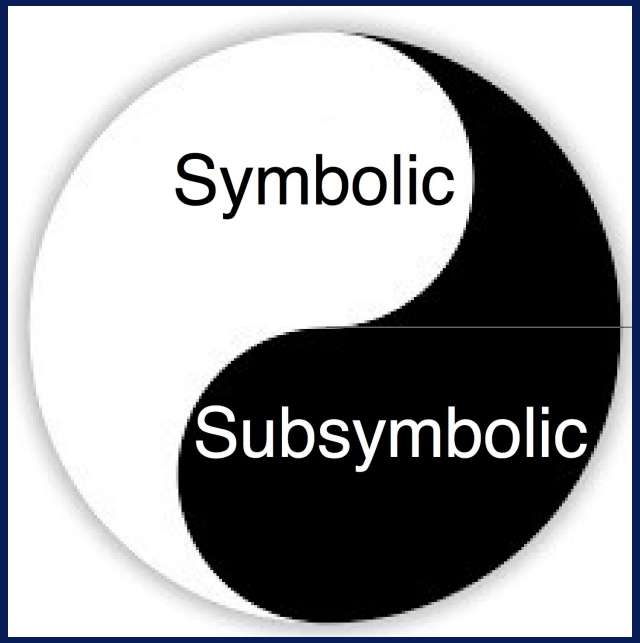
Symbolic vs. Subsymbolic AI



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Symbolic vs. Subsymbolic

- Explicit symbolic programming
- Inference, search algorithms
- AI programming languages
- Rules, Ontologies, Plans, Goals...

- Bayesian learning
- Deep learning
- Connectionism
- Neural Nets / Backprop
- LDA, SVM, HMM, PMF, alphabet soup...

Symbolic vs. Subsymbolic

- Introspection more useful for coding
- Easier to debug
- Easier to explain
- Easier to control
- Not so Big Data
- More useful for explaining people's thought
- Better for abstract problems

- More robust against noise
- Better performance
- Less knowledge upfront
- Easier to scale up
- Big Data
- More useful for connecting to neuroscience
- Better for perceptual problems

What's the goal of AI?

To have computers do things, that, if people did them, we would consider intelligent

(subject to "Disappearing AI")

To explain how human intelligence works, and reproduce it in computers

What is the appropriate level for describing intelligence?

We're just bags of chemicals.... Can we explain intelligence in terms of chemistry?

We're just a bunch of connected neurons.... Can we explain intelligence in terms of wiring?

We're just information processors... Can we explain intelligence in terms of information?

We're just {math, bio, genetic, social, ...}

Symbolic vs Subsymbolic

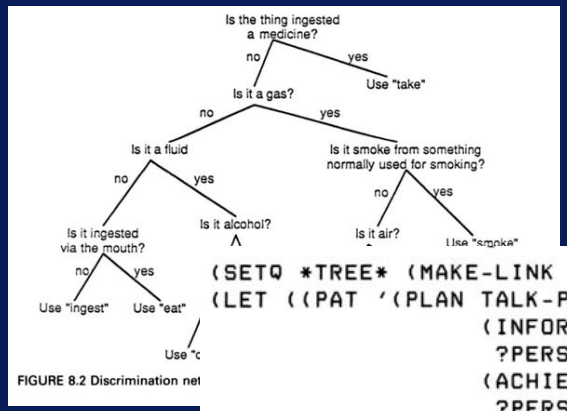
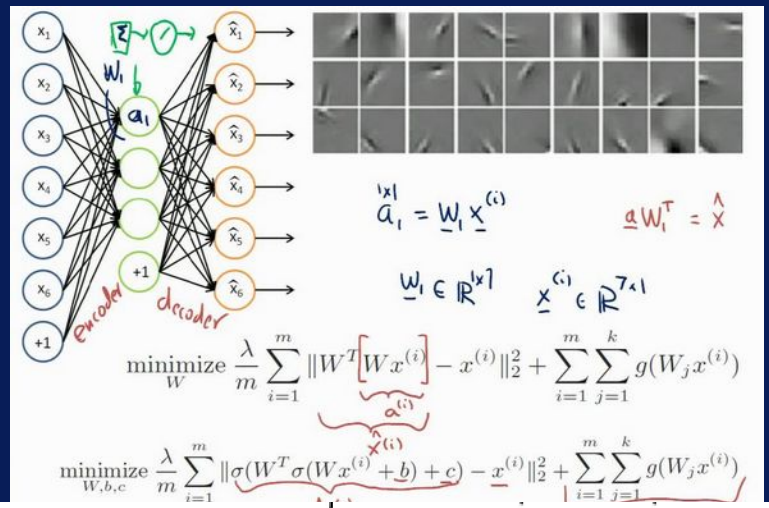
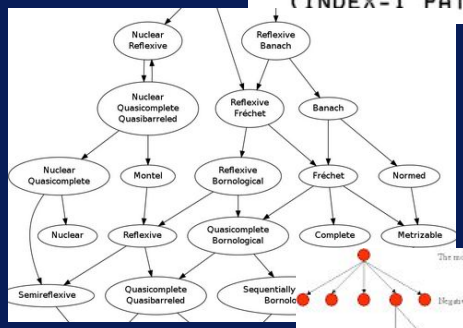
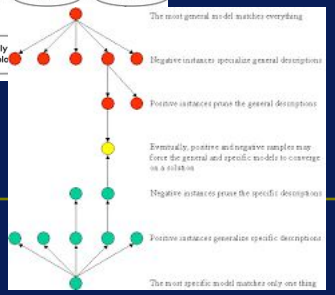


