



We Are Modelers, Pressing Our Models

How do we model?

To what extent
can we model?

Why do we model?

What are the ***long-term consequences***
of our modeling?



The First Modelers

Goal: FOOD!

- Where will deer be given current conditions?
 - What conditions will make deer most likely move under the trap?
 - If I make a noise, will deer move under the trap?
- **Prediction**
 - **Explanation**
 - **Intervention**

Inference Queries

Computable!

$$P(y|x) = ?$$

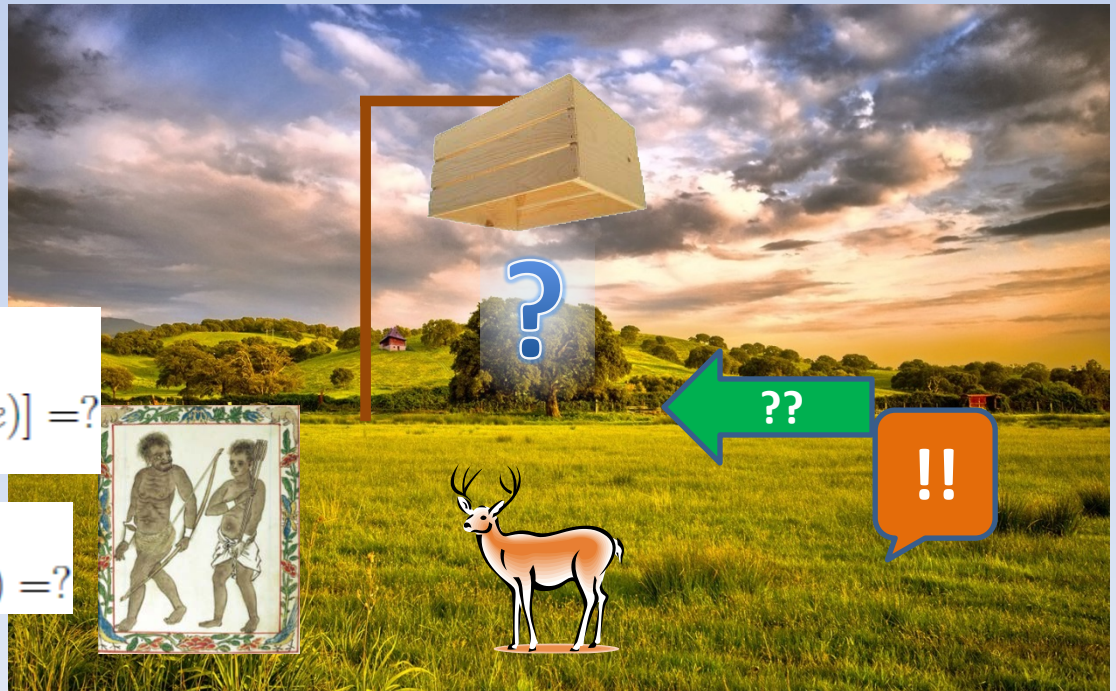
$$P(\text{DeerPos}_{t+1} | \text{state}_t) = ?$$

$$\underset{x}{\operatorname{argmax}} [P(y|x) = z] = ?$$

$$\underset{\text{state}}{\operatorname{argmax}} [P(\text{DeerPos} = \text{UnderTrap} | \text{state})] = ?$$

$$P(y | \text{do}(x)) = ?$$

$$P(\text{DeerPos} = \text{UnderTrap} | \text{do}(\text{noise})) = ?$$



God?

Limits



“What are the limits of our models?”
“How do we acquire knowledge?”

→ *Epistemology*

Rationalists

Thinking

Knowledge ← **Logic**

Empiricists

Senses

Knowledge ← **Environment**

Compute Everything → Know Everything

Observe Everything → Know Everything

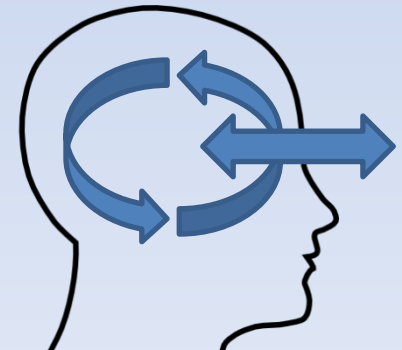
God-Machine?

