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IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

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Fabio Gadducci · Mirko Tamosanis (Eds.)

History and Philosophy of Computing

Third International Conference, HaPoC 2015
Pisa, Italy, October 8–11, 2015
Revised Selected Papers

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Preface

Computing machines, today, seem both ubiquitous and on the verge of disappearing. They evolve and metamorphose in everyday objects, from slates and phones to cars and watches; often, they simply become part of the landscape. However, it was not always so; and perhaps it will not always be so.

The Third Conference on the History and Philosophy of Computing was held in Pisa in a most fitting location for these musings. It took place in the Museum of Computing Machinery (Museo degli Strumenti per il Calcolo) of the University of Pisa, and the collections displayed there show a wonderful variety of forms and functions, from the earliest modern computing machines to the personal computers of the end of the twentieth century. Those machines have a long history, and the background of this history involves a long philosophy.

This polymorphism of computing was displayed in the variety of contributions from the participants, too. As this volume shows, the interests of the researchers in this field show amazing variety and ingenuity. We believe that the conference, held under the auspice of the DLMPST/DHST Inter-Division Commission for the History and Philosophy of Computing, offered the opportunity to survey the current state of the art, and as such it compares with the successful first and second conference, held in Ghent in 2011 and in Paris in 2013.

Indeed, even in this third edition, the HaPoC Conference brought together researchers interested in the historical developments of computers as well as researchers reflecting on the sociological and philosophical issues related to computing. From the Middle Ages to the latest theoretical tendencies, the swath of ground covered there was large.

A total of 30 out of 50 submitted papers were accepted, along with six invited talks. The selected abstracts were then printed in a volume of preconference proceedings (Pisa University Press, 2015) and distributed to the attendees at the conference.

After the conference, the authors were asked to submit a full version of their papers for these proceedings, and most of them did indeed accepted the invitation. All the submissions were anonymously reviewed, with the all-important contribution of the members of the HaPoC Program Committee, to whom goes much of the merit for the quality and the speed of the work. The final result of this process is the book you hold in your hands. This is the first published volume of proceedings for an HaPoC Conference: We hope it to be the first in a series, since we feel that it will help disseminate the very idea of the history and philosophy of computing.

As for the contents, the Pisa conference was divided into a range of thematic sessions: six sessions ranging from the world history of computing to the role of computing in the humanities and the arts. For the present proceedings, as for the preconference volume, we did not try to do the same. In this field, labels are so arbitrary that printing the papers in alphabetical order, without any attempt to categorize them, seemed to us the wisest option. The invited talks are included first, followed by the

regular submissions. The summaries of the papers provide a good idea of the variety of topics and of the vitality of the community that gathered around them.

For anyone who attended the conference, the print version will lack one of the things that made HaPoC 2015 so interesting: the vibrant discussions among the attendees. Many of these discussions led to revisions and additions that were incorporated in the final texts. However, the discussion itself is impossible to reproduce in this form and it can be only glimpsed and imagined by the reader. We hope that participating in such a stimulating forum can be one further motive to attend the upcoming HaPoC conferences.

Finally, we must thank the many people and institutions that contributed both to the conference and to the publication of the proceedings. Among others, Arthur Tatnall, former chair of the IFIP Working Group 9.7 on the History of Computing, and Giuseppe Lettieri, chair of the Organizing Committee, which included Valeria Barboni, Elisabetta Mori, and Sara Pallucco. The conference was supported by the Fondazione Galileo Galilei and by the University of Pisa. We also gladly acknowledge the support from the Department of Computer Science and the Department of Philology, Literature, and Linguistics of the University of Pisa and from the AILA-Associazione Italiana di Logica, as well as the help provided by the EasyChair system for the submission procedure.

