Towards an Integration of Mainstream and Formal Epistemology

Peter Øhrstrøm
Department of Communication and Psychology
Aalborg University

In his new book, ‘Mainstream and Formal Epistemology’ [2006], Vincent F. Hendricks (VFH) focuses on the two important traditions in modern epistemology:

- Mainstream epistemology including ‘traditional’ approaches such as epistemic reliabilism, counterfactual epistemology, and contextual epistemology.
- Formal approaches to epistemology including logical epistemology, computational epistemology, and modal operator epistemology.

Within mainstream epistemology, the aim is to find necessary and sufficient conditions for obtaining and possessing knowledge. The search for such conditions has often made relied on common-sense reasoning based on various examples and counterexamples. In the first part of the book, VFH offers a nice and readable presentation of this tradition, according to which a human agent $\Xi$ knows a proposition $h$ if and only if

1. $\Xi$ believes $h$
2. $h$ is true
3. $\Xi$ is justified in believing $h$.

(p.13)

This classic tripartite definition of knowledge has given rise to a number of problems and questions. However, it appears that the third condition is the most problematic. The notion of justification certainly deserves a further (and also very careful) analysis. As a whole, the above definition has been seriously challenged by the so-called Gettier paradoxes going back to Edmund Gettier’s highly influential article in 1963, “Is knowledge justified true belief?” [1963]. VFH’s new book contains a well written presentation of the Gettier paradoxes (p. 20 ff.) as well as mainstream discussions of them in terms of Alvin Goldman’s reliabilism (p. 40 ff.) and Robert Nozick’s counterfactual epistemology (p. 52 ff.).

VFH uses formal logic in his discussion of mainstream epistemology, in particular when dealing with counterfactual epistemology (chapter 4) and
contextual epistemology (chapter 5). However, in the second part of the book, VFH demonstrates even more clearly the usefulness of philosophical logic within the discussion of fundamental epistemological problems. The formal approaches to epistemology using traditional modal logic and possible worlds semantics are carefully discussed in (chapter 6). This is done in terms of knowledge operators like $K_\Xi$, where $K_\Xi A$ stands for the proposition that the agent $\Xi$ knows that $A$, where $A$ is some proposition. Using this formalism it becomes possible to formally discuss which of the various systems of modal logic (S4, S4.2, S4.3, S4.4, S5) will be the best representation of the logic of knowledge we are actually using in our philosophical and everyday discussions. VFH’s analysis also makes it possible to enrich the discussion of the problems regarding the perspectives of inquiry taking into account the notions of first-person versus third person. In addition, using this formalism, VFH shows how the discussion can be expanded to a multi-agent setup which supports the view that agents in cooperation will often have to take into account what the other agents in question know at a certain time (p. 105 ff.).

In chapter 7, VFH deals with computational epistemology, which, strictly speaking, is not about knowledge, but rather about knowledge acquisition (or learning). This chapter is written in the context of the investigations carried out by Kevin T. Kelly [1996, 1998a, 1998b]. VFH accepts Kelly’s approach according to which a learning strategy solves a learning problem just in case it is admitted as a potential solution by the problem and succeeds in the specified sense over the relevant possibilities (p. 115). In other words, the basic idea is to find methods that succeed in every possible world within a given range. This means that, in computational epistemology, learning is not seen as an independent process but rather as a procedure closely related to a learning method.

VFH illustrates the procedure of computational epistemology with reference to the classical discussion about statements such as “all ravens are black”. He considers a Popperian bold method, $\Xi$, according to which it is conjectured that all ravens are black, as soon as the first black raven is observed. He also considers the skeptical method, $\theta$, which is much more cautious, and which may be understood as an attempt to proceed in an infallible way not accepting anything beyond what the evidence entails. It is obvious that the two methods, $\Xi$ and $\theta$, will produce very different outputs in their attempts to obtain knowledge. In fact, it should be noted that even if
all ravens are actually black, then the method θ will never come up with this result, whereas the method Ξ will although it will never be able to unambiguously signal when it obtained the correct answer. VFH makes it very clear that in order to reliably solve the epistemic problem, the limit is needed (p.118). The temporal aspects turns out to be very important, because if a method solves an epistemic problem, the method will generally do so by converging to a correct output. VFH points out that “solvability is in general acutely sensitive to the temporal arrangement of the evidence” (p. 126).

