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## A synopsis of "Philosophy of Computing and Information Technology"

**Abstract:** The authors recently finished a comprehensive chapter on "Philosophy of Computing and Information Technology" for the forthcoming (fall 2009) *Philosophy of Technology and Engineering Sciences* (Ed.: A. Meijers), Volume IX in the Elsevier series *Handbook of the Philosophy of Science* (Eds.: D. Gabbay, P. Thagard and J. Woods). The purpose of the chapter is to review and discuss the main developments, concepts, topics and contributors in the intersection between philosophy and computing, as well as provide some suggestions on how to structure the many sub categories within what is loosely referred to as philosophy of computing. In this short synopsis, we will give an outline of the kinds of issues raised in this chapter.

The field of philosophy and computing is the topic of a chapter entitled "Philosophy of Computing and Information Technology" in the forthcoming book *Philosophy of Technology and Engineering Sciences* (ed. A. Meijers), which is Volume IX in the Elsevier *Handbook of the Philosophy of Science* series and is expected to come out in the fall of 2009. In this 27,000 word chapter, we aim to provide an extensive overview of topics and approaches in the philosophy of computing and information technology (IT). The work in this area is diverse, with topics ranging from the nature of computational systems to the political regulation of cyberspace, and from the ontological status of virtual worlds to the limitations of artificial intelligence. Our chapter follows in the footsteps of one previous introduction to the field (Floridi, 1999) and two previous anthologies (Floridi, 2004; Moor and Bynum, 2002).

In setting up our chapter, we have invested much effort into providing an appropriate structure to the field as a whole, which respects the conceptual and historical development of the field. We ended up distinguishing five subfields within the loosely structured field of computing and IT: philosophy of computing, philosophy of computer science, philosophy of

artificial intelligence, philosophy of the Internet and new media, and computer and information ethics. Conceptually, these areas have distinct subject matters and involve distinct philosophical questions, as we try to show in the corresponding sections in our chapter. Historically, the philosophy of AI and philosophy of computing are the oldest fields, having found their footing in the 1960s and 1970s, respectively. In the 1980s, a separate field of computer ethics takes shape that studies ethical and professional issues in computing. The 1990s see the emergence of philosophical studies of the Internet and other new information and communication media, and an increased interest in social, cultural and political issues. Finally, the late 1990s see the emergence of a distinct philosophy of computer *science*, as opposed to a philosophy of *computing*.

In our introductory section, we provide a concise yet comprehensive introduction to the field, which has a target audience of not only philosophers and computer scientists, but to anyone interested in the intersection between the two. We here debate a proper name for the field (including proposals like “philosophy and computing”, “philosophy of computing”, “computational philosophy” and “cyberphilosophy”) before settling on “Philosophy of computing and information technology”. We here also propose and defend our previously mentioned classification of five subfields, and briefly discuss their historical development. In the context of this historical survey, we also discuss the hypothesized emergence of a “computational turn” in philosophy and the rise of “computational philosophy”, and argue that the idea of a computational turn in philosophy has perhaps been overstated. Most current work in the field, we believe, studies philosophical issues in computing and IT. There is much less work that studies the implication of computing for philosophy, and in this way qualifies as computational philosophy and contributes to a “computational turn”.

In the second section, we turn to the fundamental nature and basic principles of computing and computational systems, which we refer to as ‘philosophy of computing’. Although this term is often used to denote any philosophical issue related to computers, we have chosen to narrow this section to issues particular to the nature, possibilities and limits of computation. This is arguably the origin of the entire field, and includes the early philosophical attention given to notions such as computability, computational complexity, and symbol

grounding, many of which were raised by pioneers like Turing, Church, Minsky, Rice, Searle, Harnad and others. In this section, we begin by giving an outline of what a computer is, focusing primarily on the abstract notion of computation developed by Turing. We then consider what it means for something to be computable and outline some of the classical problems that cannot be computed by a Turing machine. Having considered which kinds of problems are Turing non-computable *in principle*, we then consider problems that are so complex that they cannot be solved *in practice*. In both cases, one of our aims was to show that oft-discussed problems like the halting problem and Rice's theorem are not of mere theoretical interest, but that they point to problems that still lie at the core of computer science. Finally, computing is always computing of something; hence we conclude this section with a brief outline of central notions like data, representation and information. Although much of the section on philosophy of computing draws on classical problems and discussions, we also draw on more recent philosophical work on computation, including discussions of hypercomputation and some recent approaches in philosophy of information.

