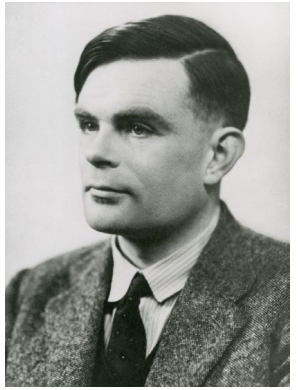
Educability

Leslie Valiant
Harvard University

Beyond the Symbols vs Signals Debate
The Royal Society
October 28, 2024

The “Turing Gap”



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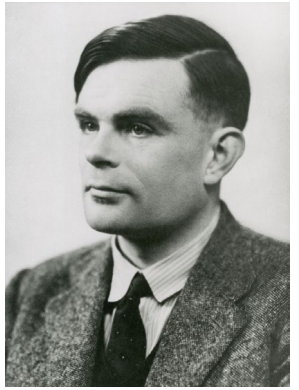

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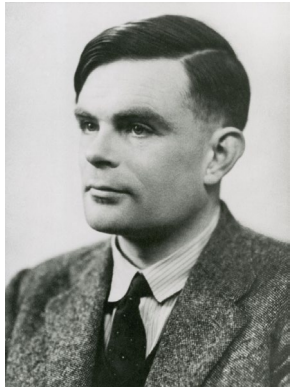

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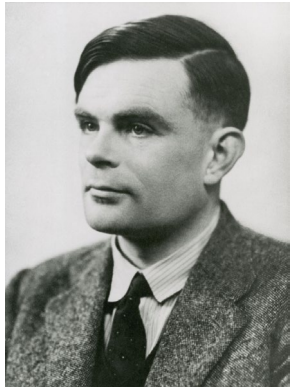

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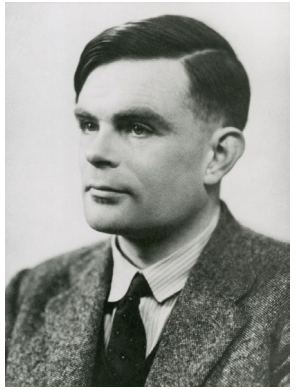

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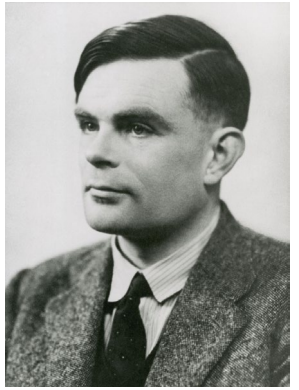

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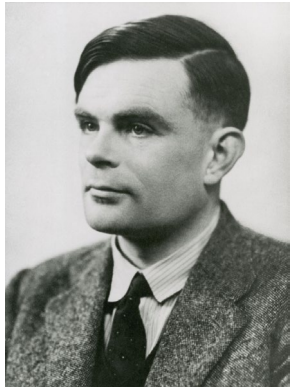

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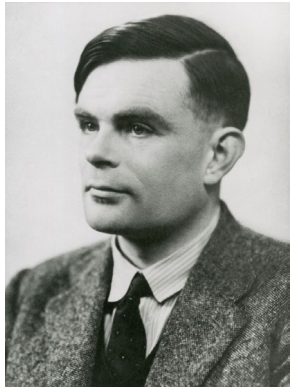

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c.f. The Imitation Game

How adequate is our understanding of Human Capabilities?

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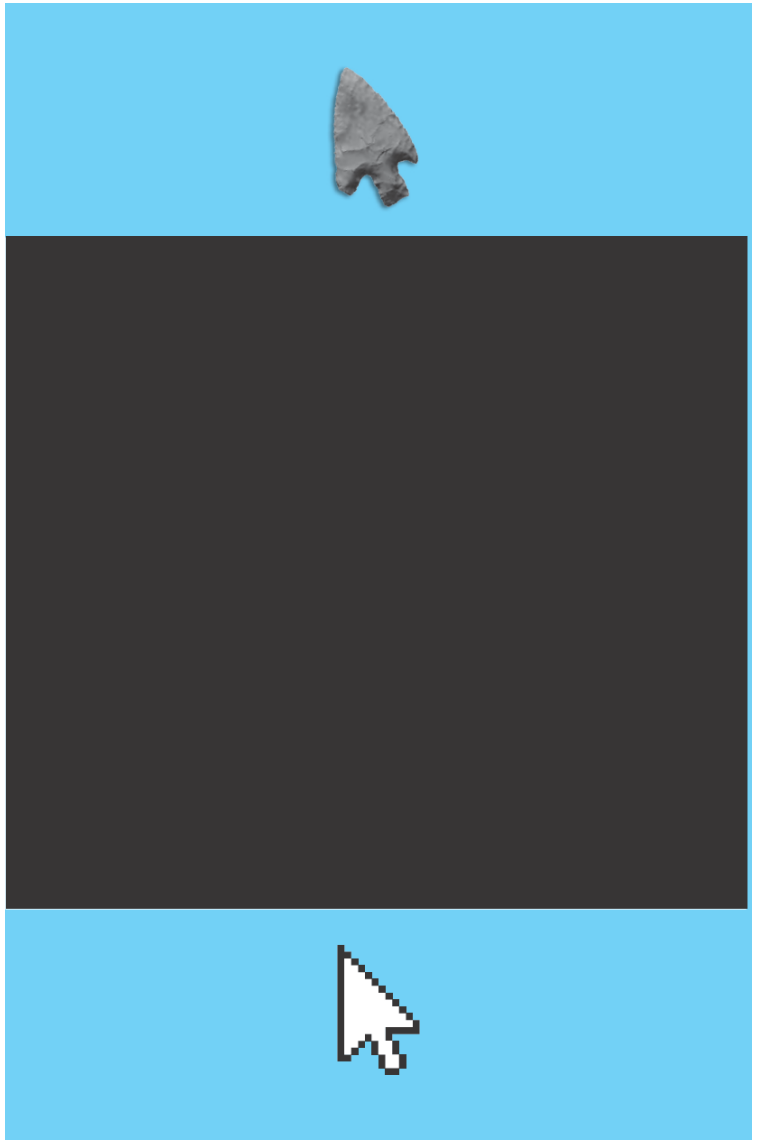
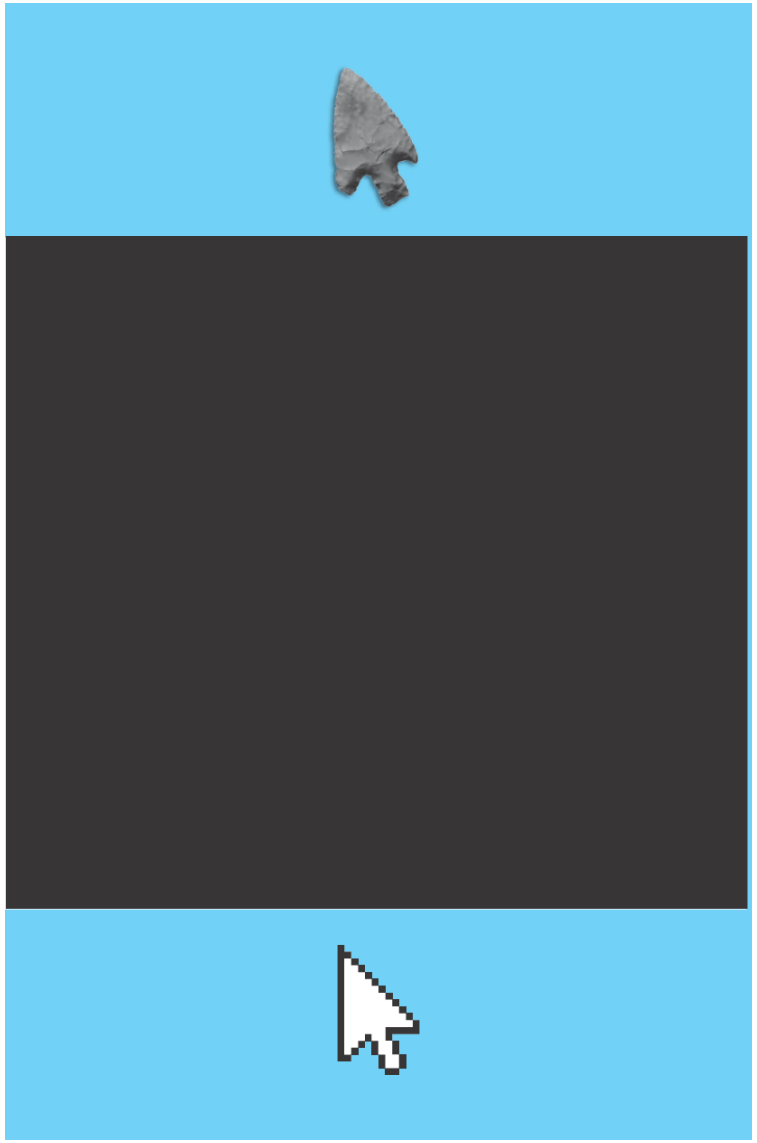


