Chapter 9
Tools and Applications for Reasoning Communities

ABSTRACT
In this chapter, technological innovations that aim to support reasoning communities are presented. These include decision support systems, group decision support systems, online dispute resolution systems, and tools for the representation of argumentation. Future directions and an analysis of requirements for enhanced tools are made.

INTRODUCTION
Rene Descartes observed in his Meditations:

Some years ago I was struck by the large number of falsehoods that I had accepted as true in my childhood, and by the highly doubtful nature of the whole edifice that I had subsequently based on them. I realized that it was necessary, once in the course of my life, to demolish everything completely and start again right from the foundations if I wanted to establish anything at all in the sciences that was stable and likely to last.

Descartes was one of the 17th century philosophers who delved into the nature of reason with the objective of establishing a sound and intellectual foundation. He was one of the “Continental Rationalists,” along with Gottfried Leibniz and Immanuel Kant, who thought that the senses alone were inadequate for the task of determining knowledge. They considered reason superior to experience and sought to establish their philosophies on the basis of more certain principles. There were also the “British Empiricists,” such as Bacon, Thomas Hobbes, John Locke, David Hume, and Mary Wollstonecraft, who maintained that all

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knowledge has its foundation in sensory experience and developed their thought on that basis. Immanuel Kant worked to combine these two approaches and in so doing developed a uniquely influential system of philosophy which saw the culmination of the ‘The Age of Reason’ (The Enlightenment). This is somewhat captured by “All our knowledge begins with the senses, proceeds then to the understanding, and ends with reason. There is nothing higher than reason”—Immanuel Kant, *Critique of Pure Reason*.

It can be argued that the age of reason dawned during the seventeenth century and we have seen the use of reasoning adopted in more formal and overt ways across almost all areas of human activity. In more recent times, advances in computing technologies (particularly the Internet) and the emergence of sophisticated reasoning paradigms have enabled the development of decision-support systems, which provide an individual or a community with support in the decision-making process. The manner in which decisions are made is determined, in part, by how the problem can be modelled. For example, if a problem can be modelled mathematically, then the decision-making process can be represented very formally and often as an optimization problem. For non-mathematical problems, a second important factor is whether reasoning or voting is used as the basis for choosing a solution from a set of candidates.

In this book, we have argued for a better understanding of the communities that engage in collective reasoning and for tools to support these communities in the processes of reasoning and decision-making. In this chapter, we consider the range of decision-support tools that are currently available, with an emphasis on tools that support reasoning. The tools are discussed in terms of their domains of application, the nature of the support that they provide and some evolving areas of application.

### DECISION SUPPORT SYSTEMS

There is a large literature on systems for supporting decision making (DSS) and systems for groups making decisions (GDSS). There are also many domains of application. Traditionally, there have been many systems deployed in areas such as engineering, medicine, and environmental sciences. However, new domains of application are opening. For example, post September 11, 2001, police have become interested in the use of DSSs to support decision making involving security and emergencies. In this and the next section, we consider some applications in some domains and, in particular, from the point of view of supporting reasoning to a decision.

The sections below will illustrate that despite a large amount of work in the area of DSS there has not been large scale penetration and acceptance. It is clear from a reasoning community perspective that DSSs do not help the Engagement phase or individual coalescing but do assist individual reasoning a little. There is almost no assistance in group coalescing because the systems have not been developed with this over-arching view in mind. Furthermore, arguably, they do not help in the decision-making phase because they largely ignore the group.

**Medicine**

In the domain of medicine, the traditional applications of decision-support systems have been in the area of support for physicians. The adoption of decision support appears to occur mostly in narrowly defined and highly specialised areas (for example, cardiac problems, pharmaceutical design and development) rather than in general medicine. Identified reasons for this include: general medicine is not a well-defined domain and many problems in the area have many aspects to them, not simply symptoms; experienced clinicians can outperform existing systems leading to a lack of...