

## Review for HPL 2008

Giuseppe Primiero, **Information and Knowledge: A Constructive Type-Theoretical Approach**. Logic, Epistemology, And The Unity Of Science 10, Springer. 210 pages. Price: EUR 134.95. ISBN 978-1-4020-6169-1.

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The aim of the author's research in the book (in his own words on page 1) is:

to find an intuitive and formally useful representation of the notion of information within a logical setting, in order to provide a clear formulation of the analyticity principle. The logical formulation is provided by the constructive version of type theory.

Chapter 1 sets out to give the theoretical, logical and formal basis of CTT, the constructive type theory due to Martin-Löf. After presenting the basic epistemic notions and the verification principle of truth:

$$truth = proof + existence, \tag{1}$$

the author presents the notions of type and identity as used in CTT and gives the formal analysis of types and judgements. One cannot discuss CTT without also describing dependent judgements and the computational rules, which the author introduces eloquently. Then, the author prepares the way to the next chapter which deals with analyticity and information.

In Chapter 2 the author first describes the various interpretations of analyticity, with emphasis both on the historical and recent contributions. It is emphasised that analyticity has been developed on the basis of the distinction between content and form. The modern origin of analyticity due to Kant is discussed in detail. According to Kant, intuition is the only activity able to produce synthetic judgements. Bolzano rejected the role given to intuition by Kant and hence his account is again explained in detail by the author who also gives an extensive comparison between both approaches. Therafter, the author moves to Frege's analyticity discussing all along the connection between analyticity and logical truth. Further influential theories such as those of Ayer, Carnap, Frege, Quine, Hintikka and others are discussed. The author ends this chapter by a discussion of the basic elements of a knowledge system with the

goal of clarifying the different epistemic aspects underlying knowledge and determining what is information. In this discussion, a clear distinction is made between the roles of implicit and explicit knowledge.

Chapter 3 puts the theoretical analysis of the earlier two chapters in action. Here, the author presents a formal description for a knowledge system which distinguishes between *information* and *knowledge*. According to principle (1), knowledge is defined in terms of justification and demonstration. To know is to be able to judge correctly. The author defines the knowledge state (k-state) and the information state (i-state) and discusses their counterparts in CTT. Here, CTT is reconsidered as a framework for knowledge representation where the roles of the various constructs of CTT (types, contexts, proofs, etc) are associated to knowledge concepts. In this way, CTT becomes a framework for knowledge representation where the retrieving and extending of information is accurately formalised and plays a crucial role. The idea of contexts as constructive possible worlds is expanded and used to describe the connection between i-states and k-states. Judgements are pieces of knowledge whose collection represents an agent's actual knowledge (formally represented as a knowledge frame, or k-frame). Kripke models and Kripke semantics are used to interpret the notion of contexts as possible worlds. Finally, the author studies the knowledge framework in further details explaining how information can be updated and knowledge can be extended and how the notion of infinity is treated constructively.

In chapter 4 the author returns to the distinction between implicit and explicit knowledge. The distinction between information and knowledge is further emphasised using constructions. The author uses mathematics to illustrate the difference between implicit and explicit and between information and knowledge. According to the author, a mathematical deduction makes explicit what is implicit in its assumptions and the various information present in a book of mathematics does not represent knowledge for someone who does not possess the meaning of the notions involved. In my opinion, the best way to review the motivation for and explain the usefulness of this work is to use the author's own final words on page 193:

In the distinction between the information assumed or accepted, and the proved knowledge, one finds the space to revise and reject falsity and error. This obviously can be reconsidered in the light of our media systems, on which essentially our perception of facts and state of affairs is nowadays based: to be able to reconsider critically and eventually reject the information received ... is a highly safe and appreciable behaviour.