What question to ask about human capabilities?



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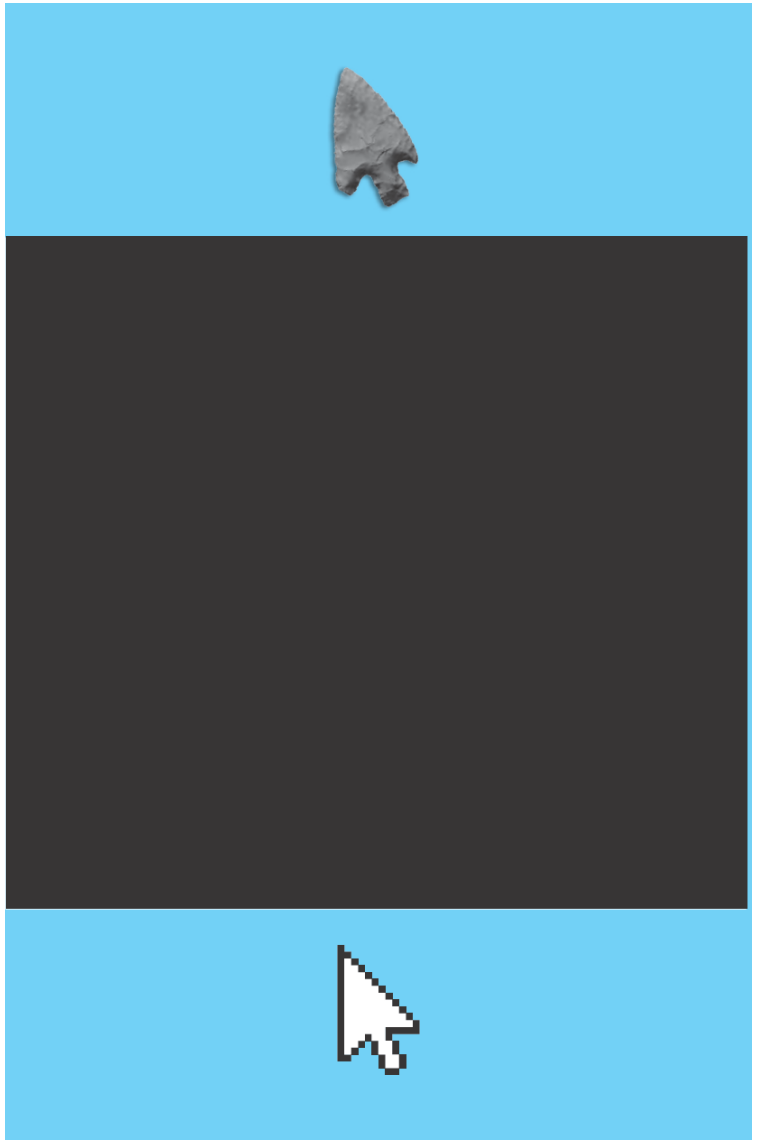

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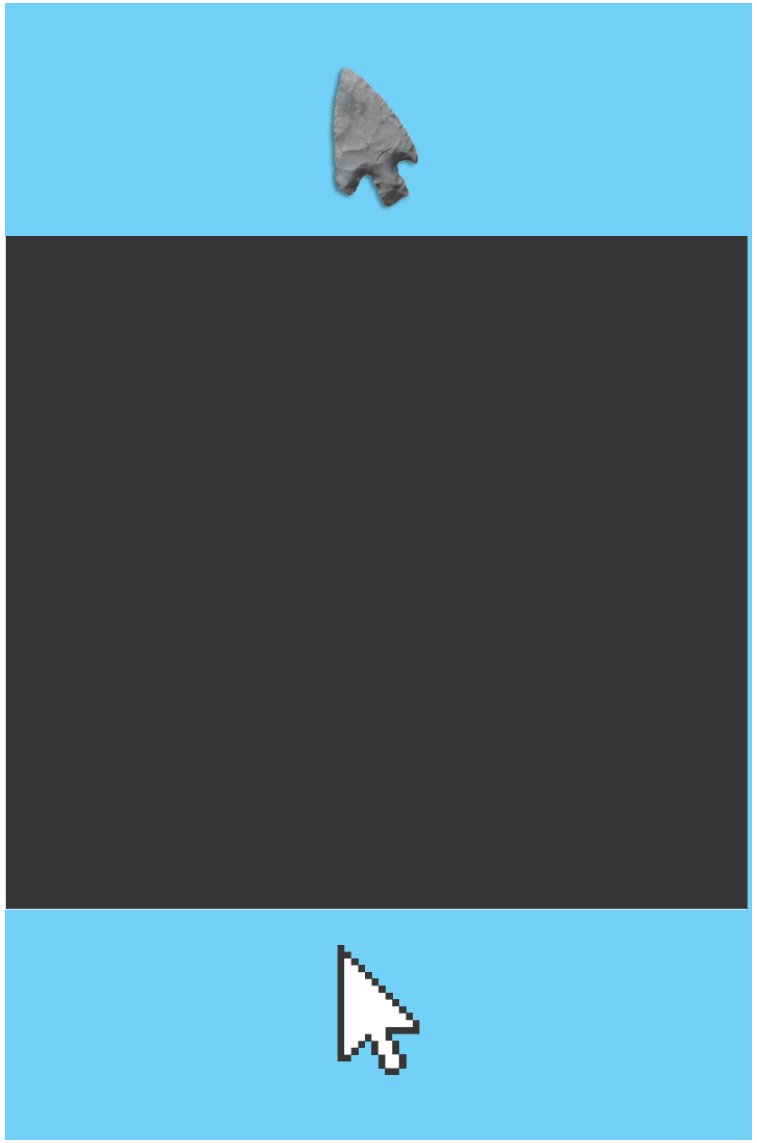

