# The Essence of Artificial Intelligence

## Chapter 2.1: Knowledge Representation and Inference (Introduction)

### Top Ten Salient Sentences

1. One of the assumptions underlying most work in artificial intelligence is that intelligent behavior can be achieved through the manipulation of symbol structures representing bits of knowledge.

2. In principle the symbol structures could be represented on any physical medium – we could develop a (very slow) intelligent machine made out of empty beer cans (plus something to move the beer cans around).

3. Knowledge representation languages have been developed to make this easier. These are special notations that make it easy to represent and reason with complex knowledge about the world.

4. The knowledge representation languages may themselves be implemented using any programming language, so a fact like red(alisons-car) may end up being represented as a collection of conventional data structures, but the AI programmer does not have to know this, and doesn't have to re-invent basic methods for representing complex knowledge.

5. A knowledge representation language should allow you to represent adequately complex facts in a clear and precise yet natural way, and in a way that easily allows you to deduce new facts from your existing knowledge.

6. The ability to represent adequately complex facts is referred to as the representational adequacy of a language. Some facts are hard to represent. Or to be more precise, some facts are hard to represent in a way that allows those facts to be reasoned with.

7. It is not enough to have a precise syntax and semantics if this means that your representation scheme is non-intuitive and difficult to use and understand. So we also require that our representation scheme is reasonably natural, capturing the structure of knowledge in an obvious way.

8. The final requirement, being able to deduce new facts from existing knowledge, is referred to as inferential adequacy. A knowledge representation language must support inference. We can't represent explicitly everything that the system might ever need to know – some things should be left implicit, to be deduced by the system as and when needed in problem-solving.

9. However, no one representation language satisfies all these requirements perfectly. In practice the choice of language depends on the reasoning task (just as the choice of programming language depends on the problem).

10. Representing and reasoning with anything that involves time, beliefs or uncertainty is hard in predicate logic. These are special logics, such as temporal and modal logics, which allow such things to be represented, but reasoning in such logics may not be efficient.