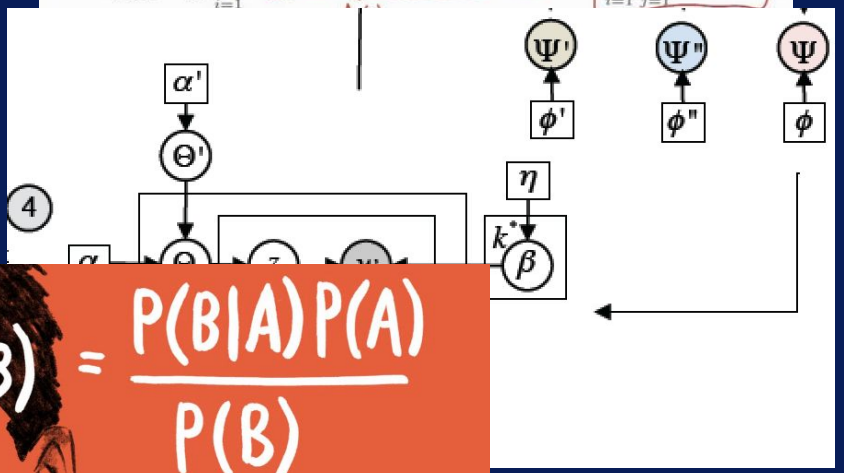
FIGURE 8.2 Discrimination net

```
(SETQ *TREE* (MAKE-LINK :KEY '*TOP*))
(LET ((PAT '(PLAN TALK-PLAN
                  (INFORM ?PERSON1
                   ?PERSON2 ?FACT)
                  (ACHIEVE (AT
                   ?PERSON1 ?PERSON2))
                  (SAY ?PERSON1 ?FACT))))
 (INDEX-1 PAT (CADDR PAT) *TREE*))
```