VFH does not present the logical or mathematical details involved in computational epistemology. For such purposes, he mainly refers to the works of Kevin T. Kelly, with whom VFH and O. Schulte published an interesting paper on “Reliable Belief Revision” [1996]. In his new book, however, VFH’s emphasis is on the conceptual notions underlying the idea of computational epistemology. The example used by VFH is very simple, but does in fact clearly illustrate that computational epistemology qualifies as an interesting third possibility between pessimistic skepticism and optimistic epistemology.

VFH’s discussions of mainstream epistemology and his investigations into traditional logical epistemology and computational epistemology highlight a need for a further development of modal operator epistemology within the context of a temporal logic. The elaboration of this approach is no doubt the most original and interesting contribution in the book (chapter 8). In this chapter, VFH has shown how mainstream theories of knowledge and formal epistemology can be brought together using the ideas of ‘forcing’ in the context of a temporal logic. In fact, according to VFH, it turns out that mainstream theories of knowledge and formal epistemology have a lot in common. In particular, he points out that the idea of so-called ‘forcing’ is of common concern. According to VFH, this idea should be viewed as essential for the understanding of epistemology. But what is ‘forcing’?

In his former book, The Convergence of Scientific Knowledge[2001], VFH has defined 'forcing epistemology' as a family of proposals to answer the skeptic. These proposals are committed to the idea that the way to answer the skeptic, who questions the very possibility of having knowledge, is to agree that real possibilities of error indeed undercut knowledge but that the skeptical possibilities can somehow be ruled out as irrelevant. In his analysis of computational epistemology, VFH has argued that using the idea of “forcing” may in fact enable the transformation of inductive inquiry into
“near deductive inquiry.” (p. 120) Since knowledge is acquired over time, it is indeed quite obvious that a satisfactory logic of knowledge should be based on a temporal logic. In a process of learning or obtaining knowledge in general, it turns out that the passage of time (and the corresponding loss of relevant future branches in a branching time framework) can be explained in terms of VFH’s notion of ‘forcing’.

VFH has developed a unified framework in which temporal logic, computation and learning theory are used to articulate and formulate these proposals rigorously. This work has been written in the grand old tradition of trying to combat skepticism and to assure us that human beings can in fact possess knowledge. However, the consequent use temporal logic and branching time is rather new and original. However, there are several kinds of branching time systems.

VFH uses the Priorean idea of branching time (see Øhrstrøm & Hasle 2005), according to which the present moment is conceived as being equivalent with the set of all propositions being true now (including all true statements regarding the past). VFH also chooses to make use of Ockhamistic semantics (p.134 ff.). He represents the possible worlds (futures) in terms of so-called evidence streams (ω-sequences of natural numbers). Following some interesting ideas proposed by K. Kelly [1996], Hendricks has studied a model in which possible worlds are represented as pairs on the form (ε,n), where n is a natural number, and where ε = (a₀, a₁, …an,...) is a so-called evidence stream (i.e. an ω-sequence of natural numbers). The model also includes so-called ‘handles’ and ‘fans’:

\[ \varepsilon = (a_0, a_1, \ldots a_n,\ldots) \quad \text{(evidence stream)} \]

\( (\varepsilon,n) \quad \text{(possible world)} \)

\[ \varepsilon|n = a_0, a_1, \ldots a_{n-1} \quad \text{(handle)} \]

\[ [\varepsilon|n] = \{ (\tau,k) | k\in \omega \text{ and } \tau|n = \varepsilon|n \} \quad \text{(fan)} \]
Given this formalism, we may speak of the set, $M$, of all triples on the form $(\varepsilon, n, a_n)$. Obviously, all truths about the model follow from the information included in $M$. On top of the model, VFH has introduced a formal language that includes epistemic modalities. The key notion is a discovery method, $\delta$, i.e. a function that takes a handle $\tau|n$ as input and produces a hypothesis conceived as a set of possible worlds as output. In fact $\delta(\tau|n)$ can be read as “the hypothesis (i.e. the suggested knowledge) obtained by the method $\delta$ on the basis of the evidence $\tau|n$”. VFH has defined knowledge as limiting convergence, suggesting that $\delta$ knows $h$ at $(\varepsilon, n)$, if $h$ corresponds with $M$, and if the hypothesis produced by $\delta$ will remain unchanged as $h$ after a certain time. Thus, a person using this discovery method may thereby obtain knowledge. In short, the method knows something! On the basis of this definition, VFH introduces an epistemic operator, $K_\delta$, corresponding to the discovery method, $\delta$. Whether a contingent hypothesis $h$ can be known by a
method $\delta$ can know anything, will obviously depend on the properties of $\delta$, but it is not ruled out in principle. It might be the case that $\delta$ at $(\varepsilon, n)$ knows that $h$ is the case at $(\varepsilon, n')$, where $n' \geq n$, although there is some $(\tau, n')$ in $[\varepsilon|n]$ so that $(\tau, n')$ does not belong to $h$. – This possibility clearly illustrates the need for an Ockhamistic tempo-modal logic, as opposed to a Peircean logic which does not accept the idea of truth regarding the contingent future.