August 2016

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Abstracts of Invited Talks

Alan Turing and the Other Theory of Computation

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Abstract. The two major traditions of the Theory of Computation have for the most part run a parallel non-intersecting course. On one hand, we have the tradition arising from logic and computer science addressing problems with more recent origins, using tools of combinatorics and discrete mathematics. On the other hand, we have numerical analysis and scientific computation emanating from the classical tradition of equation solving and the continuous mathematics of calculus. Both traditions are motivated by a desire to understand the essence of computation, of algorithm; both aspire to discover useful, even profound, consequences.

While those in the logic and computer science communities are keenly aware of Alan Turing's seminal role in the former (discrete) tradition of the theory of computation, most *still* remain unaware of Alan Turing's role in the latter (continuous) tradition, this notwithstanding the many references to Turing in the modern numerical analysis/computational mathematics literature. These references are *not to recursive/computable analysis* (suggested in Turing's seminal 1936 paper), usually cited by logicians and computer scientists, *but rather to* the fundamental role that the notion of "condition" (introduced in Turing's seminal 1948 paper) plays in real computation and complexity.

This talk, based on [1], recognizes Alan Turing's work in the foundations of numerical computation (in particular, his 1948 paper "Rounding-Off Errors in Matrix Processes" [2]), its influence in complexity theory today, and how it provides a unifying concept for the two major traditions of the Theory of Computation.

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Walter Shewhart and the Philosophical Foundations of Software Engineering

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Abstract. To create engineering standards of practice for software, the early practitioners of this discipline had to accomplish two goals. First, they had to materialize an immaterial artifact, the program. They had to conceptualize software in a way that could be measured. Second, they had to introduce the concept of randomness into a decidedly deterministic framework. Practically, these two goals forced them to reject two dominant modes of engineering practice, those of mechanical and electrical engineering. Historically, this was a relatively straightforward task as mechanical and electrical engineers proved easy to ignore. They wanted to dictate the nature of the new engineering field but were unwilling to do the work to shape it.

The early software moved quickly to base their practice on the works of Walter Shewhart (1891–1967), who was one of the founders of industrial engineering and quality control. In particular, the work of Shewhart provided the foundation for the 10 IEEE standards that formed the basis for ISO 12027, commonly called the “SWEBOK Standard” that describes what we now call the classic form of software engineering.

In the process of adopting these ideas, software engineers found that they had to accept the logical positivism that undergirded Shewharts’ work. Shewhart was a student of C.I. Lewis and borrowed ideas from Lewis’ his critique of rational positivism that borrowed heavily from pragmatism. He even suggested a substantial revision to the Peano axioms in order to address logical contradictions that he identified in common life. These ideas forced the engineers to recognize that they had to deal with the problem of logical implication, the case in which a true consequent can be paired with a false antecedent and still produce a true statement. While the problem of logical implication could be found in other forms of engineering, it had a powerful impact on a field that was thought to be based on deterministic automata and logical proof.

Keywords: Logical implication · Software engineering · SWEBOK standard · ISO

Wherefore Art Thou . . . Semantics of Computation?

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Abstract. Nearly 60 years have passed since the notion of *semantics* was first used to explain *Programming Languages*. There was quite some divergence of opinions, at the time, in what the *semantics of semantics* was supposed to be. Today, in face of the plethora of different models and logical systems based thereupon, are we in a better position to address this *socratic* question? We analyse philosophical issues revolving around the Foundations of Formal Reasoning, Proof Cultures, Logical Frameworks, the Algebraic/Co-algebraic Duality, and Games. We put forward the thesis that, rather than being a drawback, *plurality* is what makes Semantics useful. In that Semantics of Computation is a “*partita doppia*”, a double check of what we think we understand in computing.

Logic, Formal Linguistics and Computing in France: From Non-reception to Progressive Convergence

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Abstract. How did the theory and practice of computing interact to generate a new discipline, computer science? Studying the French scene, in comparison with other countries, reveals that in most cases computing developed initially as an ancillary technique of applied mathematics, with little awareness of the path-breaking theories of computability elaborated in the 1930s. This was particularly clear in France, where mathematical logic was almost inexistent and disregarded by the Bourbaki group.