∞ processing

∞ memory

∞ bandwidth

**Can we reach the
God Machine?**



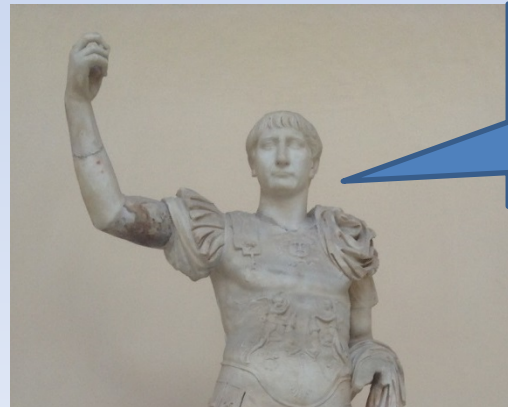
Reality Check: Hard Limits

lim

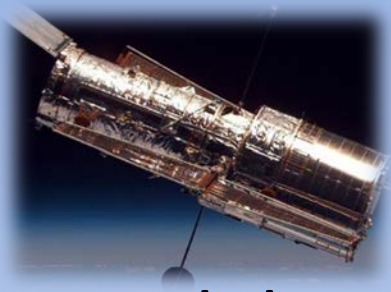
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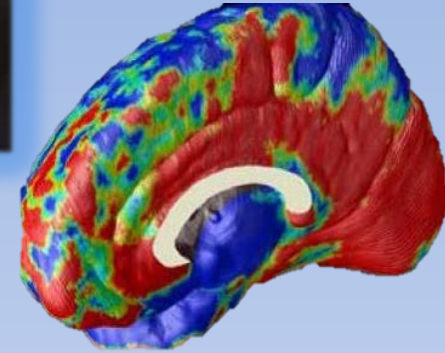
PERFECTION



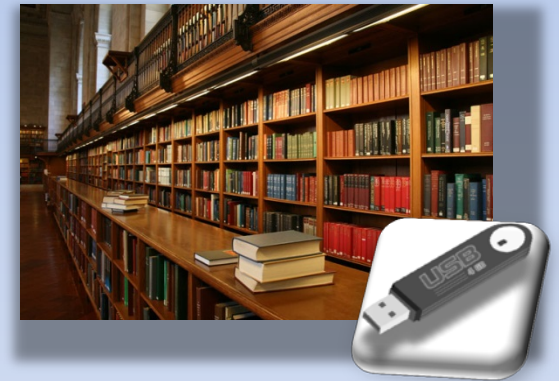
But we can
get closer!



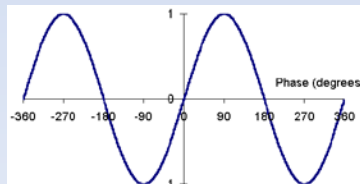
Push the Limits



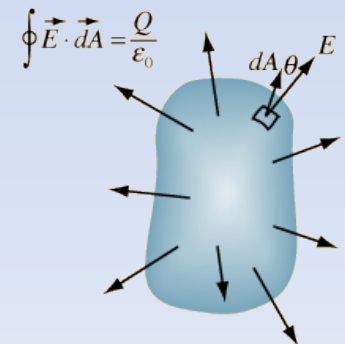
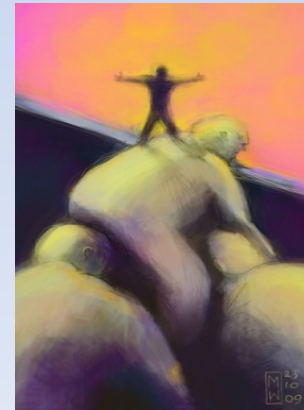
- Push bandwidth (I/O)
 - More Data, More *Relevant* Data
- Push Memory (RAM, Storage)
 - Summarize and condense (Hash)
- Push Computation (Processor)
 - New ways of thinking → Theories
 - Classical to Probabilistic
 - Increase thinking efficiency



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XYZ



Taking Models to the Next Level

- Accuracy & Precision ↗

- Assumptions ↘
- Minimize error

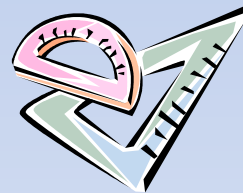
Scientists: expand knowledge via ↗ models



- Compatibility w/ other models ↗ (Unification)

- Computability ↗

- Simplicity ↗ (*Language*)



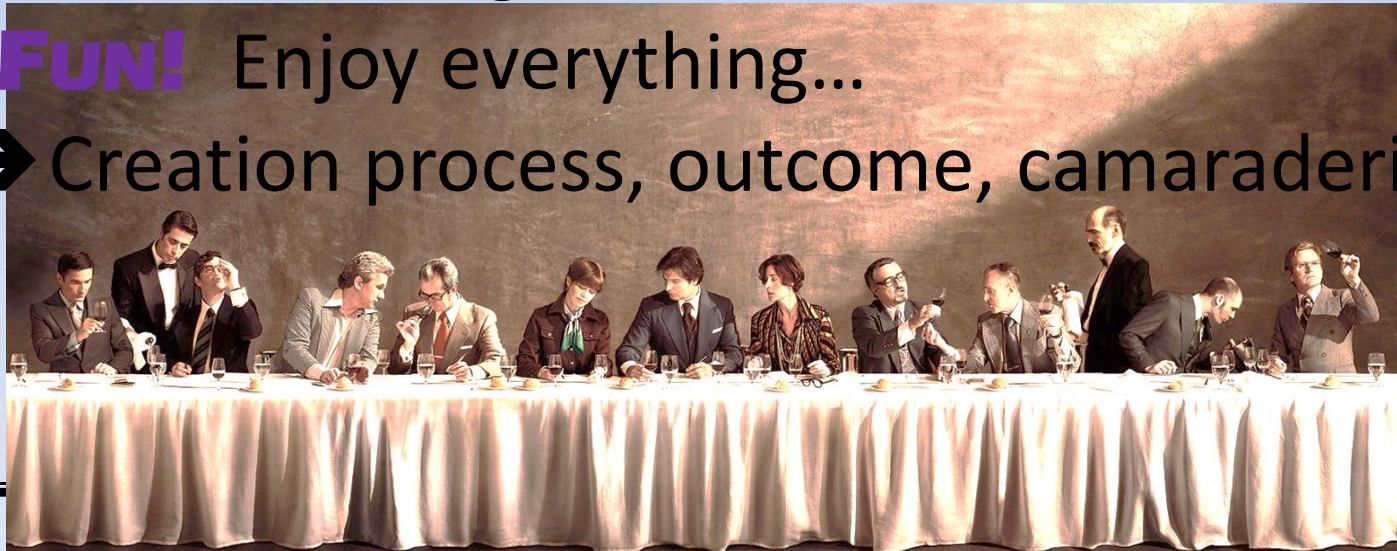
Engineering: leverage all knowledge & Solve problems

The Bottom Line:

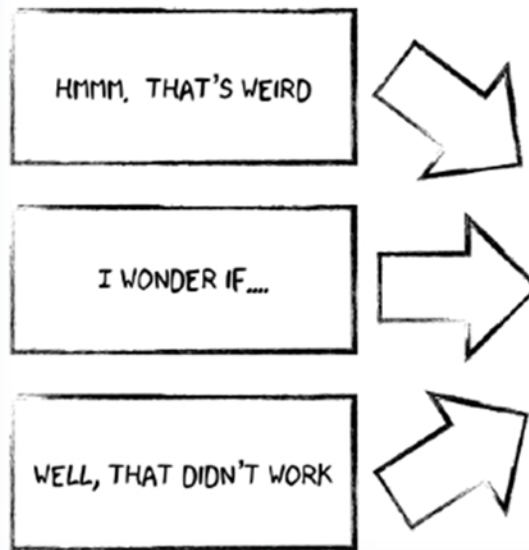
Within limitations, make *most likely* inferences

For what purpose?