Following the section on philosophy of computing, we then consider 'philosophy of computer *science*'. This was for many years a neglected field of study, perhaps explained by the fact that philosophy of science has tended to focus on sciences that aim to represent reality, not on fields that model and design artifacts. In recent years there has, however, been a number of substantial contributions to the field, a field that, in analogy to the philosophy of science in general, aims to analyze, interpret and clarify the central concepts, aims, assumptions, methods, scientific status and the role in society of computer science and its various subfields. Following a comprehensive sub section on the nature, scope and methods of philosophy of computer science, we give special attention to philosophical issues raised within some particular computer professions, including issues concerning programming languages, software engineering, data modeling, information systems management, computer simulation and human-computer interaction.

In the fourth section, we turn to philosophy of Artificial Intelligence (AI). AI is arguably the area of philosophy of computing that has received the most attention from philosophers, in part due to its close ties with numerous sub disciplines of philosophy, such as philosophy of mind and

philosophy of language. It is clearly not possible to give full justice to this field, but we start out with discussing some of the fundamental assumptions, challenges and contributors in philosophy of AI, ranging from symbolic AI to connectionist and anti-representationalist approaches, as well as the closely related approaches that can be found in philosophy of artificial *life* and dynamic systems theory. Given the purpose of our chapter to reach both philosophers and computer scientists, we continue by addressing a number of philosophical issues raised by particular applications of AI, including knowledge engineering, robots and artificial agents. We conclude this chapter with a discussion of the (potential) social impact of AI as well as the way in which AI research has shed new light on notions like 'risk', 'responsibility' and formalization of morality.

The rise of the personal computer and multimedia technology in the 1980s and the Internet and World Wide Web in the 1990s ushered in a new era in which the computer became part of everyday life. This has brought along major changes in society, including changes in the way people work, learn, recreate and interact with each other, and in the functioning of organizations and social and political institutions. It has even been claimed that these technologies are fundamentally changing human cognition and experience. These social and cultural changes have prompted philosophers to reflect on different aspects of the new constellation, ranging from the epistemology of hyperlinks to the ontology of virtual environments and the value of computer-mediated friendships. In our fifth section, we tie these different investigations together under the rubric 'philosophy of the Internet and new media'. Whereas most of the contributions in the other sections have been in the analytic tradition in philosophy, a large part of the research in this area is taking place in the Continental tradition, and includes phenomenological, poststructuralist and postmodernist approaches. Additionally, philosophical work in this area is often affiliated with work in social theory and cultural studies. We start this section by giving a broad outline of new media and discuss theories on how society has increasingly become an information society. We also consider epistemological and ontological issues related to the Internet and other new media, as well as their status as a platform for communication and virtual communities. Closely related, we conclude this section with a discussion of how our identity might be affected by the

disappearing barriers between body and technology and between real and virtual selves, through such notions as 'cyborgs' and 'avatars'.

In the sixth and final section, we turn to computer ethics and the shared concerns of both computer scientists and philosophers about social and ethical issues related to computers. Throughout the other sections, in particular in sections four and five, we consider a number of ethical issues in the contexts in which they naturally arise. In this section, however, we focus on a number of more general issues in computer ethics and outline its main topics, contributors and meta-ethical challenges. Some of the topics raised in this section are privacy, security, computer crime, freedom of expression, equal access and intellectual property, as well as a number of foundational issues. Again, with an eye to the audience in mind, we conclude the section with a discussion of 'value sensitive design', which is an inherently interdisciplinary approach that aims to analyze embedded values in computer software and systems, and to devise methodologies for incorporating values into the design process.

Undoubtedly, many will find that their niche of specialty has been underrepresented in this chapter, but one of our main challenges was to condense as much of the philosophy of computing and information technology field as possible within a limited number of pages, as well as making it accessible well beyond the community of scholars who are already doing philosophy of computing and IT. Our aim and hope is to introduce the philosophy of computing and IT field to anyone interested in this intersection, be they philosophers, computer scientists or from other disciplines, be they students or professionals. We also want to showcase the field as a good example of interdisciplinary research, and to give an impression of what philosophers and computer scientists alike have brought to the table. Still, in trying to show how the many different sub categories are related and how they do, after all, form a coherent yet many-faceted discipline, we hope and believe that the chapter will also be of interest to those who are already acquainted with the field.

## ***References***

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