Think first about the limitations of the search or game formulation of problems that we have looked at so far. 1) it is assumed that they have complete access to the current state (fully observable); 2) all knowledge is provided a priori in the form of a successor function (information may be hidden, e.g., why an action leads an agent to that state); 3) problem representation is often clumsy and large.

**Knowledge bases:** Knowledge base works similarly to how we think. The base provides the basic knowledge on which inferences are made while the inference engine allows us to THINK to derive new knowledge.

Sentences in knowledge based often refer to declarative sentences, which we can associate them with a truth or false value.

TELL usually comes from sensing or actuation information (knowledge augmentation). The agent must incorporate information INTO its mind about what it perceives (you no longer directly observe the state space) AND what it may do to the environment (predict action consequences similar to a goal-based agent).

ASK often refers to the decision-making process, which is based on logic inferences (thinking).

So far, we focus only on the computational aspect. In knowledge-based agent, how they store information also becomes important. Both the knowledge aspect (i.e., knowledge about the world and what can be derived from the existing knowledge) and implementation details (i.e., how the agents store knowledge, or the modeling aspect) are important parts of an agent.

**A simple knowledge-based agent:** the parts that is not enabled in a search agent include: 1. incorporate percepts; 2. update internal representations of the world; 3. deduce hidden properties of the world. Notice that the internal representation of the world may be very different from the actual world (in the form of an abstraction).

**Wumpus world PEAS description:** the game ends when the agent is dead or the gold is picked up. The goal is for you to always survive with as much reward as possible.

**Other tight spots:** when uncertainty is there, we may need to consult probabilities, or utilize available actions to remove uncertainty (i.e., coercion).

**Logic in general:** To achieve this reasoning ability, we need the ability to derive conclusions from existing information. This is studied in the field of logic, which can be seen as a language. Logic syntax is used to specified sentences and semantics specifies the truth value of sentences in a given world. An important concept here is “world”. A world is concretization of the basic sentences (its exact meaning is dependent on the form of logic). In propositional logic, for
example, a concretization is an interpretation (a mapping from all propositional symbols to their truth or false values).

**Entailment:** Entailment allows us to reason about the semantics based on the syntax. This can be used to derive new information given what we already know. KB is a partial specification of the world and hence it specifies a set of possible worlds, given a domain. For example, when KB contains “the Giants won” and “the Reds won”, it leaves other aspects of the world unspecified, e.g., whether or not it is rainy.