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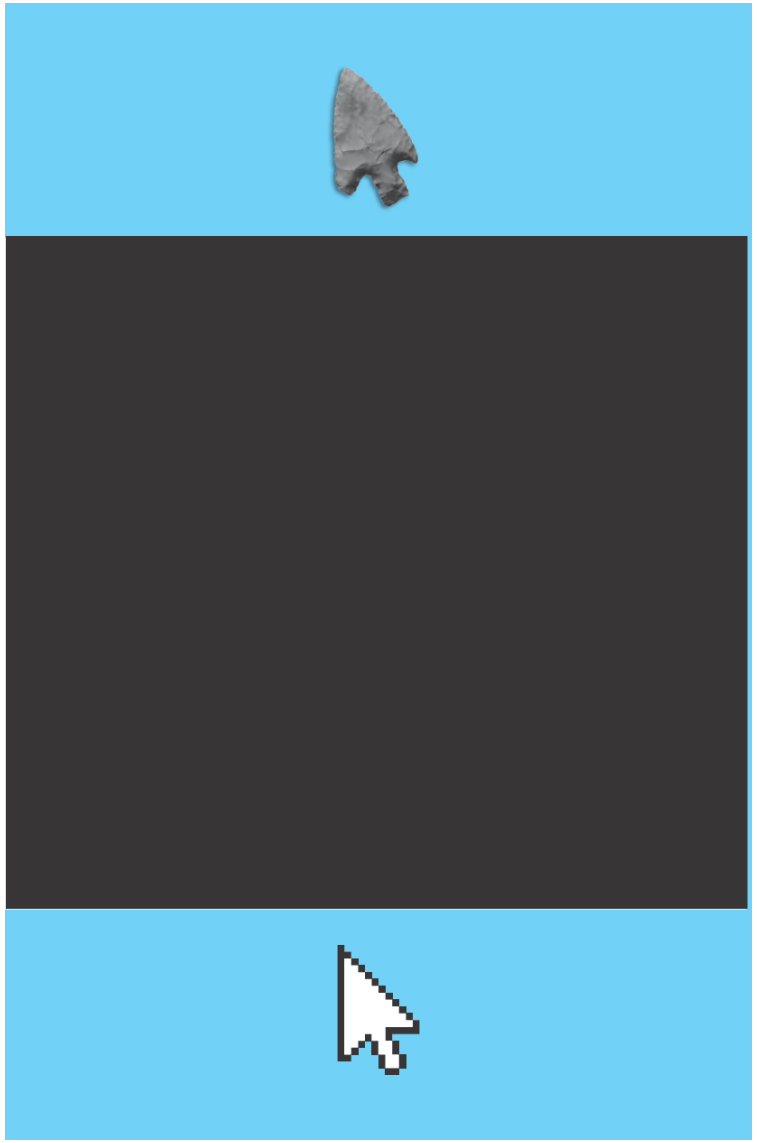

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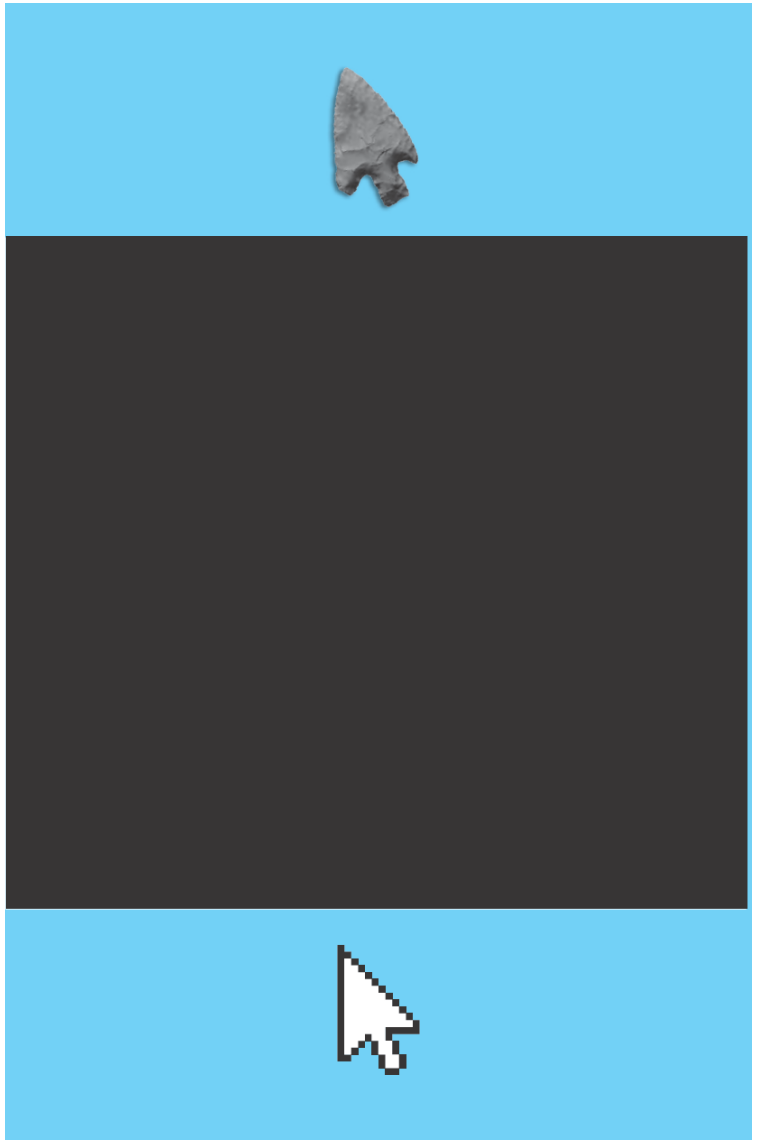

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?Models of Computation make complex hypotheses expressible.

Proposed Civilization Enabler:

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(c.f., educational philosophy)

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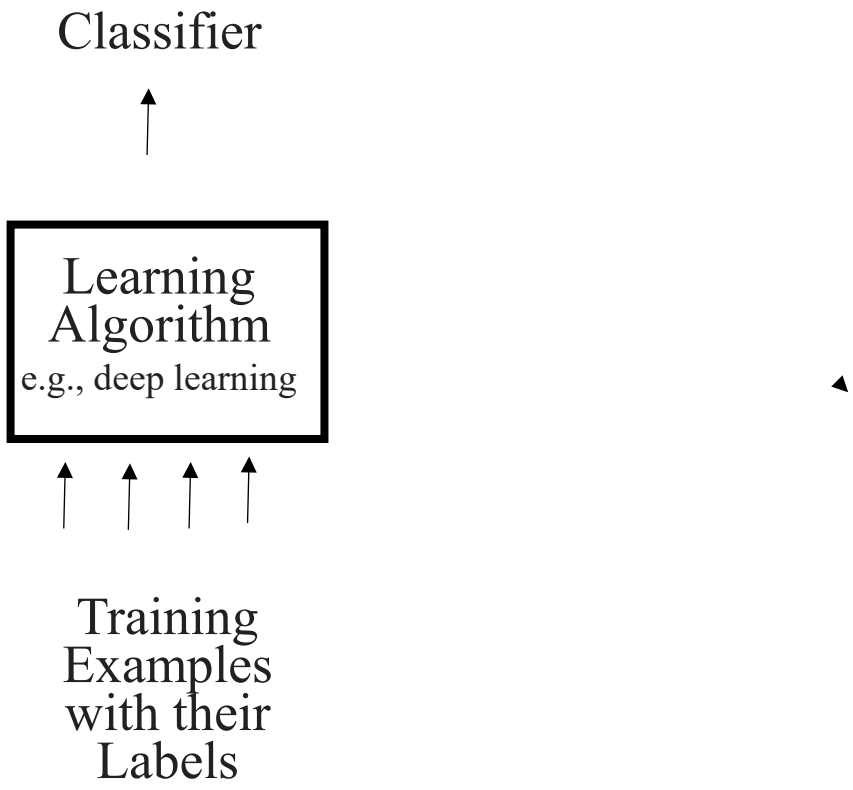

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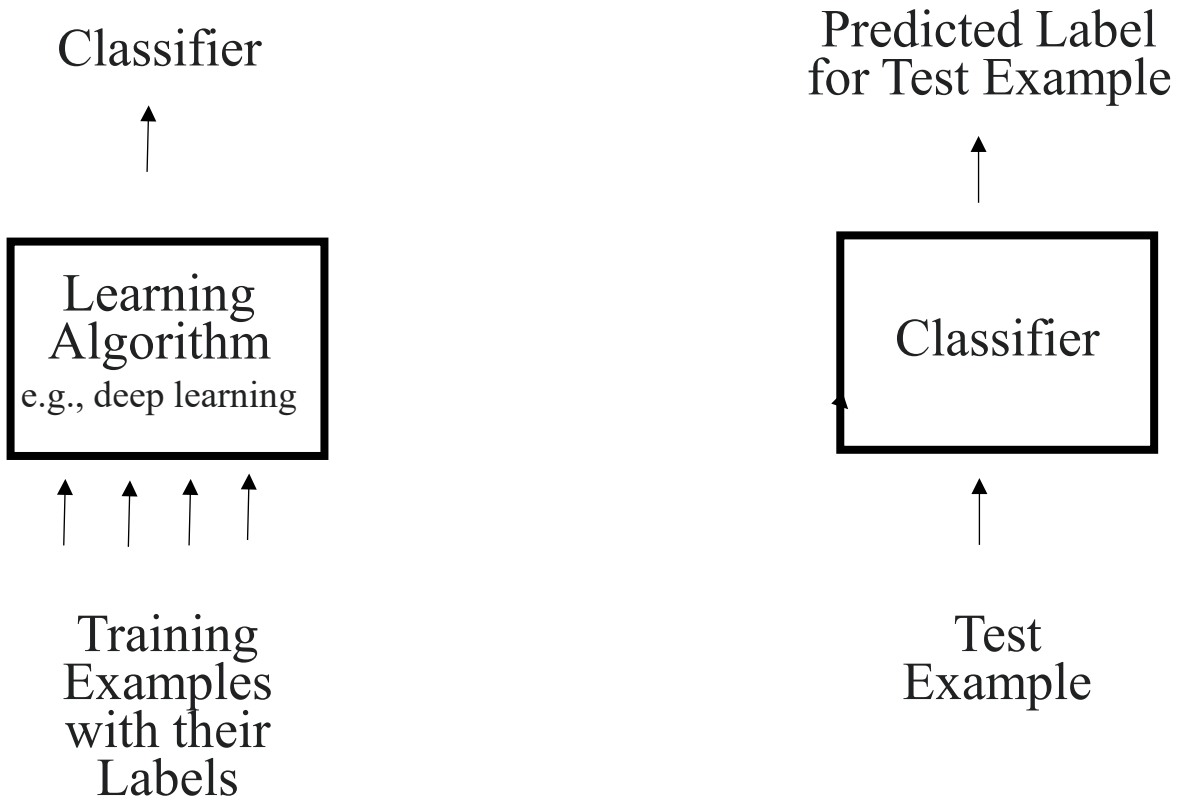

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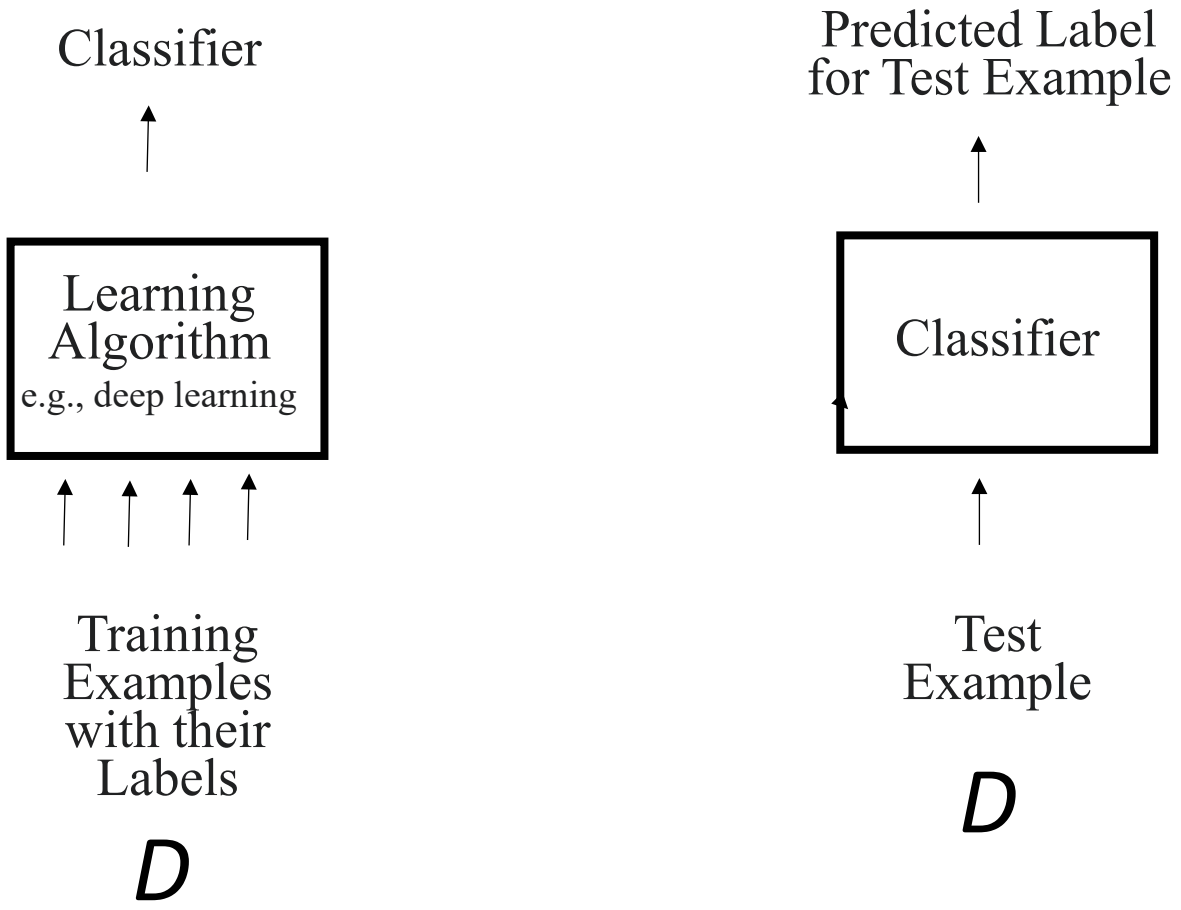
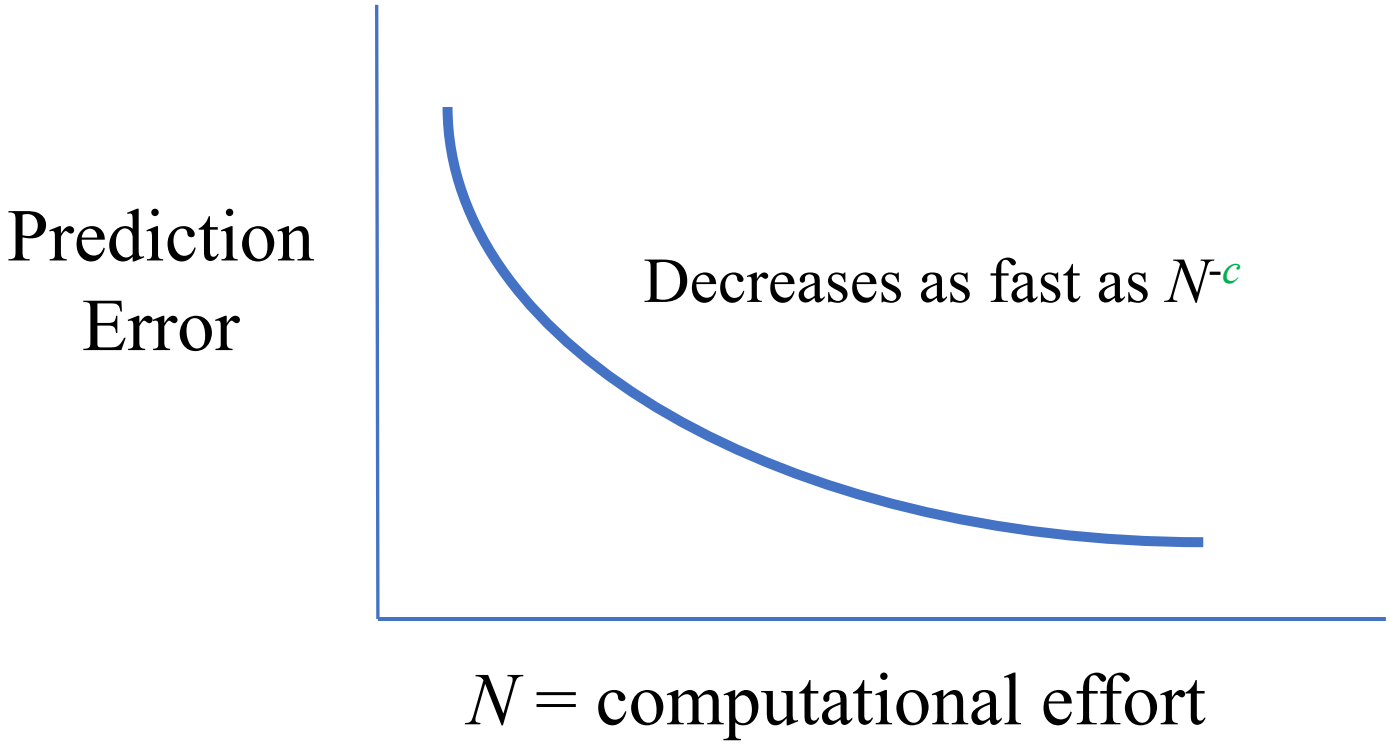


Probably Approximately Correct (PAC) Learning



PAC Learning: Better prediction with more effort, and affordably so!

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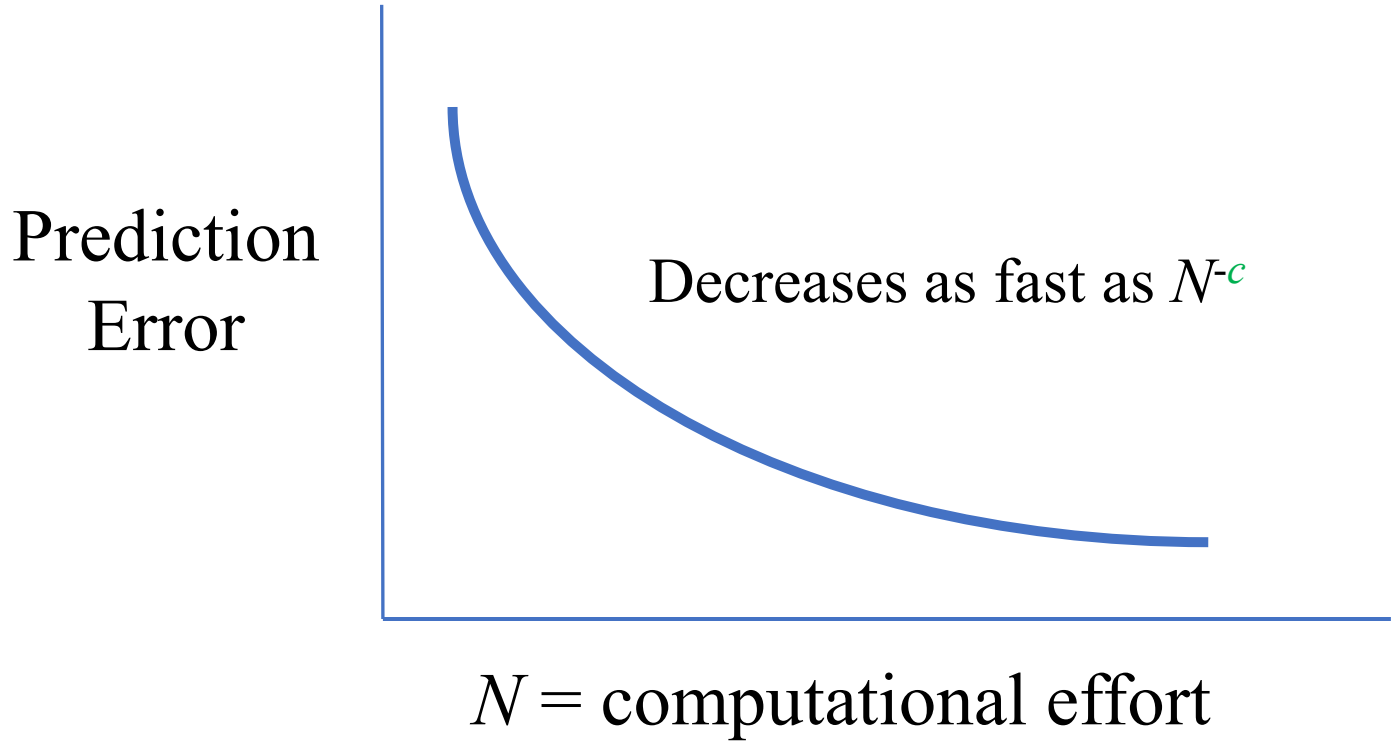

e.g. If with 10x more effort we halve the error,
then with another 10x more effort we halve the error again.

Precision versus Informality

“PAC Learning” versus “(Self-)Supervised Learning”

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Generalization

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Do they do anything else reliably???

Think of Newton's 3 Laws, Maxwell's 4 equations.

Several principles whose interaction produces the richness of the phenomena.

(II) Chaining Beliefs (Reasoning)

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Phenomenon addressed here: Chaining on uncertain beliefs.

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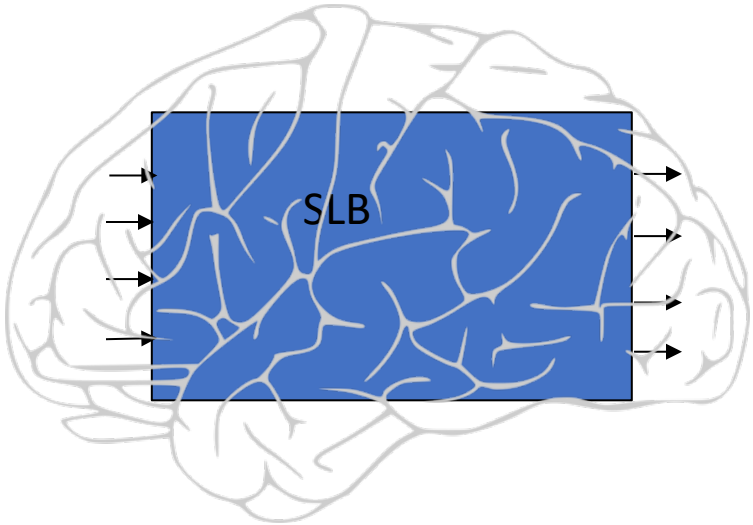
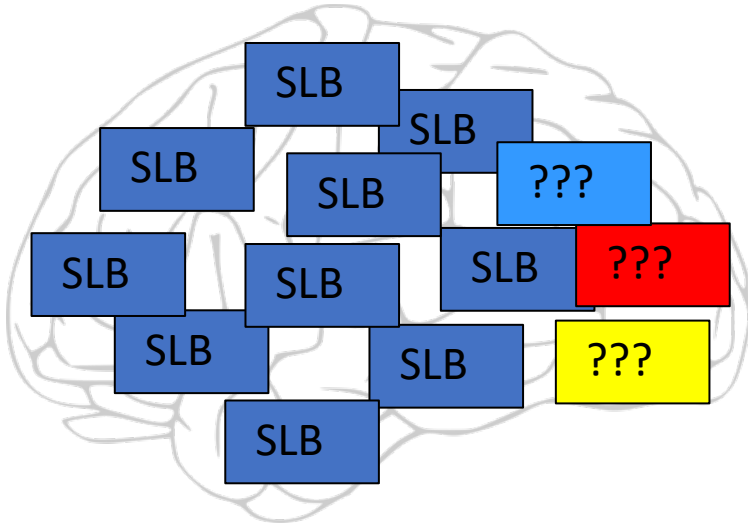
Formulation: Robust Logic

Soundness of conclusions??

