CONCEPT-BASED AGI

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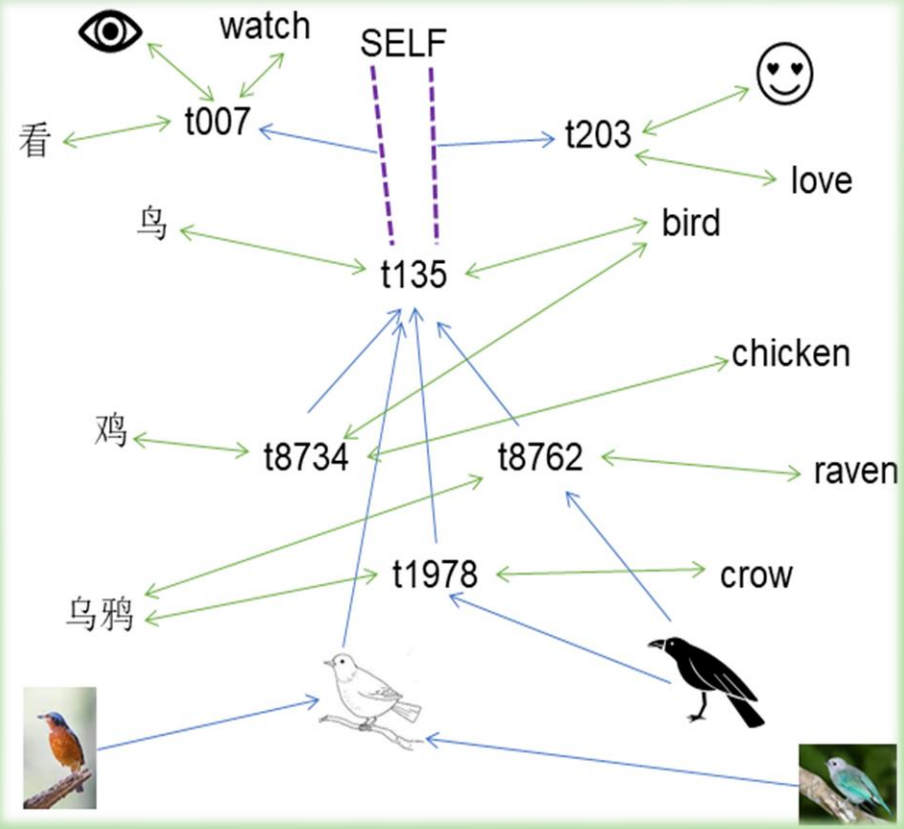
INTELLIGENCE AS ADAPTATION

- **Intelligence** is *adaptation with insufficient knowledge and resources*
- Using the *past* experience to predict *future* situations, and distributing limited time-space among unbounded demands
- This is the opposite of *Turing computation*, which repeatedly uses a predetermined algorithm on problem instances with a fixed expense
- **NARS** (Non-Axiomatic Reasoning System) is a model based on the above theory and aims at Artificial General Intelligence (*AGI*)

