Computing and Philosophy Global Course:
What can we hope for (from computing)?
What should we do (with computing)?
What can we know (about computing and by computing)?

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0. Computing and Philosophy Global Course

The first Computing and Philosophy Global Course is planned for fall 2008 as a result of collaboration between several European and American universities and with ambition to grow in the future into an even bigger course including more countries worldwide (CaP 2008). The course is based on an earlier Swedish National Course (see Dodig-Crnkovic & Crnkovic 2007). The co-organizers and invited speakers include Peter Boltuc, Keith Miller, Gaetano Lanzarone, Vincent Müller and Gordana Dodig-Crnkovic, the course coordinator, with involvement of students from respective institutions. Luciano Floridi, Marvin Croy and Bill Rapaport are associated with the project.

Before describing the course (how?), let me present our motivation for organizing it (why?). Preparing Computing and Philosophy Global Course we have to answer number of questions. Let us take from where Vincent C. Müller's article in this issue *"What A Course on Philosophy of Computing Is Not"* left us:

"Immanuel Kant famously defined philosophy to be about three questions: "What can I know? What should I do? What can I hope for?" (KrV, B833). I want to suggest that the three questions of our course on the philosophy of computing are: What is computing? What should we do with computing? What could computing do?"

Indeed those are precisely the questions we will have to answer. I would only broaden the scope and re-phrase them in the following order:

1. What can we hope for [from computing]?
2. What should we do [with computing]?
3. What can we know [about computing and by computing]?

In what follows I will try to answer above questions, one by one.

1. What can we hope for [from computing]?

This first question is about the goals of the course. In what way can the course be important and reflect the current and possible future interests of the communities we are supporting? How can we contribute to the development of the field?

The initial step is to understand the state of the art. I take *computing to encompass both computation and information*. As argued in Dodig-Crnkovic (2003), the German, French and Italian languages use the respective terms "Informatik", "Informatica" and "Informatique" (Informatics in English) to denote Computing. It is worthwhile to observe that the English term "Computing" is empirical, while the corresponding German, French and Italian term "Informatics" has an abstract orientation. This difference in terminology may be traced back to the tradition of nineteenth-century British empiricism and to continental abstraction, respectively.

The following list[1] over research topics (research presented at Computing and Philosophy (CAP) conferences) illustrates the present day state of the art of the research field:

Philosophy of information, including Philosophy of information technology (global information infrastructures: technological architectures, converging information technologies etc)

Philosophy of computation, including Philosophical aspects of Bioinformatics, Biocomputation and Computational evolution, Artificial life

Computational approaches to the problem of mind, including Philosophical questions of Cognitive Science

Philosophy of Computing, including Philosophy of CS, Models of Logic Software, Philosophy of AI, Computational Linguistics and Philosophy of computing technology

Real and virtual, modeling, simulations, emulations

Computing and Information Ethics, including Roboethics and Norms and Agents

Societal aspects of computing and IT, includingCultural Diversity and Technoscience Studies

Philosophy of Complexity (distributed processes, emergent properties, etc)

Computational metaphysics, including Computational ontologies and Computational cosmologies (e.g. pancomputationalism, digital physics)

Computational Epistemology

Computer-based Learning and Teaching, including Distance Learning in Philosophy and Computing

From the list above it is evident that under CAP many research traditions co-exist and as Müller correctly points out, CAP is **not** any of the following: philosophy of computer science, theoretical computer science, philosophy of information, philosophy of AI or philosophy of technology. It is a forum for cross-disciplinary – inter-disciplinary – multi-disciplinary process of knowledge exchange and establishment of relationships between existing knowledge fields, among others those just mentioned.

