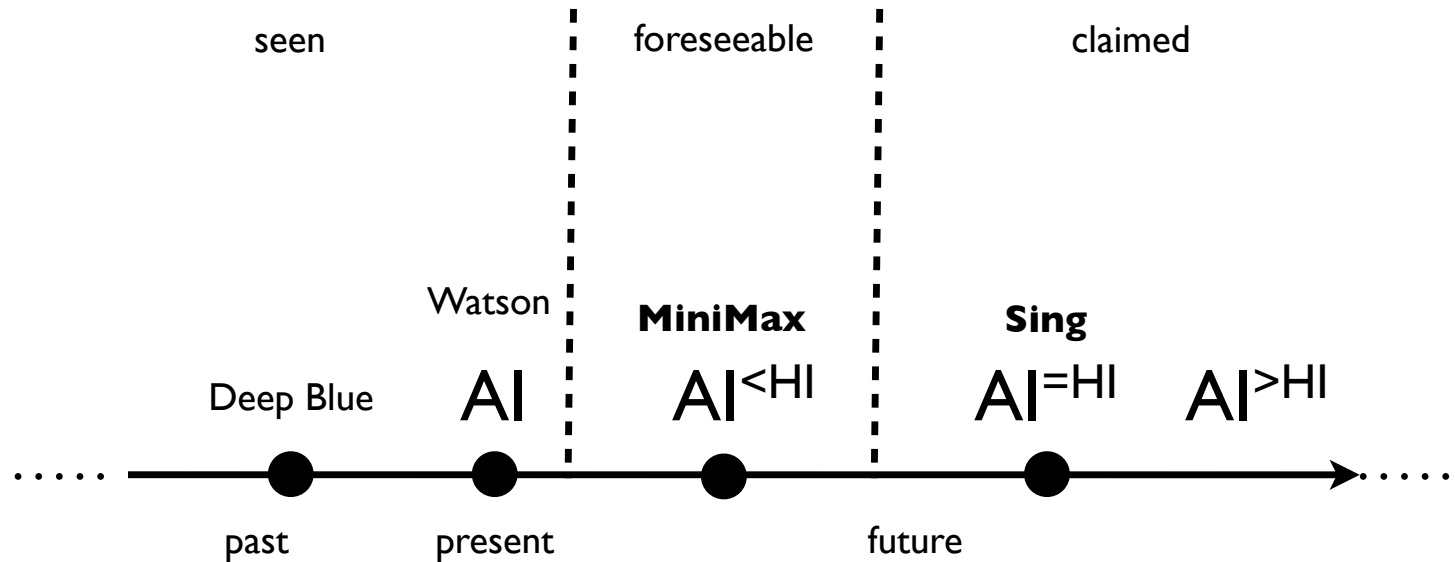
# Applying this to ...

## The Singularity Question

So, these super-smart machines that will be built by human-level-smart machines, they can't *possibly* be smart enough to solve the *Entscheidungsproblem*. Hence they'll be just faster at solving problems we can routinely solve? What's so super-smart about *that*?

Recall from earlier ...

# A Realistic Timeline





# The Problem: We're Ignoring the Mathematics!

Super-Serious Human Cognitive Power

Serious Human Cognitive Power

HI

AI<sup>++</sup>

AI<sup>+</sup>

AI

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Mere Calculative Cognitive Power

Jeopardy!:

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**Entscheidungsproblem**



# The Problem: We're Ignoring the Mathematics!

Super-Serious Human Cognitive Power

Serious Human Cognitive Power

HI

AI<sup>++</sup>

AI<sup>+</sup>

AI

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Mere Calculative Cognitive Power

Jeopardy!:

