Chapter 1
A Tribute to Antoni Olivé on the Occasion of His Retirement

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Abstract We share a common professional history with Antoni for around 40 years. From that perspective, we give a short overview of the research problems that we encountered and how we tried to contribute in finding solutions on data processing, human computer interaction and modeling languages and tools

As friends of Antoni and also contributors to the field of conceptual modeling, the three of us are happy to have been invited to contribute to this book which is honoring Antoni Olivé's contributions to the field.

All three of us have been retired for several years, ranging from 15 years to just a few. Our professional positions as university professors have been taken over by our former doctoral students. Our previous students are doing splendid work in research as well as in education and technical development, some of them in academia and many of them in industry and public organizations. We cannot today give research contributions which match those of our students. So we will not contribute to this book with new research. We will rather look back and give a short overview of the problems that we encountered, and where our research community tried to contribute in finding solutions.

The three of us share a common professional history with Antoni dating back to the mid-seventies, for around 40 years. The most striking feature during these years has been the fantastic increase in computational capacity and in telecommunication

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capacity. There has been a steady 10-fold increase in computer capacity per dollar every 5 years. This amounts to 100-fold increase every 10 years, and 1000-fold every 15 years. Over the 40 years that we have been professionally active the increase in computational capacity per money unit has been an incredible 100 million.

This has led to major equipment changes every 10-15 years, starting with the batch-processing central computers being replaced by time-shared computers around 1979, and desktop personal computers around 1980, laptop computers around 1990-95, handheld computers 2000-05, into today's smartphones and every-physical-item-having-its own-computer, into a world with computers-everywhere, in to the internet of things

Over the years this has led to important changes in the field, shaping research themes, e.g.,

- change in emphasis from calculation and data processing to information processing
- increasing interaction between humans and computers
- language as communication tool: syntax, semantics, pragmatics $\rightarrow$ conceptual modeling
- the need for better modeling tools, e.g., information systems engineering

During the 1970's the use of computers expanded quickly. The need for better cooperation between computers and human beings became obvious. This led to an increased interest in methods for building such systems, and an increased interest in building information systems, rather than the more limited data processing systems. The International Federation of Information Processing societies (IFIP) decided to form a Technical Committee on "Information Processing" (TC8). The two first working groups were on the themes "Design and Evaluation of Information Systems" (WG 8.1) and "The Interaction of Information Systems and the Organization" (WG 8.2).

The working groups soon became focal points for arranging international working conferences. Likeminded young researchers found communities of people with common interests. WG8.1 became a focal point for computer science researchers with a common background in mathematics and engineering. The three of us together with Antoni became driving forces in the activities of WG8.1. The close cooperation which was initiated during the IFIP years was carried over to the CAiSE conference series which started in 1990.

In focus of our research interests was how to express the intended properties of planned information systems. Our common backgrounds in mathematics, natural sciences and technology made it a natural objective for us to search for ways to predict the future effects of a planned information system based on its stated properties. The ideal was seen to be able to design an information system in similar ways as engineers designed technological artifacts like bridges and engines. So we sought after approaches to specify software artifacts and human operations in ways that permitted us to calculate emerging properties of the combined system of software operations and human operations. A great encouragement for our work along this line of reasoning was the first paper on formal specifications of an information sys-

tem which was published by Young and Kent more than sixty years ago. Even if the term "conceptual model" was not used at this time, the basic intention of the abstract specification was to a large extent the same as for developing conceptual models today: to arrive at a precise, abstract, and computing machine independent model of the informational and time characteristics of the data processing problem. The abstract notation should enable the analyst to organize the problem around any piece of hardware. In other words, the purpose of an abstract specification was to use it as an invariant basis for designing different alternative implementations, perhaps even using different hardware components.

Research and practice of abstract modelling of information systems has since the late fifties progressed through many milestones and achievements. In the sixties, pioneering work was carried out by the CODASYL Development committee who in 1962 presented the "Information Algebra". At about the same time BÃűrje Langefors published his elementary message and e-file approach to specification of information systems.