VFH limits the discussion in the book to absolute time-invariant empirical hypotheses, $h$. In fact, he gives a very narrow definition of truth (p.136). This is a bit surprising, since there can be no doubt that all the results in the book could have been presented in the context of a more traditional temporal logic based on the usual idea of truth.

Defining knowledge as limiting convergence, VFH investigates the logical strength of the resulting modal operator epistemology. Given the semantics sketched here, it is possible to establish a logical tense-logical system extended with the epistemic operator, $K_\delta$. In this system, it turns out that for instance the implication $K_\delta h \supset GK_\delta h$ is a valid theorem. Theorems like this one, which involve temporal as well as epistemic operators, nicely illustrate the interesting formal features of the kind of modal operator epistemology suggested by VFH.

VFH’s framework for dealing with agency and epistemic logic in the context of a temporal logic is certainly interesting, but definitely not the only attempt of the kind. As indicated above, crucial aspects of the discussion may be traced back to the works of A.N. Prior (see Øhrstrøm & Hasle 2005). However, a proper theory of agency has to incorporate several other aspects than knowledge. It also has to deal with notions such a belief, desire and obligation. In particular, much attention has been given to the challenge of incorporating deontic logic in a satisfactory manner.

Having established his formalism, it becomes possible for VFH to ask rather precise questions regarding the properties for the $K_\delta$-fragment of the logic. In particular, he studies which conditions $K_\delta$ would validate the axioms of the modal logic $S4$. The crucial axiom is the Axiom 4: $K_\delta h \supset K_\delta K_\delta h$. He argues that this holds if the method $\delta$ has the property which he calls ‘consistent expectations’ (p.139). From a formal point of view, VFH’s result is established convincingly. It is however not made intuitively clear in the
book why and how the notion of a ‘consistently expectant method’ could be conceptually relevant in the context of epistemology.

In the last chapter of the book, chapter 9, VFH comments on some general aspects of modern epistemology. Among other things, he comments on the use of counterexamples in epistemological analysis. It is generally assumed that when discussing a general thesis in epistemology (or other parts of philosophy), the construction of a counterexample can give rise to a very strong argument against the thesis in question. VFH argues, however, that only counterexamples within the range of relevant worlds should be accepted as generators of such crucial arguments. In some cases, such counterexamples turn out to be very speculative and ‘way-off thought experiments’. For instance, one may imagine a strange setup somewhere near Alpha Centauri involving infinitely deceiving demons. Some of these examples cannot occur within the range of relevant worlds. Obviously, the problem here is how to distinguish between relevant and non-relevant worlds. In chapter 8, VFH has given some hints referring to ‘forcing in time’ and ‘forcing in worlds’ (p.140), but he does not offer a very precise relevance criterion. It should be admitted that it is possible that nobody can ever provide such a criterion, at least if it has to be formulated in a very precise manner.

In conclusion, it should be emphasized that although ‘Mainstream and Formal Epistemology’ leaves many interesting questions unanswered, it is definitely a major contribution to epistemology. The unifying concept of “forcing” emphasizes a fruitful and deep investigation of the fundamental questions, which arise on the borderline between logic, epistemology and computation theory. It is VFH’s ambition “to merge not only themes from mainstream and formal approaches to epistemology but likewise to bring together tools from different formal epistemologies to accommodate more and more mainstream as well as formal concerns ranging from justification and rationality issues to multi-modal systems and learning” (p.150). In his book, VFH has presented an elaborated outline of a program towards this ambition. In this way, ‘Mainstream and Formal Epistemology’ outlines a research program, which is likely to guide future investigations into epistemology, logic and cognitive sciences.
References: