Chapter 2

ASPECTS OF KNOWLEDGE REPRESENTATION

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1. INTRODUCTION

Programmers represent knowledge about the world in a computer language to produce an information system (IS) that may be used to help human beings in various tasks. For example, to make the process of writing contracts in the construction industry more open, the team led by Hibberd and Basden (1995) created the INCA knowledge based system (KBS) to write contracts that more accurately reflect the intentions of the parties than is possible by adapting standard forms of contract. On asking its user around three dozen questions and making inferences based on the answers obtained, the KBS selects appropriate clauses and combines them intelligently together to form the draft contract. An important feature of the KBS was that it encouraged the parties to explore the reasons for each clause, to question and change clauses. INCA ‘contains’ sophisticated knowledge about legal principles of contract and how to use it.

All this knowledge had to be represented in a programming language, or ‘knowledge representation language’, KRL. But what form of KRL is appropriate to such wide-ranging types of complex knowledge? Many of the issues in knowledge representation (KR) were explored in the 1980s but have now re-emerged in the field of knowledge management (KM), which seeks to represent wide-ranging knowledge relevant to an organisation, as a general aid to that organisation’s processes.

There is one issue that had not been resolved by the end of the 1980s and still deserves our consideration. Reflecting on the experience of the 1980s, Brachman (1990) called for ‘KR to the people’. KR had become a specialist field from which lay people were excluded. In KM, ‘the people’
are employees immersed in the knowledge that requires representation, and they should be the ones to represent it.

'KR to the people' is the issue we address in this chapter. It is part of a wider story, alongside the issues of knowledge elicitation and analysis that are discussed in chapters 3 to 5, and that of whether IS are effective and useful in aiding human tasks that is discussed in chapters 9 to 11. In this chapter, we are concerned solely with KR, and specifically with the basic facilities that enable 'the people' to represent knowledge easily.

1.1 Knowledge representation

In the process of representing knowledge, depicted in Fig. 1, a programmer (or 'knowledge engineer', KE) expresses knowledge in symbols offered by the chosen KRL (which can be textual or graphical). The knowledge so represented is that which is relevant to a domain of the world (such as contract authoring).

![Figure 1. Knowledge representation as human activity](image)

Traditional KRLs tend to be of certain basic types, which we will call knowledge representation formalisms (KRFs), developed out of pioneering work in the 1970s in artificial intelligence (AI) and computer science:

- production rules, in which knowledge is expressed as IF-THEN productions,
- logic programming (e.g. PROLOG), in which knowledge is expressed as predicate logic statements,