



The Royal Academy
of Engineering

Engineering and Metaphysics

A philosophy of engineering seminar

The Royal Academy of Engineering
29 Great Peter Street, London SW1P 3LW

Monday 3rd September 2007, 2pm for 2.30pm

This seminar will take a wide ranging look at metaphysical questions in engineering. It will investigate the relevance of philosophical metaphysics to engineering – in particular the application of ontological analysis in engineering processes. It will also investigate questions that are ‘metaphysical’ in the broad sense, questions that examine the nature of engineering and the engineering process, and the status of laws and definitions in engineering.

Programme

Chair: Dr Keith Guy FREng

2pm: Registration, Tea and Coffee

2.30pm: Chair's introduction

2.35pm: Professor Peter Simons, Department of Philosophy, University of Leeds: *Ontology in engineering*

3.15pm: Dr Hasok Chang, Department of Science and Technology Studies, University College London: *When water does not boil at the boiling point*

4.05pm: Coffee

4.30pm: Dr Luciano Floridi, Faculty of Philosophy and Oxford University Computing Laboratory, University of Oxford: *Constructionism, the Maker's Knowledge Tradition and Knowledge Engineering*

5.15pm: Discussion

5.55pm: Closing remarks by chair

6 – 7pm: Reception

To register for this event or for further information about the seminar series contact Dr Natasha McCarthy on natasha.mccarthy@raeng.org.uk or telephone 020 7227 0575

Peter Simons FBA is Professor of Philosophy at the University of Leeds. After studying mathematics and philosophy at Manchester he taught at Bolton Institute of Technology and the University of Salzburg in Austria. His specialisms are metaphysics and ontology and their applications, the history of logic and the history of philosophy in Central Europe. He is the author of *Parts* (Oxford, 1987/2001) and *Philosophy and Logic in Central Europe from Bolzano to Tarski* (1992), and over 200 papers. From 1989-2001 he was ontology consultant at Ontek Corporation in California, and at Leeds he collaborates with the Department of Mechanical Engineering and the Keyworth Institute.

Ontology in Engineering Engineering and philosophy share breadth, abstractness and a reflexive attitude. The uses of philosophy for engineering are most obvious in ethical issues, but this talk will concentrate on ontological analysis as a potential source of mutual help and insight. Ontology is the maximally abstract, go-anywhere theory of everything. It aims at a categorial framework for any subject matter. Though philosophers trade in its internal disputes, away from the specialist journals ontology can provide relatively neutral analyses of concepts and objects fundamental to engineering: part/whole, structure, function, life-cycle, emergence, process and product, needs and requirements, success and failure, design and planning. Negatively, this can prevent conceptual foul-ups, whether informal or as enshrined in IT models. Positively, it can enhance conceptual transparency and inform tools for managing complexity.

Hasok Chang is Reader in Philosophy of Science at University College London. He received his PhD from Stanford University in 1993 with a dissertation on the philosophy of quantum mechanics. His current research focuses on philosophical analyses of historical developments in physics and chemistry in the 18th and the 19th centuries. He is the author of *Inventing Temperature: Measurement and Scientific Progress* (Oxford University Press, 2004).

When water does not boil at the boiling point: Contrary to common belief, the boiling temperature of pure water under fixed pressure is not constant. It is dependent on the nature of the vessel in which the boiling takes place, and even more on the amount of air dissolved in the air. These variations were well known to physicists and chemists in the late 18th century and throughout the 19th century, but seem to have been

largely forgotten in modern science. In contrast, mechanical and chemical engineers have preserved and developed this knowledge, at least concerning the effects of surface quality. In standard thermal physics the presumed ontology of boiling is encoded in the sharp liquid-gas boundary in the phase diagram. For engineers working on heat transfer, the "boiling curve" has "surface superheat" as its main independent variable, which at the outset abandons the assumption of a sharp temperature at which the phase transition occurs. The two frameworks of analysis are incommensurable with each other, which raises interesting questions about the relation between science and engineering.

Luciano Floridi (<http://www.philosophyofinformation.net>) is Fellow of St Cross College, University of Oxford, where he also coordinates the Information Ethics research Group, and Professor of Logic and Epistemology, Università degli Studi di Bari. His research areas are the philosophy of information and information ethics and his works include over sixty articles on epistemology and the philosophy of computing and information and several books. He is currently working on a new book entitled *The Philosophy of Information* for Oxford University Press, and editing the *Handbook of Computer Ethics* for Cambridge University Press. He is President of the International Association for Philosophy and Computing (www.ia-cap.org).

Constructionism, the Maker's Knowledge Tradition and Knowledge Engineering In this talk, I shall argue in favour of a constructionist approach to knowledge. To put it simply, an epistemic agent knows something only if that agent is able to build (reproduce, simulate, control, modify etc.) that something (where "something" could also be a conceptual construct). Alternatively, an agent qualifies as an epistemic agent when she is not just a mere user but a producer of knowledge. The maker's knowledge is knowledge of the ontology of the artefact. I shall begin by giving a broad account of what I mean by constructionism, with some references to the philosophical tradition that has inspired it, the so-called "maker's knowledge" tradition. I shall then discuss the approach in some details, sketching how it works in computer science. The main thesis will be that constructionism is a form of knowledge engineering. In the conclusion, I shall illustrate the general thesis of the talk by showing how the Turing Test can be correctly read as an application of the constructionist method.