Computational feasibility??

Single Learning Box v. Robust Logic





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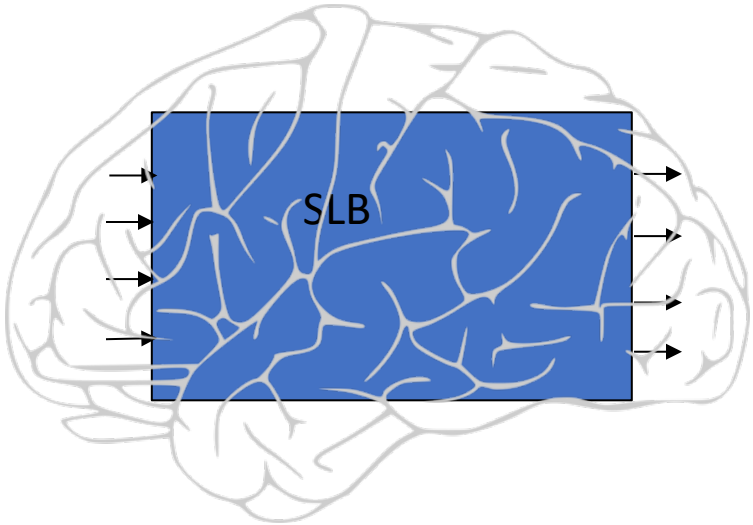

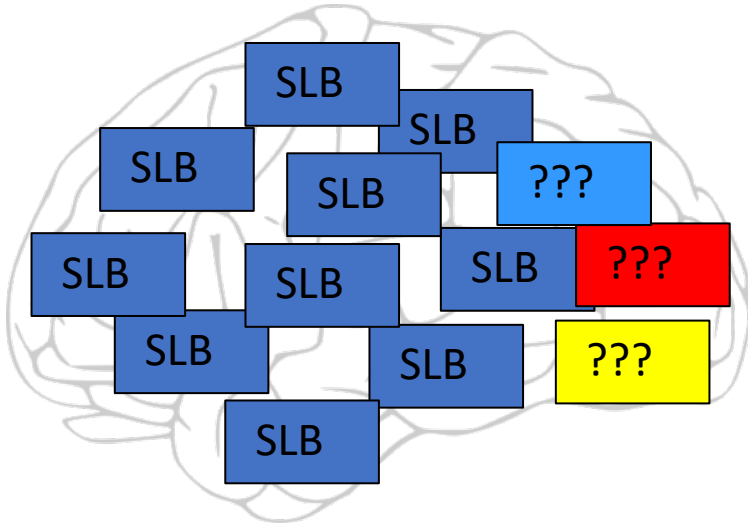

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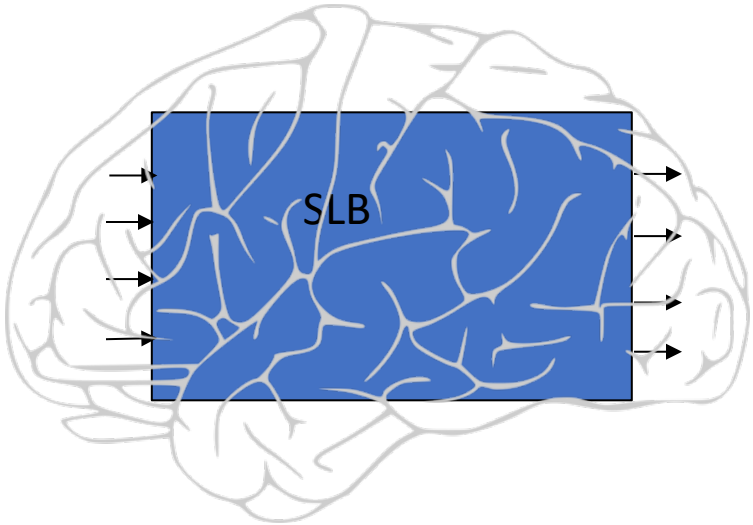

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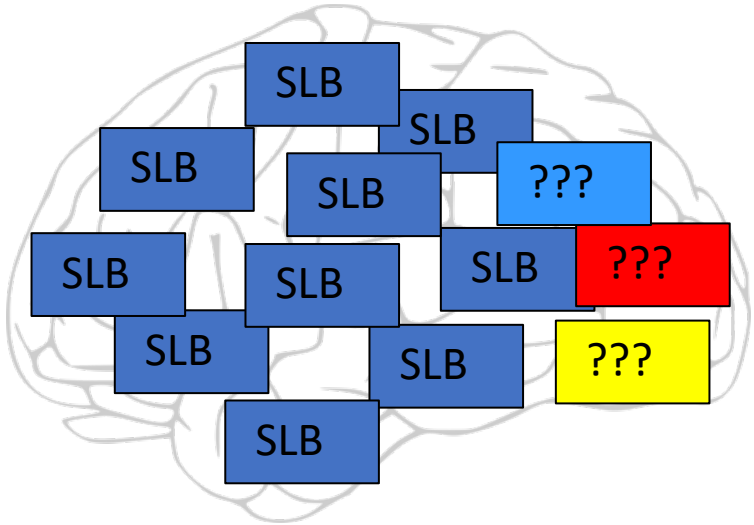

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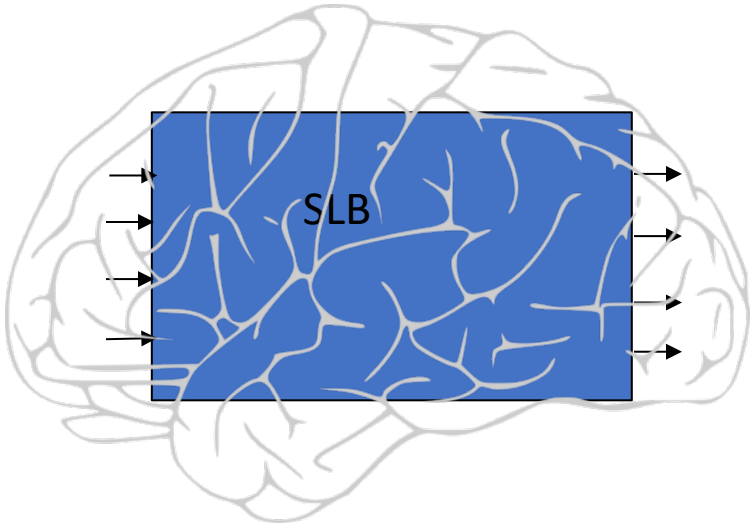

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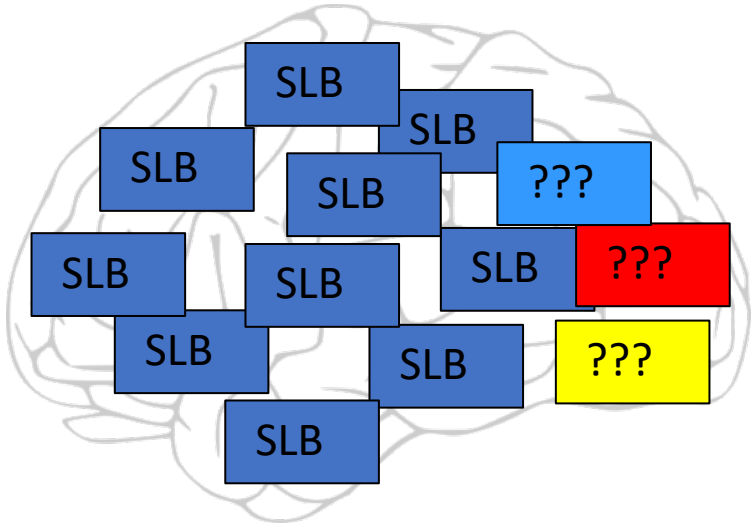

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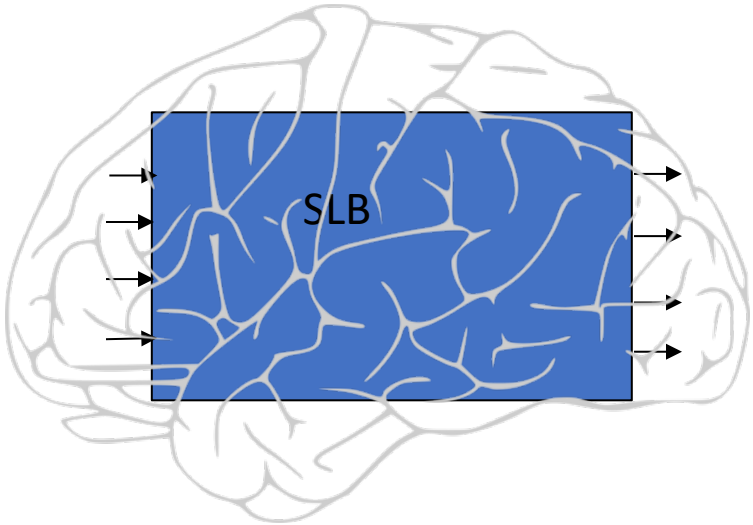

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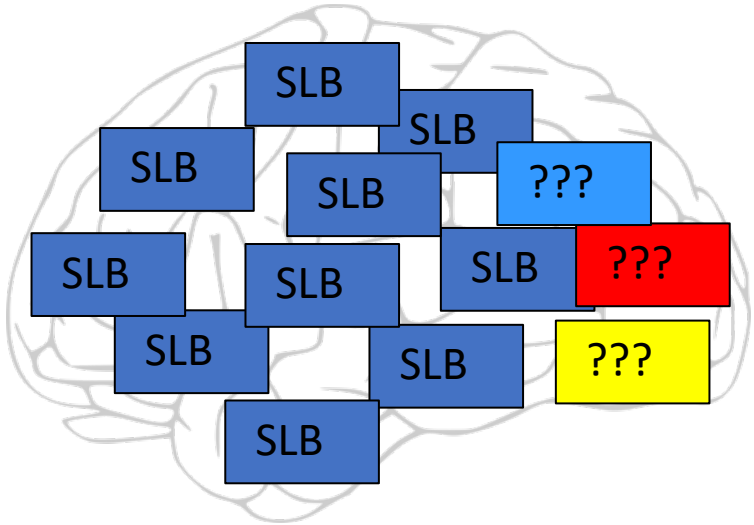

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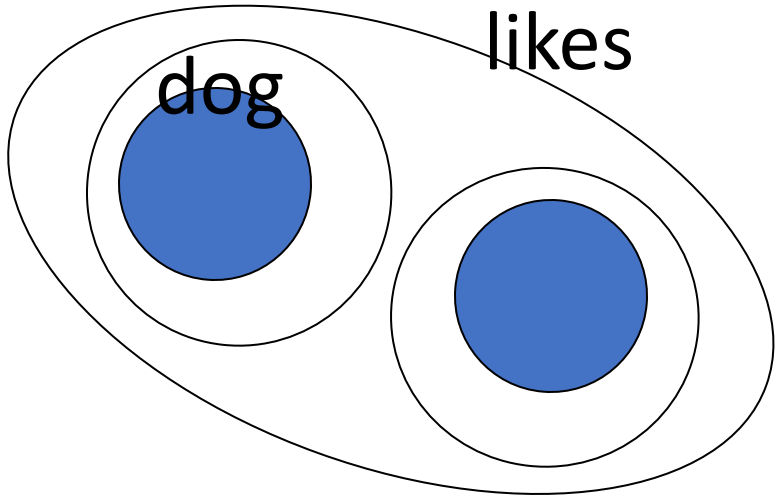

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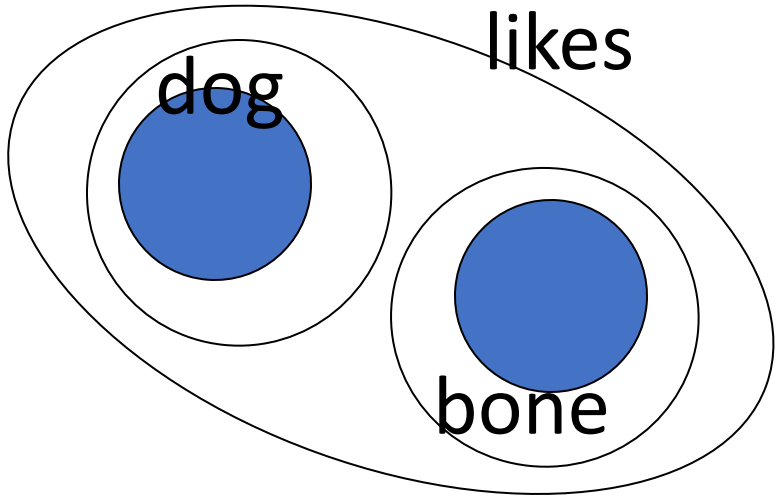

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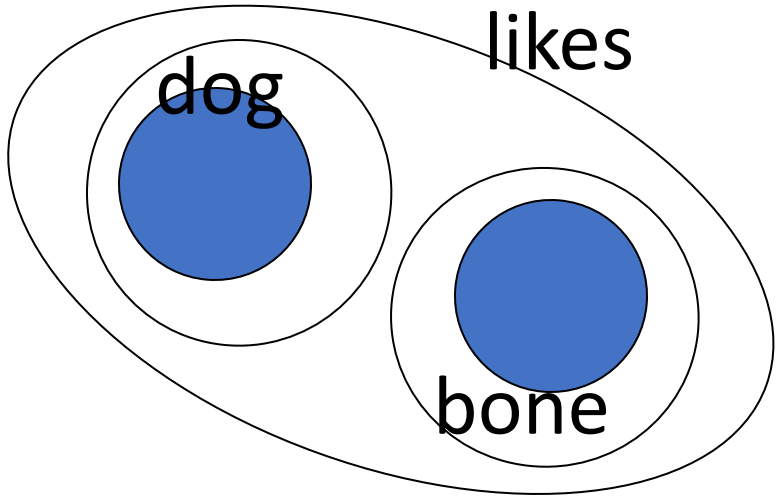

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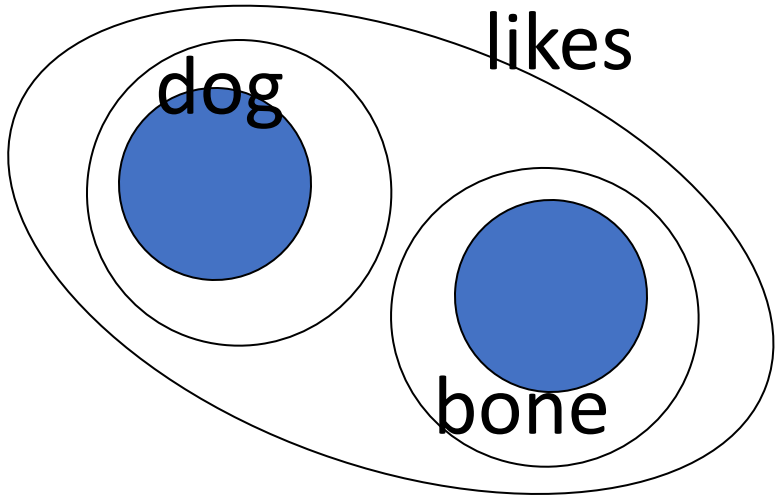

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For a situation in Mind's Eye chain the applicable learned rules.

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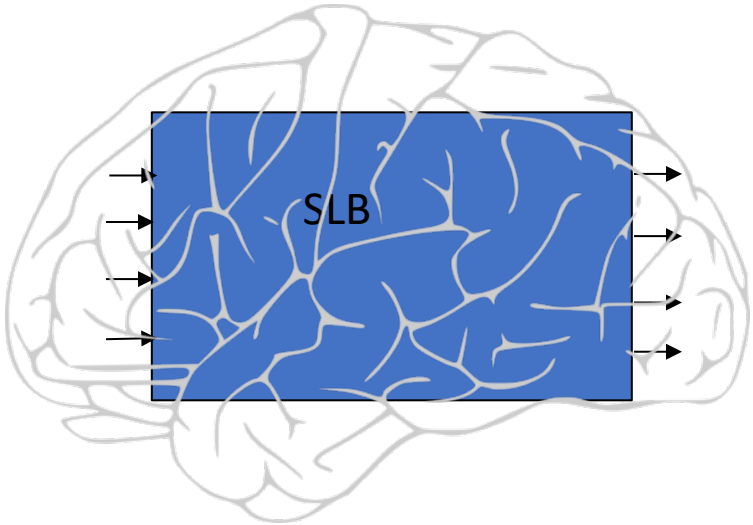

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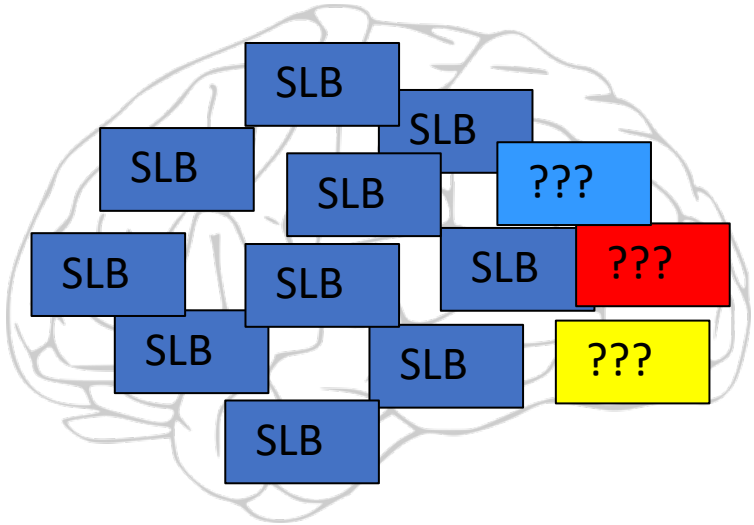

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Back to Civilization Enabler: Hypothesis is that the complex architecture needed for supporting learning, chaining, and Mind's Eye had evolved well before humans.

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Educability is the realization and integration of the three capabilities (i), (ii) and (iii).

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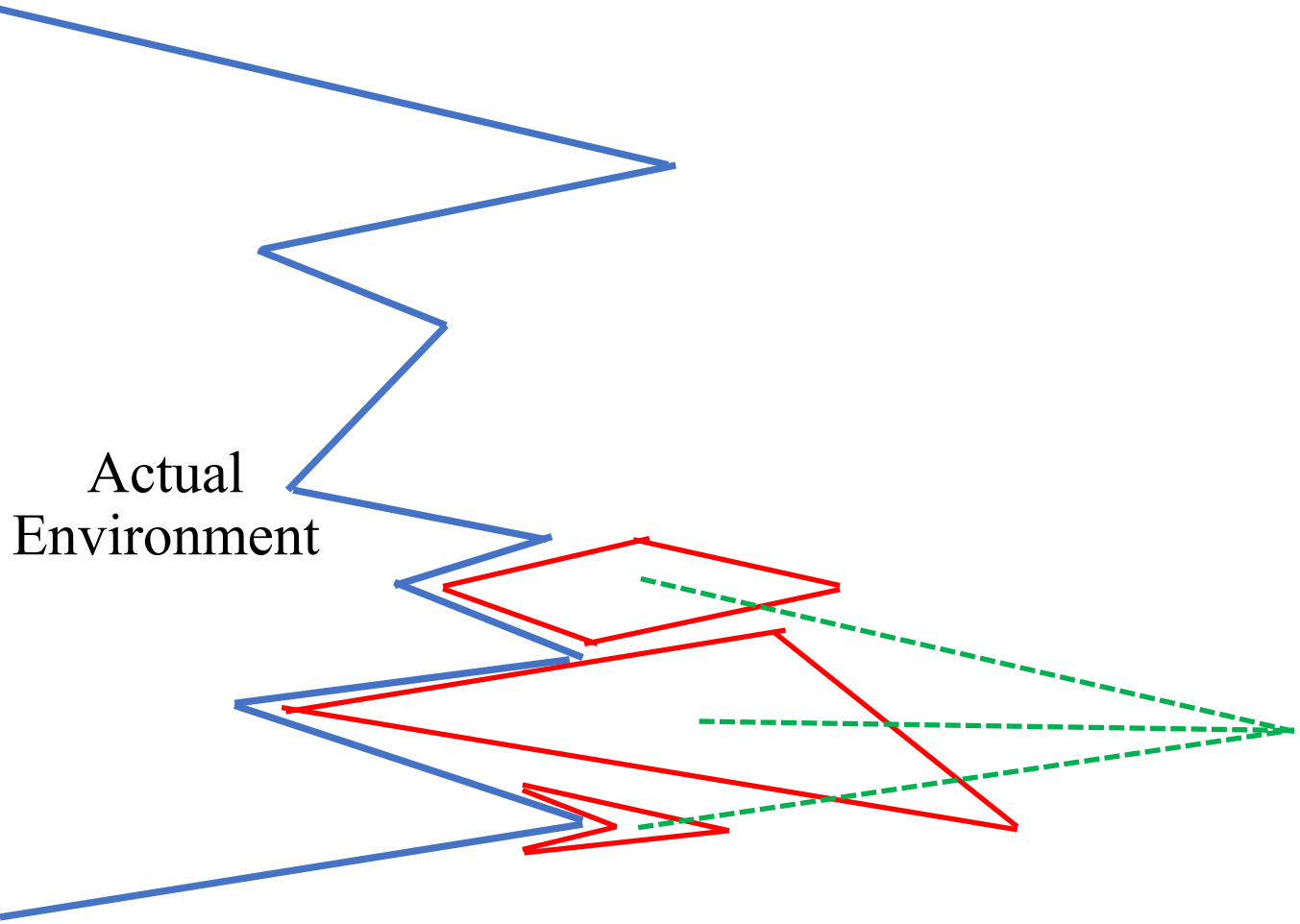
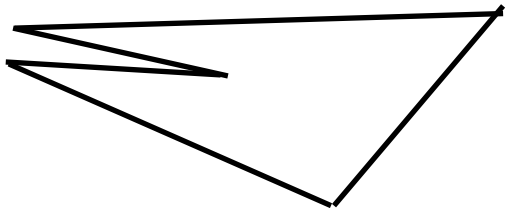
- Complex cultures





PAC
Learning

Robust Logic

Program
Acquired by
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Seven Differences all this may Make

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- Hence educable beings are easy victims to arbitrary belief systems, ideologies, conspiracy theories. (The fault is also in ourselves!)

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If apple is to seed, then …. **NO**

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Parameters are not a bug of the educability model but a feature of cognition.

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Answer to all: EDUCABILITY

6. Education

It would be nice to contribute some to
“a more scientific basis for education.”

7. Like PAC Learning, a Technological Proposal

THANK YOU

Informal Definition of Educability

Educability consists of capabilities to

(i) *acquire* beliefs by *generalizing* from experience,

(ii) *apply* beliefs in *combination* to specific situations,

(iii) *acquire* beliefs *explicitly described* to us by others,

all *integrated* with *(iv) multi-object scene analysis*

and *(v) symbolic naming*.