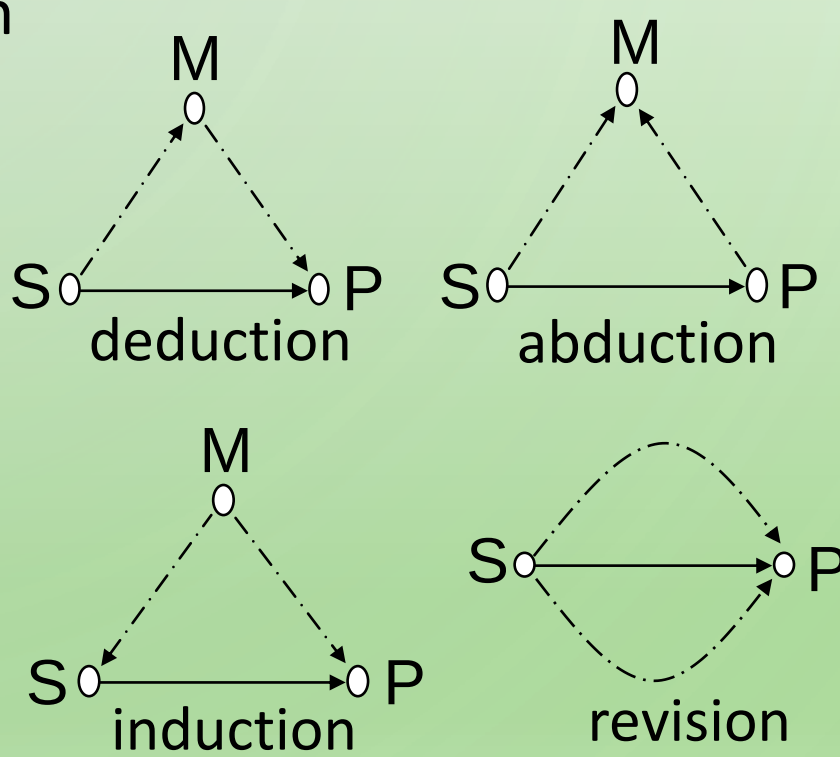
KNOWLEDGE AS CONCEPTUAL GRAPH

- A *concept* is an abstracted fragment of experience identified by a *term*
- A term can be *sensory, operational, linguistic, private*, or *compound*
- The *meaning* of a concept (term) is its experienced relations with the other concepts (terms)
- Basic conceptual relations (*copulas*) express substitutability in usage

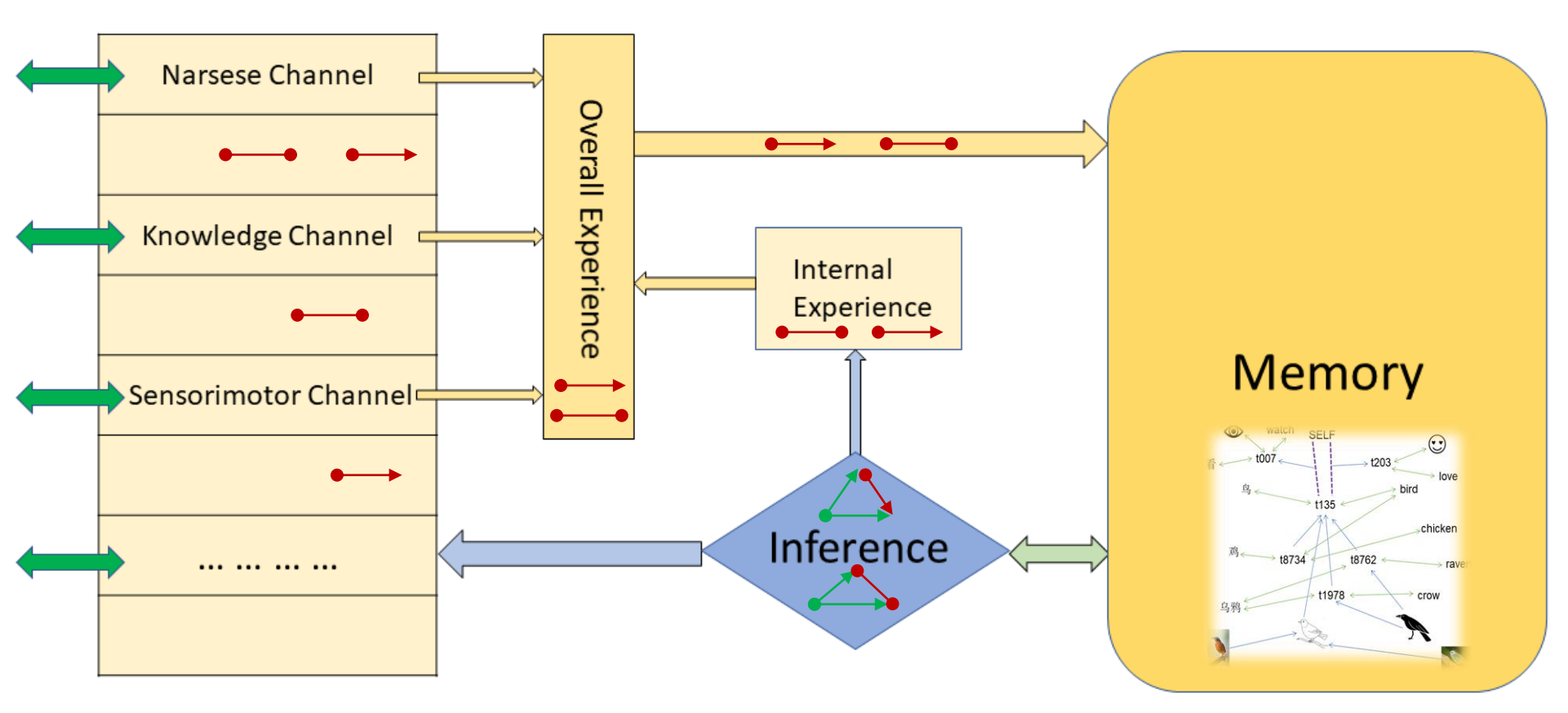


INFERENCE AS CONCEPT SUBSTITUTION

- *Inheritance* specifies each term's extension (generalizations) and intension (specializations)
- *Similarity* is symmetric *inheritance*
- Truth-value indicates evidential support
- An Inference rule corresponds to a type of transitivity of *inheritance/similarity*
- Concepts and beliefs are derived from experience, and revised accordingly



NARS ARCHITECTURE



ATTENTION AS RESOURCE ALLOCATION

- The system dynamically allocates time-space among tasks
- Priority-biased time-space sharing among data items considers
  - current context (urgency, relevance)
  - historical record (usefulness, stability)
  - intrinsic quality (simplicity)
- Each concept is a semi-independent unit of storage-processing
- Each inference step follows a routine and has a constant cost
- Problem solving is case-by-case, without fixed algorithm and cost

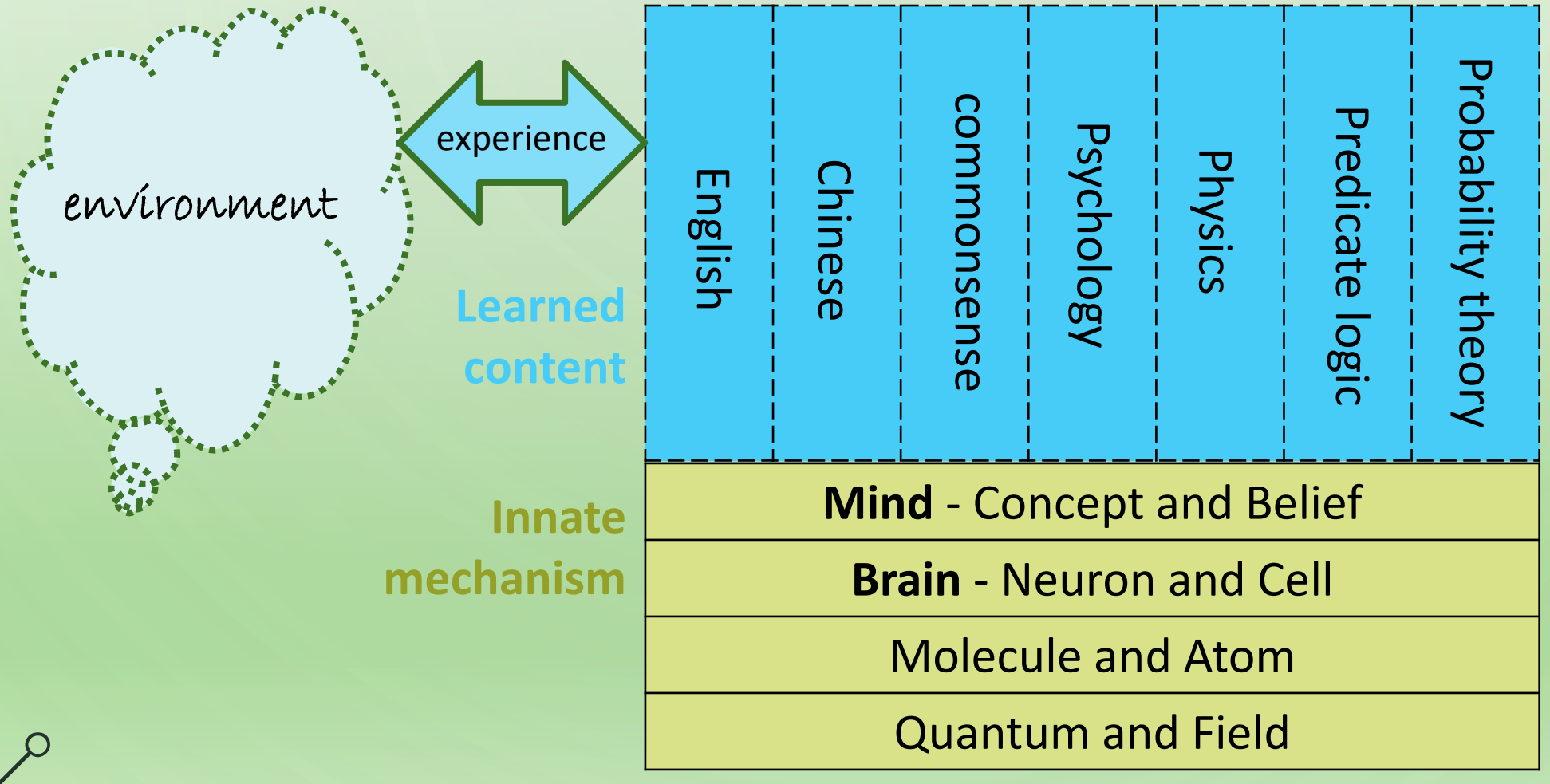
CURRENT STATUS

- The theory uniformly explains many cognitive functions and phenomena, and has been described in books, journal articles, and conference papers
- The logic model is fully formalized and mostly implemented in several open-source software
- Recently, the robotic experiments and partial applications (for Cisco, JPL/NASA) have shown promises and potentials