At present we are witnessing a major scientific, technological and global-scale societal transformation that accompanies the extensive use of information networks and computing capabilities in all spheres of knowledge creation. The Computing and Philosophy (CaP) global course will offer a glimpse of a new complexly networked and dynamic world, emerging from the research results in sciences, humanities, technologies, and variety of supporting information-intense fields. This development of a new body of knowledge is followed by a distinct paradigm shift in the knowledge production mechanisms. (Dodig-Crnkovic 2003)

Globalization, information networking, pluralism and diversity expressed in the cross-disciplinary research in a complex web of worldwide knowledge generation are phenomena that need to be addressed on a high level of abstraction, which is offered by philosophical discourse. Examples of philosophical approaches closely connected to the on-going paradigm shift may be found in (Floridi 2004 and 2005), Wolfram (2003), Mainzer (2003 and 2004), Chaitin (2005), Lloyd (2006), and Zuse (1967).

The objective of the CaP course is to present philosophical reflection over computing and related phenomena and to provide philosophically interesting insights into current state of the art knowledge in computing and information. We hope to increase the understanding between computing and philosophy by building conceptual bridges enabling information flow between the fields.

In order to understand various important facets of ongoing info-computational turn and to be able to develop knowledge and technologies, a dialogue and research on different aspects of computational and informational phenomena are central. Taking information as a fundamental structure and computation as information processing (information dynamics) one can see the two as complementary, mutually defining phenomena. No information is possible without computation (information dynamics), and no computation without information. (Dodig-Crnkovic 2005, Dodig-Crnkovic & Stuart 2007)

2. What should we do [with computing]? Knowledge as complex informational architecture: Necessity of a multidisciplinary dialogue

Why is it important to develop Computing and philosophy as a multi-disciplinary discourse? One of the reasons is epistemological – it provides the fundamental framework suitable for common understanding of a huge number of presently disparate fields. This argument builds on a view of knowledge as structured informational construction. According to Stonier (1997), data is a series of facts and observations, which is converted into information by analyzing, cross-referring, selecting, sorting and summarizing the data. Patterns of information, in turn, can be worked up into knowledge which consists of an organized body of information. This constructivist view emphasizes two important facts: going from data to information to knowledge involves, at each step, an input of work, and at each step, this input of work leads to an increase in organization, thereby producing a hierarchy of organization.

Research into complex phenomena (Mainzer 2004) has led to an insight that research problems have many different facets which may be approached differently at different levels of abstraction and that every knowledge field has a specific domain of validity. This new understanding of a multidimensional many-layered knowledge space of phenomena have among others resulted in an ecumenical conclusion of science wars by recognition of the necessity of an inclusive and complex knowledge architecture which recognizes importance of a variety of approaches and types of knowledge. [see, for example, Smith and Jenks, 2006.] Based on sources in philosophy, sociology, complexity theory, systems theory, cognitive science, evolutionary biology and fuzzy logic, Smith and Jenks present a new interdisciplinary perspective on the self-organizing complex structures. They analyze the relationship between the process of self-organization and its environment/ecology. Two central factors are the role of information in the formation of complex structure and the development of topologies of possible outcome spaces. The authors argue for a continuous development from emergent complex orders in physical systems to cognitive capacity of living organisms to complex structures of human thought and to cultures. This is a new understanding of unity of interdisciplinary knowledge, unity in structured diversity, also found in Mainzer (2004).

In a complex informational architecture of knowledge, logic, mathematics, quantum mechanics, thermodynamics, chaos theory, cosmology, complexity, the origin of life, evolution, cognition, adaptive systems, intelligence, consciousness, societies of minds[2] and their production of knowledge and other artifacts … all have two basic phenomena in common: information and computation. In the Computing and philosophy global course we will use computing and information as a means to provide a framework for those jigsaw puzzle pieces of knowledge to put together into a complex and dynamic info-computational view.