Newell & Simon: The Physical Symbol System Hypothesis

Physical symbol system

From Wikipedia, the free encyclopedia

See also: Philosophy of artificial intelligence and Data system

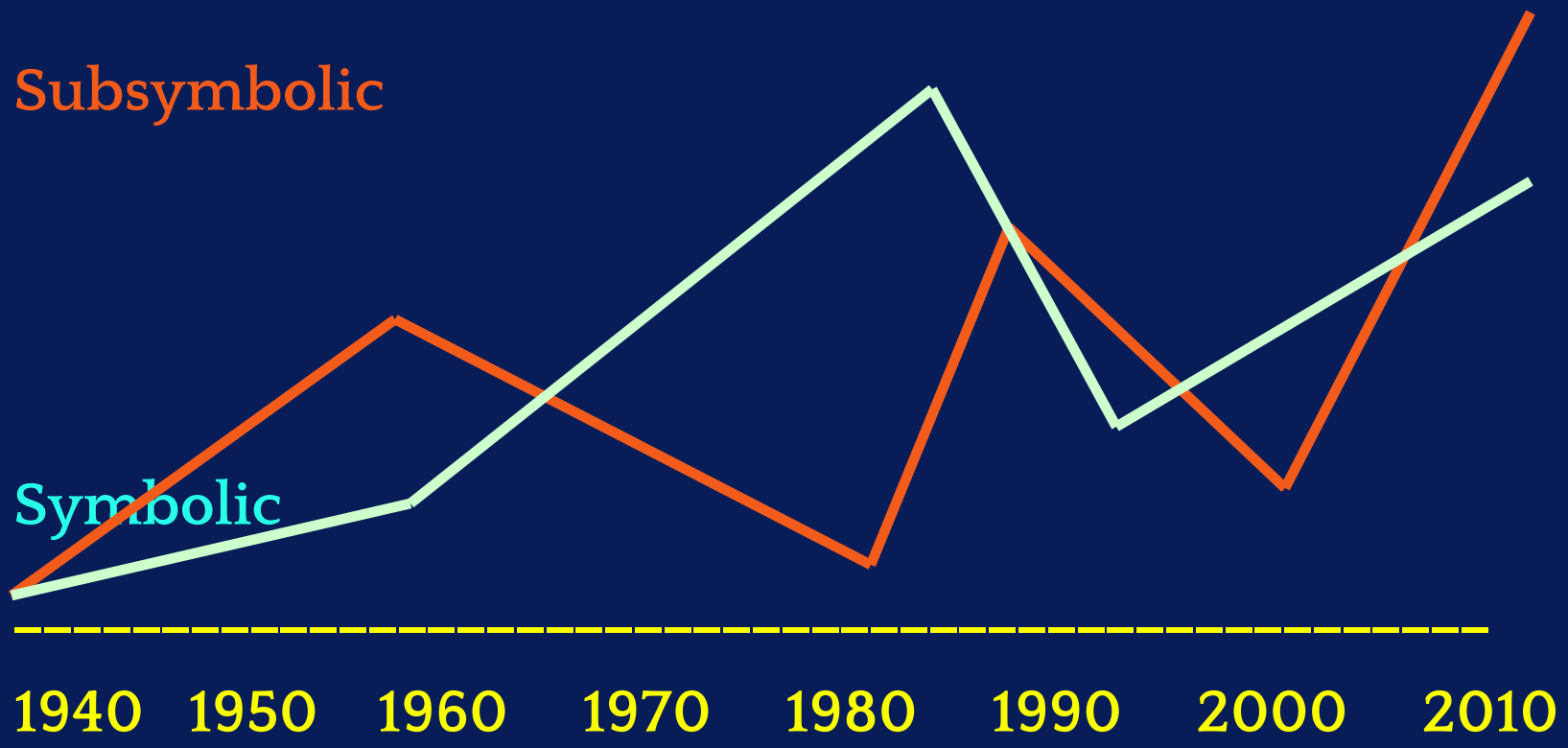
A **physical symbol system** (also called a formal system) takes physical patterns (symbols), combining them into structures (expressions) and manipulating them (using processes) to produce new expressions.

The **physical symbol system hypothesis (PSSH)** is a position in the philosophy of artificial intelligence formulated by Allen Newell and Herbert A. Simon. They wrote:

> "A physical symbol system has the necessary and sufficient means for general intelligent action."[1]
>
> — Allen Newell and Herbert A. Simon

This claim implies both that human thinking is a kind of symbol manipulation (because a symbol system is necessary for intelligence) and that machines can be intelligent (because a symbol system is sufficient for intelligence).[2]

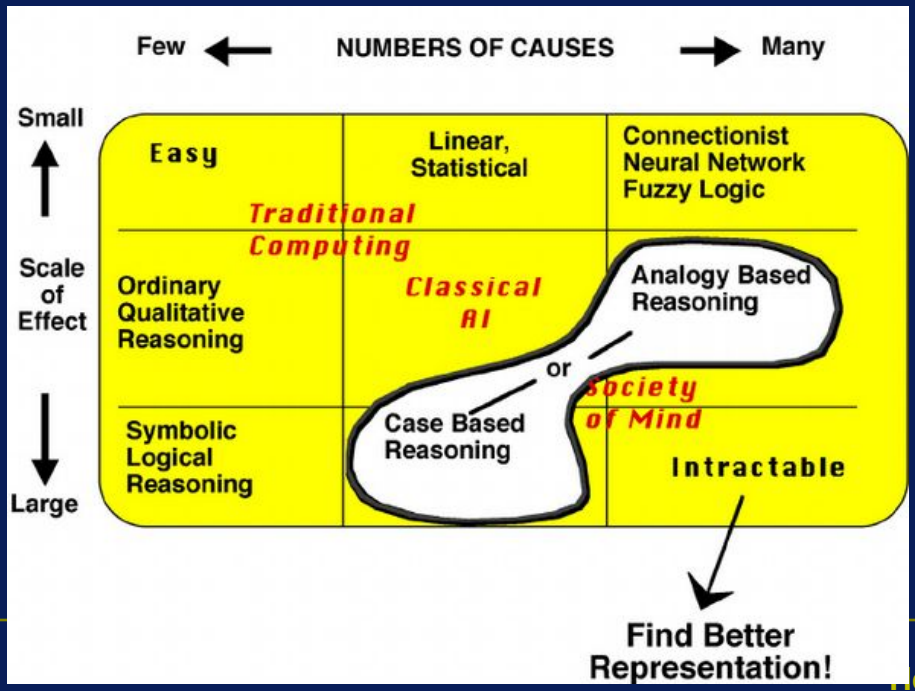
Timeline


Subsymbolic
Symbolic
1940
1950
1960
1970
1980
1990
2000
2010

Reconciling approaches

Top down vs. bottom up

Bits of the other approach are seeping into both sides



Peace!

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