Chapter XII

The Knowledge Society Applications: The RRR Language Machines

Introduction

Like in the human mind marked by rationality, goals, and purposeful actions, knowledge in advanced computer systems and intelligent agents is thought to constitute a distinct level lying above the symbol (computational), the logical (algorithmic), and the physical (biological, mechanical) levels (Newell, 1980; Newell, 1990; Newell, 1993). The symbol or code level with its two kinds of representations, data structures (contents) and processes (codes and procedures), is considered to be a representational medium level realizing knowledge content and actuating the agent's thoughts and decisions. Accordingly, all inquiries of AI usually are arranged as a separate contribution either to the symbol (code) level or to the knowledge (semantic) level. Any sort of logic, whatever may be its generality, contributes little directly to the knowledge level, since "no matter how general a logic is, it is not at the knowledge level" (Newell, 1980). Logical principles are by nature merely rules of reasoning, deductive arguments, and demonstration, they are not principles of real knowledge. So, being neutral to their subjects, formal logical systems neither describe nor represent, nor explain, nor predict any real phenomena. Consequently, nothing substantive can be deduced from the logical axioms or postulates regarding the nature and order of things in the real world. Nevertheless, despite the public fact that logic says nothing about any real thing, and that it is all about proposition and inference forms, there is an established habit to combine formal logic languages with entity taxonomies and typologies so that to construct a general representational language for the DA, in particular, and knowledge technologies, in general (Ontology and Taxonomies, 2001). Nowadays, such versions of logical formalisms and languages as semantic networks, rule systems, fuzzy logic, frame models, predicate calculus, or situation calculus still constitute all the thrust of current knowledge and reasoning applications. Some AI practitioners feel concern about this conceptual confusion, and urge on replacing "form-oriented AI research" with "content-directed AI Research," whereby substituting knowledge engineering with ontological (domain knowledge) engineering, thus, underlining the higher value of content theories in comparison with so-called logical mechanism theories (Mizoguchi, 1998).

A few AI researchers even undertook a new line of attack on the nature and meaning of knowledge representation, as combining five various senses: an entity surrogate, or imitation, or sign to reason about the world instead of premature unreasonable acting in it; the terms and concepts to intelligently reason about the world, or ontological commitments; the computational environment for effective intelligent reasoning; a language to say things about the world (Davis, Shrobe, & Szolovits, 1993).

Still it is not all to understand the evident things: that the whole issue of knowledge representation was misguided, that "KR *is* a set of ontological commitments,", that the content (basic classes and rules about the world), rather than the form (arbitrary notations and formal languages as logic, rules, frames, XML, RDF, or OWL constructs), makes the essence of information about the world.

As a matter of fact, all the difference is how the AI designer is constructing reality, or how to view and reason about the world. For if the world is modeled as the totality of mental experiences, as being inside the mind of some intelligent human observer, then the representation is narrowly restrained by a sort of intuitive ontological categories and principles to which some individual agent (or a group of cognitive subjects) is culturally committed. In this case, the developer is doomed to create reasoning machines with different worlds, where spiritual agents and supernatural constructions may become as much as a part of reality as natural objects.

Again, the lack of success of the pilot stage of the Digital Aristotle (or rather its full failure) was attributed to that the task of knowledge representation (modeling and formulation), was assigned to knowledge engineers who misunderstood "the true domain knowledge models." To head off this, the subsequent stage is planned to concentrate on making a set of knowledge learning tools, such as document-based knowledge formulation applications. Such software application is planned to be designed as the means whereby the domain experts are suggested to get the basic content of the textual material, its ontology (entity and relationship classes and instances, axioms, definitions, and rules) (Friedland & Allen, 2004), as it is projected with the Semantic Web ontology languages. Still these measures hardly prevent another failure, mostly because of lack of understanding that an application capable to run the world's scientific knowledge is a sort of knowledge system fundamentally different from traditional AI knowledge technologies. First and foremost, what is distinctive of the Virtual Aristotle is that it typifies a new class of intelligent machines, a world representation and reasoning (WR&R) system, whereas the DA epitomizes a KR&R system involving formal logical languages much contributed to the taxonomy of shortcomings (Friedland & Allen, 2004). Below we look into the nature and meaning of world knowledge and its formal representation in the context of computing intelligent artifacts. Also, the VA's general meaning framework accounting for a comprehensive hierarchy of entity representations will be outlined.

Briefly, the topics to analyze are as follows:

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