3. What can we know [about computing and by computing]?

The main course textbook is *The Blackwell Guide to the Philosophy of Computing and Information* (Blackwell Philosophy Guides, 2004), Edited by Luciano Floridi. Following fields will be covered by the CaP global course (CaP 2008):

Philosophy of Information

The course will give an introduction to Luciano Floridi's Philosophy of Information, including Information Ethics and among others introduce ideas of "infosphere" and "being as being informed". (Floridi 2004-2007). We also introduce philosophy of the web (see Halpin 2007).

Philosophy of Computation

Computation may be understood as information processing. At present, research on computation is intensely developing new views of the phenomena, especially natural computation (MacLennan 2004, Siegelman 1999), which uses natural phenomena as computing devices. Some relevant questions are: What is computation? How do computation and information relate? Turing machine model vs. interactive computation as closed system vs. open system (Wegner 1998, Goldin 2005, Goldin et al. 2006). Church-Turing thesis´ domain. Digital vs. analog (Müller 2007). Natural computation as interactive computation in the world goes in an important sense beyond Turing paradigm. It also calls for new logical approaches (Dodig-Crnkovic 2005 and 2008) and references therein - Abramsky (2003), Allo (2007), Benthem (2006), Hintikka (1973) Japaridze (2007), Kelly (2004), Priest and Tanaka (2004). Pancomputationalism views the whole of the universe as a network of computational processes. Taking information as a structure and computation as its dynamics, info-computationalism is a flavor of pancomputationalism which not only sees computational universe as a process but also as an informational structure. Conceptually, the ambition of new info-computationalism is to explore the possibilities of the real world as a resource of computational devices. In this view the Turing machine computational model is a subset of a more general natural computation.

Philosophy of Mind

Here we present Computationalism and its critics. Epistemology naturalized (Dodig-Crnkovic 2007), vs. Epistemology computerized (Ganascia 2007). Discrete vs. continuous. Digital vs. Analog (Müller 2007). The classical Problem of Other Minds will help us to explore the systems in which computer "minds" approach the complexity of human minds. Cyborgs, human/machine combinations. Self-reflexive systems (Lanzarone 2007). Agent vs. environment. Bio-AI based on Bernie Baars' work.

Philosophy of Computer Science

Pioneering contributions to Philosophy of Computer Science are courses done by Rapaport (2005), Tedre (2007) and research of Taylor and Eden (2007). Among others, the following philosophically significant questions will be addressed: what is a computer program? What is software?

Philosophy of AI

Of all research fields of Computing, AI has the deepest connections to philosophy and with good reason. According to Chaitin (2007) you really understand something if you can program it, so we can say we really understand intelligence if we can program it. One could generalize "to program" into "to compute" meaning that computing may not be the same as programming, having in mind natural computation.

Virtual-Real-Model-Simulation[3]

One of the characteristic features of computers and computing technologies is what Moor (1985) calls "logical malleability" – computers are excellent for representation of information and in that capacity they may stand for both virtual worlds and the real one, and the distinction between the two might be difficult to tell. Ubiquitous computing is winning space and we understand that we more and more live in an infosphere (Floridi) which is radically different from the one of the era without ICT. That raises questions of the future use of computing in the production of virtual worlds and inspires investigations into the character of reality and the distinction real-virtual.

On the pragmatic side, there is a wide-spread use of computational models as a tool in natural and social sciences, humanities, engineering, government, etc. It is now well-recognized that we are witnessing a golden age of nanotechnologies with design of novel materials, and discoveries important for both basic science and applications. All mentioned is enabled by powerful computational tools.

We will discuss the role of computation and simulation in the dramatic advances of modeling and representation techniques we are witnessing today. Some specific present advances will be mentioned, such as quantum materials design, with the goal to synthesize in a controlled way materials on the atomic scale. The theory continues to develop along with computing power.

More examples of simulation will be found in robotics, artificial life, games, modeling of social systems, process monitoring software and many others. Lanzarone (2007) presents an interesting view of Second Life (SL) as computational self-reflective system:

"The internal/external, observer/observed relationship is the basic concept of all virtual worlds.[11] In SL there seems to be a continuous interplay between in-world and out-world (jumping in and out of the system). In a certain sense, one could continuously enter and exit from the screen, or be at the same time on both sides of the screen. A sort of third life emerges from the interact ion between RL and SL."