The next decade, the seventies, was characterized by introduction of a large number of new types of, as they were called, "data models". We saw the birth of, for instance, Binary Data Models, Entity Relationship Models, Relational Data Models, Semantic Data Models, and Temporal Deductive Models. At this time, most of the researchers in the modelling field had, essentially, data-base orientation. The first time the term "conceptual schema" was used was probably by the ANSI/X3/SPARC, Study Group on Data Base Management Systems, in 1975 when they formulated the "three schema approach" to data-base management. The conceptual schema was seen as the "essential schema", depicting the content of the database in an implementation, and external representation independent way.

The term conceptual modelling gradually gained general acceptance, perhaps largely due to use of the term conceptual schema in the ISO working group's TC97/SC5/WG5 preliminary report, Concepts and Terminology for the Conceptual Schema edited by J.J. van Griethuysen, et. al. in 1982. At about the same time information system researchers began to use the term "conceptual modelling" for modelling of information systems in an implementation independent way. Usually, this kind of modelling was carried out during the requirements elicitation and specification phase of systems development.

The last two decades of conceptual modelling practice are dominated by two main trends. The first is the spread and use of the object oriented language and approach UML, including its language OCL (Object Constraint Language) for formulating business rules and constraints. The second trend, in our opinion, is the change of mode of modelling towards a way where users and stakeholders are very much more actively involved - participatory modelling. This trend points to the importance of modelling skills and knowledge becoming important not only to system development professionals but also to stakeholders and users.

Antoni Olivé has in his professional working life made an impressive amount of contributions that brings and puts together knowledge of conceptual (and data-) modeling, produced in research during more than half a century.

One of the first important contributions of Antoni to conceptual modeling was the DADES methodology presented at the IFIP WG8.1 conference on 'Comparative Review of Information Systems Design Methodologies' in 1982. The idea of the conference was to select the seven methodologies the most representative of the state-of-art based on a call, which was not only requiring the presentation of the methodology but also imposing a test case to be solved. This event has also been the starting point of our cooperation with Antoni as the three of us were also presenting our own methodologies at the conference.

DADES was one of the selected methodologies and its originality was to promote a deductive approach to design whereas most of the competitors were defending 'operational' ones. The main characteristic of the former is to provide a complete specification of an information system expressing only its logic component whereas the latter define also part of the control component. In deductive approaches like DADES, the specification of the control component is entirely left to the subsequent phases of the information system development. On the contrary a deductive approaches uses deduction rules to relate the information base to external events thus providing an elegant and synthetic conceptual view of what the information system is supposed to do.

Antoni was the first to introduce in information system design a logic-based approach in the line of logic programming which was emerging at that time. He contributed to the understanding of the respective advantages of operational approaches versus deductive approaches (refs) and to the transformation of a deductive conceptual schema to an operational one as well as. It is not possible to detail all of the many contributions of Antoni to conceptual modeling; the focus on this one is due to the fact that it has been the starting point of a long cooperation between us.

Most of Antoni's contributions are manifested in his book "Conceptual Modelling of Information Systems" (Springer, 2007). The book puts in context, research on conceptual modelling presented in more than 200 references. It deals with most essential aspects of conceptual modelling, thoroughly explained and illustrated in detail. Structural as well as behavioural conceptual modelling concepts are explained in detail. Every chapter is concluded with a bibliographical note that gives the research-oriented reader a possibility to further dwell into references to works on that particular topic. Each chapter also gives students a challenge to test their new knowledge acquired by solving a number of problems. A fairly large chapter at the end, describing a case study, illustrates the use of modelling constructs presented earlier. Of practical interest are the frequent translations of modelling concepts introduced to UML and OCL. A chapter on "Metamodelling" and a chapter on "Meta-metamodelling" and Metadata Interchange (XMI), a standard that enables the exchange of data about schemas as well as about schema instances, conclude the book. Metamodeling is also an important mechanism for reasoning about conceptual schema languages of different types and for integrating conceptual models with other kinds of models, such as business and enterprise models.

The book is one of the most informative and comprehensive texts on conceptual modelling published to date. It is very appropriate for students of advanced level university courses in information systems, requirements engineering, or in data base

design, as well as for qualified practitioners of the field. In conclusion, we would like to offer Antoni our most sincere appreciation for more than thirty years of co-operation and friendship. It has been great fun to produce research work together and to arrange research events and conferences. We look forward to continued co-operation.