Chess: Deep Blue

Checkers: Chinook

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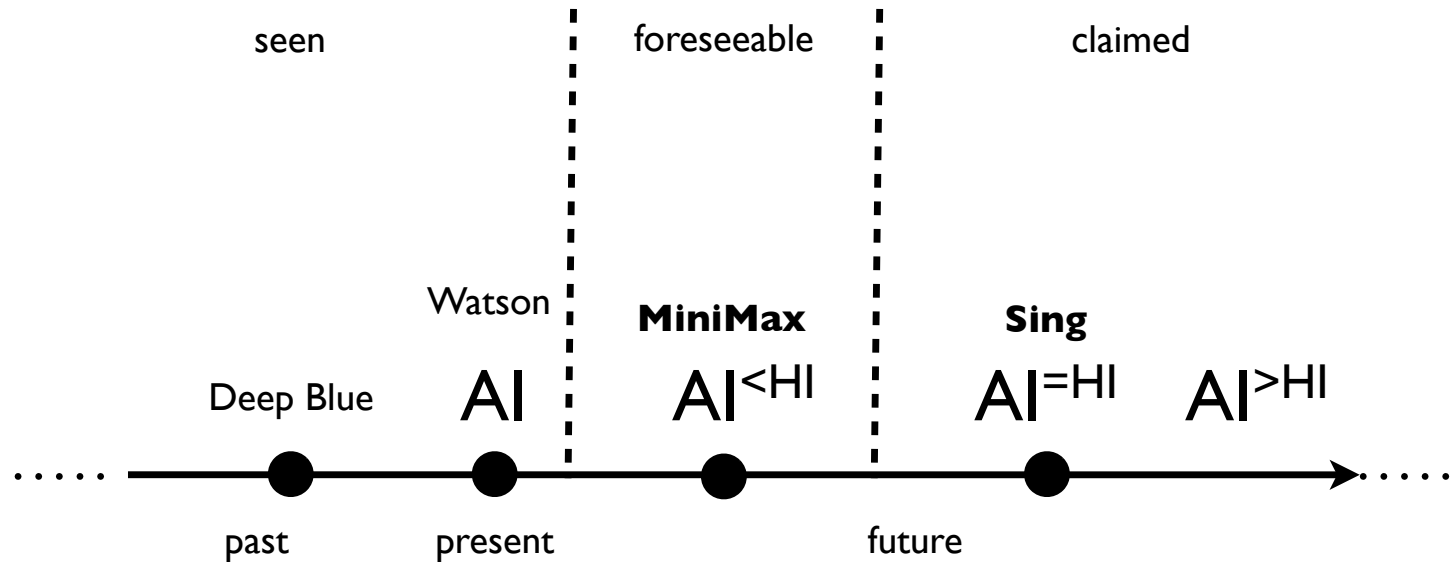
AI