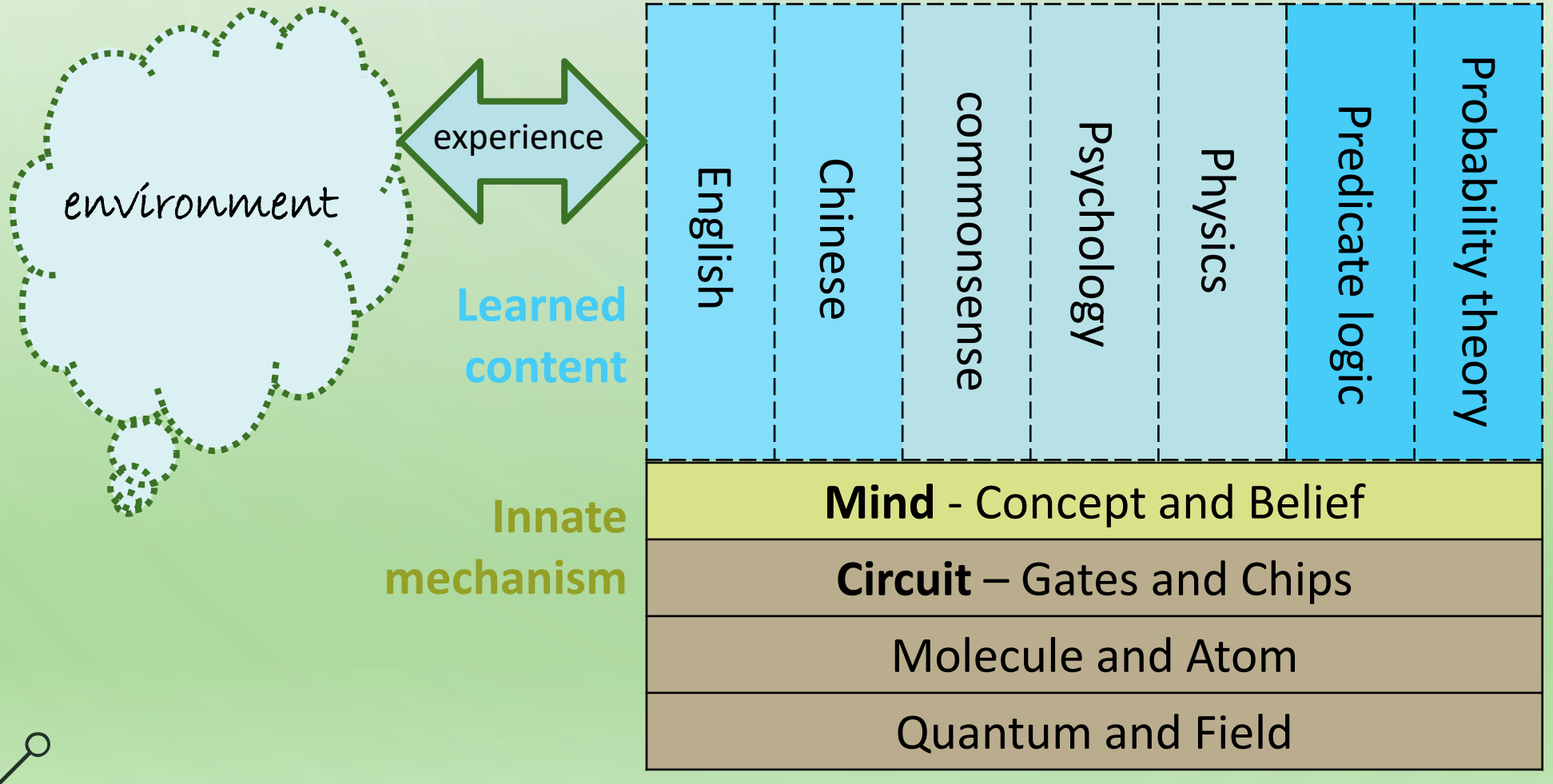
HYBRIDS OF AI PARADIGMS

- NARS inherits ideas from both *symbolic* and *connectionist* paradigms, though does not belong to either, and nor with two parts
  - *Concept* vs. *symbol*: experience-grounded, fuzzy boundary, constructive, change over time, …
  - *Concept* vs. *neuron*: explainable, non-biological , constructive, …
- A proper model of **concept** is a central problem in AGI

DESCRIPTIONS OF HUMAN INTELLIGENCE



DESCRIPTIONS OF COMPUTER INTELLIGENCE



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