It was only in the early 1960s that researchers in the emerging field of computing felt the need for theoretical models, and discovered the Turing machine and recursive functions. Simultaneously, an interest for language theories and information structures, fostered by practical projects such as machine translation, converged with issues raised by software development and the nascent theory of automata.

The convergence of these diverse intellectual agenda was central in the process of construction of the new discipline.

Interactive Spatial Sound Intervention: A Case Study

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Abstract. Bodily positioned intervention art creates some remarkable challenges for the conception, development and achievement of interactive, electronic sonic works. Analysis of multiple spectators, habitat reactivity, display modes, socio-political impact and planning strategies are considered through a case study of my own artwork. I trace the challenges in this field using a recently installed interactive piece, *Sonic Space #05*, which unfolds as a functional interrelated system with undetermined pathways to real-time sound creation. This case study provides an investigation into the demands made by the physical world upon intervention art and the subsequent results.

Contents

Invited Talks

Wherefore Art Thou ... Semantics of Computation?	3
<i>Furio Honsell</i>	
Logic, Formal Linguistics and Computing in France: From Non-reception to Progressive Convergence	24
<i>Pierre Mounier-Kuhn</i>	
Interactive Spatial Sound Intervention: A Case Study	42
<i>Elisabetta Senesi</i>	

Regular Submissions

Theory of Knowing Machines: Revisiting Gödel and the Mechanistic Thesis	57
<i>Alessandro Aldini, Vincenzo Fano, and Pierluigi Graziani</i>	
Algorithmic in the 12 th Century: The Carmen de Algorismo by Alexander de Villa Dei	71
<i>Nadia Ambrosetti</i>	
From Close to Distant and Back: How to Read with the Help of Machines . . .	87
<i>Rudi Bonfiglioli and Federico Nanni</i>	
Computing, Design, Art: Reflections on an Innovative Moment in History . . .	101
<i>Stephen Boyd Davis and Simone Gristwood</i>	
From Cells as Computation to Cells as Apps	116
<i>Andrea Bracciali, Enrico Cataldo, Luisa Damiano, Claudio Felicioli, Roberto Marangoni, and Pasquale Stano</i>	
«Omnia Numerorum Videntur Ratione Formata». A ‘Computable World’ Theory in Early Medieval Philosophy	131
<i>Luigi Catalani</i>	
From <i>urelements</i> to Computation: A Journey Through Applications of Fraenkel’s Permutation Model in Computer Science	141
<i>Vincenzo Ciancia</i>	
The Contribution of Carl Adam Petri to Our Understanding of ‘Computing’ . . .	156
<i>Giorgio De Michelis</i>	

Frege’s <i>Habilitationsschrift</i> : Magnitude, Number and the Problems of Computability	168
<i>Juan Luis Gastaldi</i>	
Trente ans ou la Vie d’un scientifique	186
<i>Vladimir A. Kitov, Valery V. Shilov, and Sergey A. Silantiev</i>	
From Information to Perception: The New Design of the Emerging Computer Technologies and Its Effects	203
<i>Nicola Liberati</i>	
Several Types of Types in Programming Languages	216
<i>Simone Martini</i>	
Playfulness and the Advent of Computerization in Spain: The National Club of ZX81 Users.	228
<i>Ignasi Meda-Calvet</i>	
Impact of Informatics on Mathematics and Its Teaching: On the Importance of Epistemological Analysis to Feed Didactical Research	243
<i>Simon Modeste</i>	
Epistemic Opacity, Confirmation Holism and Technical Debt: Computer Simulation in the Light of Empirical Software Engineering	256
<i>Julian Newman</i>	
The Brain in Silicon: History, and Skepticism.	273
<i>Alessio Plebe and Giorgio Grasso</i>	
The Role of Computers in Visual Art	287
<i>Mario Verdicchio</i>	
In Search of the Roots of Formal Computation	300
<i>Jan von Plato</i>	
Author Index	321