Chapter 2.1 | Knowledge Representation and Inference

10 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 cans around). However, computers make this much easier; we can represent facts using data structures, and write program code to reason with them.”

3. “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.”

4. “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.”

5. “The requirement for a clear and precise way of representing knowledge means that we need to have a *well-defined syntax and semantics*. We have to know what the allowable expressions are in the language, and what they mean.”

6. “A precise semantics is particularly important given that an AI program will be reasoning with knowledge and drawing new conclusions. To solve an AI problem we first have to work out how to represent the real world knowledge using our representation language.”

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, begin able to deducing 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. "Making arbitrary deductions from existing knowledge is a complex process. The more sophisticated the deductions required, the longer they are likely to take. There is a tradeoff between *inferential adequacy* (what we can infer) and *inferential efficiency* (how quickly we can infer it), so we may choose to have a language where simple inferences can be made quickly, although complex ones are not possible."

10. "A logic, almost by definition, has a well-defined syntax and semantics and is concerned with truth preserving inference, so seems like a good candidate as a method to represent and reason with knowledge. However, using logic to represent things has problems. "