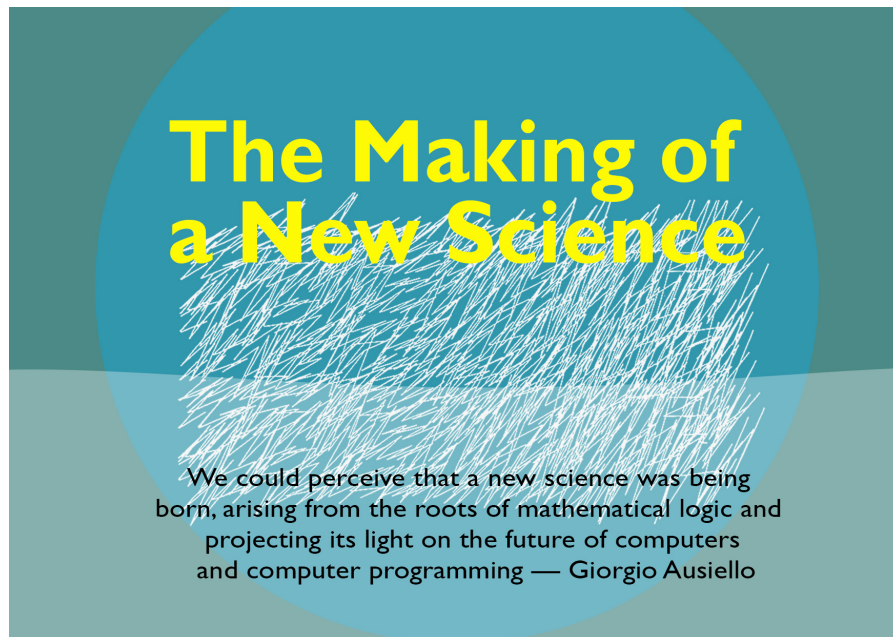


THE MAKING OF A NEW SCIENCE

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An exhibition, entitled ‘The Making of a New Science,’ on the early history of theoretical computer science is being held from June to October 2025 at Galleria Chodba at Malostranské náměstí 2/25 in Prague, curated by the authors of this article. The origins, motivation and sources of this exhibition are explained in a short text prefacing the exhibition catalogue (to be published by the Karolinum Press) which, with small modifications, is reprinted here. The exhibition opened on 18 June and will run until October 2025, a few weeks after the start of the winter semester at Charles University, thereby giving an opportunity for incoming and returning students at the School of Computer Science of the Faculty of Mathematics and Physics to see the exhibition. The opening of the exhibition was coordinated with a major event hosted by Charles University in Prague from 23 to 27 June this year, the 57th ACM Symposium on Theory of Computing (STOC 2025). Galleria Chodba is located in the very centre of Prague and our exhibition has been attracting the attention not only of students and scientists but of the general public (among them the many tourists visiting Prague at this time of year).



Preface to the exhibition

It is very rare that one can make an exhibition tracing the entire history of an established scientific discipline. Theoretical Computer Science (TCS for short) – which only emerged in the 1970s as a recognized field per se out of its origins in logic, mathematics and engineering – has developed and matured so quickly that this is possible; or, better, we can at least try to present the history of the field in a concise and yet uncrowded way.

TCS (or the Theory of Computing, Computability Theory, or even Algorithms and Complexity, to give just a few of the several names that are used to refer to the discipline) develops the abstract concepts and mathematical models that underpin computation, with a particular focus on the design, analysis, and efficiency of algorithms. It has developed in the last few decades from humble origins into a field which is taught at most universities worldwide, and which spans a large part of technological development today. One can say even more: perhaps nowhere in contemporary science is there such a direct line from theory to development and then to praxis and its consequent impact on everyday life. Our aim here can only be to sketch parts of this evolution of TCS. We concentrate on the early origins in the 1920s to c. 1990 (with occasional glimpses beyond); we thereby also limit our scope by concentrating on the theory that established itself in the

twentieth century, omitting some trends which have proved to be very active more recently. This is more concretely described below. We are fortunate that we can build our exhibition around two earlier instances. One is the excellent book *The Making of a New Science* (Springer 2023) by Giorgio Ausiello. This book, by one of the pioneering leaders and organizers of the development of TCS in Europe, is both a factual report of the history of TCS until 1980 and a memoir replete with personal details, making it fascinating reading for non-specialists and specialists alike. Prof. Ausiello put us in contact with the people behind our second source, the exhibition ‘50 Years of Theoretical Computer Science’ shown at the ICALP ’22 conference in Paris. We thank Sandrine Cadet and Sylvain Schmitz, organizers of this exhibition, for allowing us to use and modify their material.

Our exhibition ‘The Making of a New Science’ consists of thirteen large panels accompanied by an explanatory text. The following outline may give an idea of the exhibition for those unable to make it to Prague to see it.

The first panel (bearing the title of the exhibition, **The Making of a New Science**) pays tribute to Prof. Giorgio Ausiello, featuring a brief quotation from his book along with quotes from other recognized computer scientists, and two of Vera Molnár’s digital plotter drawings (from the series *Letters from my mother*).

The second panel (**On the shoulders of giants**) picks out some of the major milestones and key figures in the theory of computation. This of course goes back to star mathematicians (and scientists) of the early twentieth century (we omitted traces of the field to be found in previous centuries). This earlier history is recorded in the reels of black-and-white “film” while more recent names are recorded in the array of colour “polaroids”. The panel is complemented by a list of awardees of the Nevanlinna–Abacus medal of the International Mathematical Union (established in 1982 and given at the International Congress of Mathematicians ever since).

The next panel **Pioneers in TCS** continues the focus on key figures of the field, featuring a spotlight on Maurice Nivat (transferred directly from the Paris exhibition 50 Years of Theoretical Computer Science), whose individual story has counterparts for each and every one of the notable figures in TCS listed in the remainder of the panel. These lists give in chronological order all the winners of four major annual international prizes: the A. M. Turing Award, Gödel Prize, EATCS Award and Donald E. Knuth Prize. Seeing these lists, one gets a better feeling of how the development of TCS has been a product of collective endeavour by a remarkable and numerous set of individuals.

Brussels, 1972 reworks a panel from the Paris exhibition ‘50 Years of Theoretical Computer Science,’ supplementing it by facsimiles of key documents reproduced in the appendix to Ausiello’s *The Making a New Science*. Described are the key events leading to the creation of the European Association of Theoretical Computer Science (EATCS), highlighting the role played by Maurice Nivat and

others in bringing it to fruition.

The foundation of new institutions led to the creation of a new type of conference, one with refereed contributions selected by a programme committee. Such conferences became the dominant medium for scientific communication in TCS, and a (non-exhaustive) selection of the most long-running, active and prestigious are displayed in the panel **Early conferences in TCS**. The penultimate panel of the exhibition (see below) features an editorial by Moshe Vardi discussing the role of conferences in computer science, which is very different from mathematics.

The next five panels are devoted to particular areas of TCS in their early development. The choice of topics is of course rather arbitrary as current TCS is a very broad field. But on the history there is a consensus. We included material from the Paris panels on computational complexity, logic and complexity, automata and a schematic overview of algorithms that have shaped the world; on the other hand, we left out the Paris material on zero-knowledge proofs, fine-grained complexity, model checking, the science of programming, machine-checked proofs, and quantum computing. We are limited to thirteen panels and some of these topics will be treated in a follow-up exhibition.

With these constraints, our panels are **Automata theory**, describing the development of this area from Alan Turing on; **Computational complexity (I)**, describing the birth of complexity classes and “complexity” as we know it today; **Computational complexity (II)**, describing the influence of logic and the logical side of TCS; and **Algorithms (I)**, representing some of the plethora of beautiful algorithms from which the theory of algorithms has evolved. These four panels are adapted from the Paris panels, to which we have added photographs of some of the key figures involved. Additionally, in the Algorithms (I) panel we highlighted seven major algorithms from those “shaping the world”, while, in the Automata theory panel we included diagrams illustrating the evolution of a pair of elementary cellular automata (rules 30 and 110).

The next two panels are the only panels devoted to specific problems. **Algorithms (II)** treats a topic dear to all Czech mathematicians and computer scientists as it describes the role of Borůvka and Jarník in the development of the minimum spanning tree algorithm (as well as the Steiner tree algorithm). The panel **Advanced graph theory in TCS** describes the story of expanders – another TCS saga. Expanders represent a key structure in the theory of algorithms and their construction involves beautiful and difficult mathematics.

The last two panels document some of the bewilderingly extensive activity in TCS. The panel **Publishing research** includes material from the Paris exhibition panel focusing on ICALP publications, to which we have added a discussion about the distinctive practice of theoretical computer of using conferences and their proceedings as the primary mode of communication rather than journals: we reproduce an editorial by Moshe Vardi in Communications of the ACM, concern-

ing a still very current topic of debate. The final panel **Selected textbooks in TCS, 1966-1999** gives a panorama of various twentieth century textbooks, both basic and advanced, many appearing in new editions to the present day, and all of them influential in directing the course of TCS as it entered the twenty-first century.

Remarks or questions related to this exhibition are welcome and can be sent to the gallery email address, galleriachodba@iuuk.mff.cuni.cz.

It remains for us to thank the School of Computer Science of the Faculty of Mathematics and Physics for supporting Galleria Chodba as well as the UNCE project 'Language, image, gesture: forms of discursivity' (a joint project with the Faculty of Arts, Charles University).