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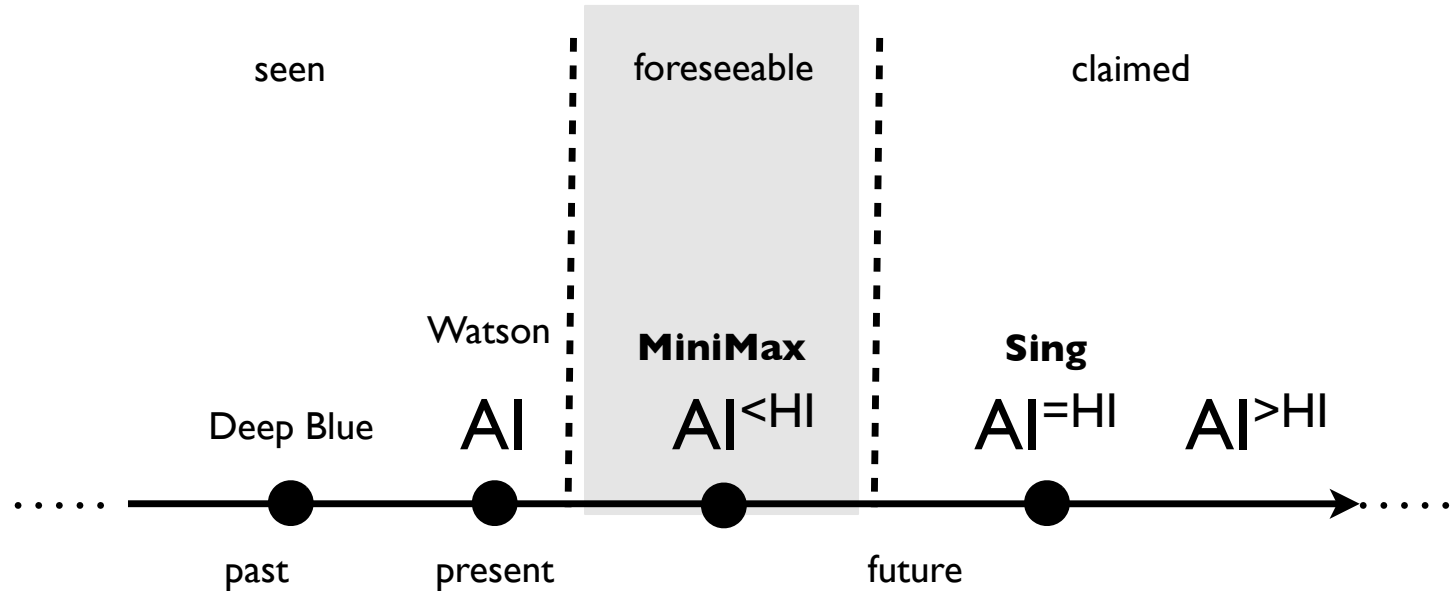
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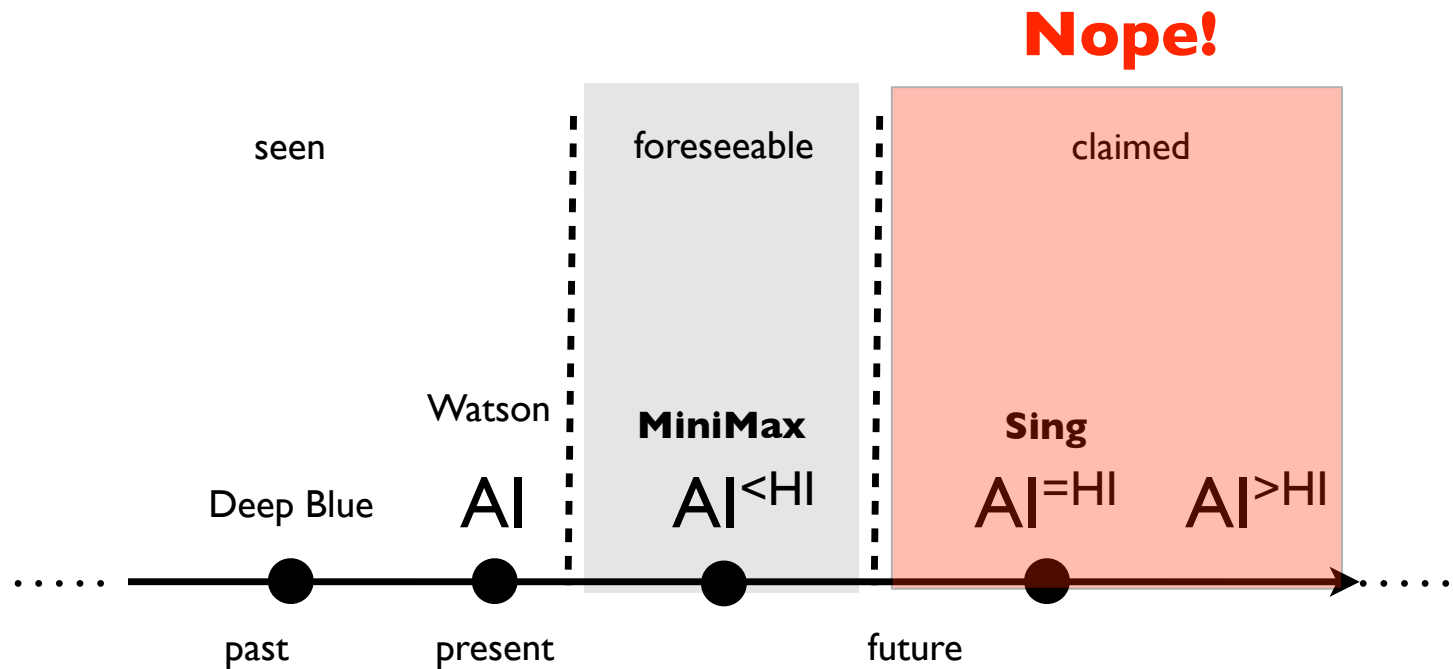
# A Realistic Timeline



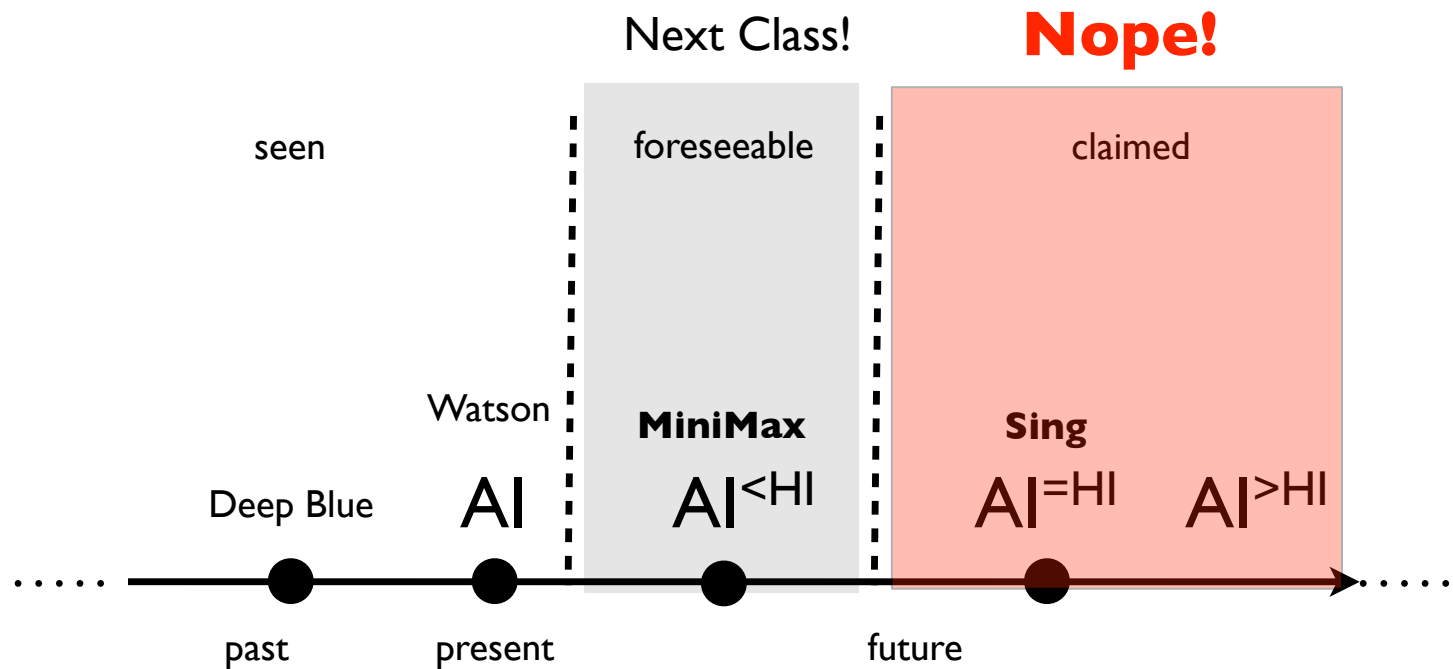
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# Further Reading on The Singularity for Rationalists

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- [http://kryten.mm.rpi.edu/SB\\_singularity\\_math\\_final.pdf](http://kryten.mm.rpi.edu/SB_singularity_math_final.pdf)