Ethics

Theoretical concepts. (I. History of the term "computer ethics:" Walter Manor, Jim Moor, Deborah Johnson and Information Ethics Luciano Floridi (2007); II. Philosophical meta-ethics and computing, professional ethics, micro/macro ethics: Don Gotterbarn; III. "Procedural ethics" for IT issues: just consequentialism, STS analysis, virtue ethics, and the importance of technical detail), and

Selected topics. (I. Privacy and IT; II. Killer robots in North Korea, Iraq, and downtown; III. Intellectual property and IV. Open source software: moral imperative?)

Computers in Society. Computers and Arts

The course will address the role of computers in society and arts, as a part of the answer to the questions what can be done with and what we can expect from computing.

4. The relevance of the course

The body of knowledge and practices in computing, as a new research field, has grown around an artifact – a computer. Unlike old research disciplines, especially physics which has deep historical roots in Natural Philosophy, research tradition within computing community up to now was primarily focused on problem solving and had not developed very strong bonds with philosophy[4]. The discovery of philosophical significance of computing in both philosophy and computing communities has led to a variety of new and interesting insights on both sides.

The view that information is the central idea of Computing/Informatics is both scientifically and sociologically indicative. Scientifically, it suggests a view of Informatics as a generalization of information theory that is concerned not only with the transmission/communication of information but also with its transformation and interpretation. Sociologically, it suggests a parallel between the industrial revolution, which is concerned with the utilizing of energy, and the information revolution, which is concerned with the utilizing of information. (Dodig-Crnkovic 2003)

The development of philosophy is sometimes understood as its defining new research fields and then leaving them to sciences for further investigations (Floridi's lecture in Swedish National PI course on the development of philosophy, PI, 2004). At the same time, philosophy traditionally also learns from sciences and technologies, using them as tools for production of the most reliable knowledge about the factual state of affairs of the world. We can mention a fresh example of current progress in modeling and simulation of brain and cognition that is of vital importance for the philosophy of mind. As so many times in history, the first intuitive approach when scarce empirical knowledge exists, does not necessarily need to be the best one. Wolpert (1993), for example, points out that science is an *unnatural mode of thought*, and it very often produces a counterintuitive knowledge, originating from the experiences with the world made by tools different from everyday ones, experiences in micro-cosmos, macro-cosmos, and other areas hidden for everyday experience. A good example of "unnatural" character of scientific knowledge is a totally counterintuitive finding of astronomy that earth is revolving around the sun. At present, similar Copernican Revolution seem to be going on in the philosophy of mind, epistemology (understood in informational terms), in philosophy of information, and philosophy of computing.

Finally, it is worth pointing out the novelty of the CaP course subject and scope. This is the first course of its kind, even though several courses have recently been developed internationally, addressing Computers and Philosophy, Philosophy of Computer Science and Philosophy of Information. At present we have established collaboration between several American and European universities with an ambition to develop an even wider global course in the future. (see CaP 2008)

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Endnotes

1. The majority of the above research (topics 1-7) will be addressed in the present course.
2. P. Thagard."Societies of minds: Science as Distributed Computing. Studies in History and Philosophy of Science" 24, (1993): 49-67. Available at http://cogprints.org/676/0/Societies.html
3. Excellent reading is (Lanzarone 2007) which gives a broader context of the relationship of real and virtual worlds as a relationship between inside and outside in an open interactive system.
4. Alan Turing was one of the notable exemptions to the rule. Others are Weizenbaum, Winograd, and Flores (G A Lanzarone, *APA Newsletter* Fall 2007). It should also be mentioned that Computing always had strong bonds with logic, and that especially AI always had recognized philosophical aspects.

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