- 1) Advance humanity toward *your future vision*
 - ➔ Your meaning of life
- 2) **FUN!** Enjoy everything...
 - ➔ Creation process, outcome, camaraderie

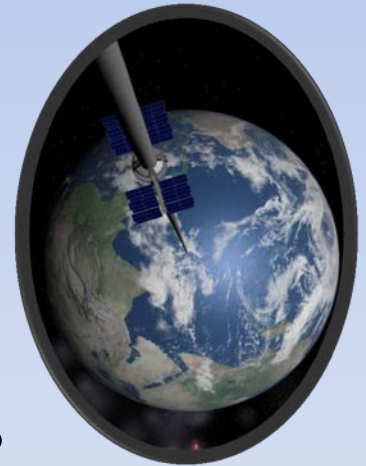


- 1) Advance humanity toward *your future vision*
→ Your meaning of life
- 2) **FUN!** Enjoy everything...
→ Creation process, outcome, camaraderie



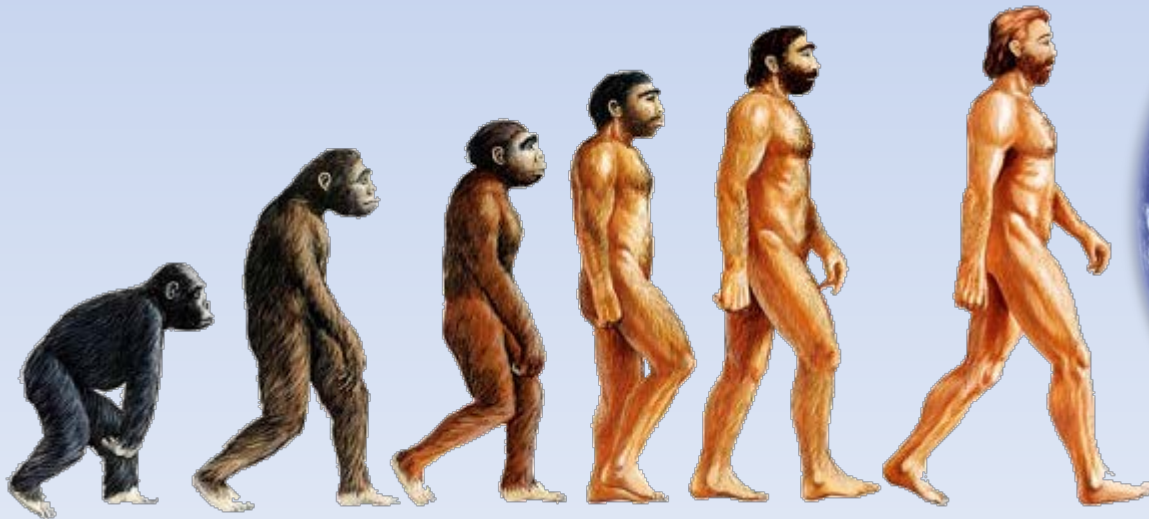
Better...

- Predictions
- Explanations
- Interventions



**APPROACH OUR
LIMITS AND PROSPER!**

PART II: CONSEQUENCES



Increase
Efficiency

Invent New
Technology

Cure
Cancer

End World
Hunger

Majority's Future
Vision: "*Progress*"

Increased Human
Quality of Life

Decreased Human
Quality of Life

Human Population
Growth



Crime &
Disease

Species
Elimination

Environmental
Terraforming

Resource
Scarcity

Progress Cycle → ...?



1. Stop human population growth

- Redefine society's notions of ethics and “progress”

2. Colonize Space

- Infinite growth ok
in the infinite universe



3. Perish

- Humans kill themselves or Earth?
- Black swan event?



Backup!





Modern Models

- Physics
 - Prediction: What is the path of an electron?
 - Explanation: What causes gravity?
 - Intervention: If we build a rocket and ignite it, will it launch into orbit?
- Finance
 - What will the value of Apple be in 3 months?
 - What circumstances led to the 2008 crash?
 - If the Federal Reserve repurchases treasury bonds, will inflation decrease?
- Music
 - How will it sound if a violin plays A, a Flute plays B, a Cello plays C, ...
 - What leads an audience to most appreciate a sound? [psychology]
 - If we change the increase a tune's time signature, will it appear faster?
- Love, History, Biology, Mathematics, Engineering, Health,