Elio Lanzarone: a life for science

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Abstract
We are sincerely grateful to have been invited by the Guest Editor of this special issue, Prof. Francesca Lisi, to write an article in honor of our mentor Gaetano Aurelio Lanzarone (for students, colleagues and friends simply ‘Elio’). We were the first (Stefania) and last (Federico) of Elio’s students, and we both entertained a particularly deep relation with him. What we want to do here is to provide a memoir of his life and career, while his smile, laughter and humor cannot be described in words, but only in the language of our hearts and memories. We believe that Elio’s attitude towards life is well described by the words that Dante Alighieri in his ‘Divina Commedia’ (Divine Comedy, Inferno [Hell], Chant XXVI) attributes to Ulysses:

‘Considerate la vostra semenza: fatti non foste a viver come bruti, ma per seguir virtute e canoscenza’

(‘Call to mind from whence ye sprang: Ye were not form’d to live the life of brutes, But virtue to pursue and knowledge high’).

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1 Short biography
Elio was born on 5 June 1945 in Palermo, Sicily, where he lived until the age of 19 and did classical studies in high school. Then, he moved to Milan to study Nuclear Physics at the University: at the time, for Elio, Physics was ‘the Queen of Sciences’. In that period however a young professor of Physics, Giovanni (‘Gianni’) Degli Antoni had initiated in 1969 the ‘Electronics and Cybernetics Group’ that evolved into the new Cybernetics Institute in 1977. Gianni Degli Antoni, one of the pioneers of Computer Science in Italy, finally founded in Milan the ‘Dipartimento di Scienze dell’Informazione’ (Information Sciences Department), that he directed for many years, and that still exists under the name ‘Dipartimento di Informatica’. Elio grew more and more interested in the new research field of Computer Science, and in fact he got a Master Degree in Physics in 1970, discussing however a Thesis in Computer Science, supervisor Gianni Degli Antoni. The Thesis concerned the evaluation of Piaget’s studies on children: in fact, Elio never considered humanities and science as separate fields, on the contrary he was constantly seeking a synergic interaction.

After graduating, Elio started to work as a consultant for the R&D Labs of Honeywell Information System Italia. Later, from 1976 to 1985, he became the head of the Software Methodologies Group at the R&D Labs of Italtel, at the time a very important Italian Telecommunications Company. His first academic experience was lecturing in the courses in Cybernetics and in Computer Science at the University of Milano from 1974 to 1977, and from 1978 to 1985 as a tenure professor. In the years 1982–84 he was a member of the group of European experts appointed for the definition of the European research programmes JEPE-IT/ESPRIT (Joint European Planning Exercise - Information Technology / European Strategic Programme for Research and Development in Information Technology) and PET-RACE (Planning Exercise in Telecommunications - Research and Development in Advanced Communications Technologies in Europe). For at least one generation...
Elio Lanzarone: a life for science

of Italian computer scientists, Lanzarone is still known nowadays as one of the first scientists who introduced structured programming in Italy, after the famous Dijkstra’s dictum in 1968: in fact, he co-authored a very influential book about this topic [35].

At Honeywell, he met a fascinating and witty young American woman, Marian Farago, who became his wife and his companion for life. Marian had got a Master Degree in Literature after three years of study in Engineering, and worked at Honeywell as a computer scientist. She was in a way the living example of the creative merge of scientific and humanistic culture, which Elio could not resist. They were put at facing desks by their common boss and told to exchange their knowledge—and so they did, living happily together since then, with their common love for arts, literature, travel, …, and new technologies.

In December 1985, he became full-time Associate Professor at the University of Milan. In the meanwhile, his curiosity and his constant quest for new fields of knowledge to explore led him towards logic, logic programming and Artificial Intelligence: Elio was in fact one of the pioneers of logic programming in Italy. At the University of Milan he founded the Laboratory of Logic Programming, where he was joined by Stefania Costantini. Elio had met Stefania in 1983 when, after her Master Degree, she went to work at Italtel. As soon as he became an Associate Professor, he offered Stefania a position which she gratefully accepted. She thus arrived at the University of Milan in February 1986. Also in cooperation with Pierangelo Dell’Acqua, Elio and Stefania worked for several years together. Elio started to teach Prolog in undergraduate and graduate courses, and to this aim he wrote the first book on logic programming in Italian [33], a very complete and clear textbook which is still popular among instructors and students.

Elio always cared for cooperation between University and ICT industry, and was scientific coordinator of several research projects funded by different public and private institutions, from EU programmes to Lombardy regional projects. In particular, he was responsible from 1995 to 1998 for the participation to the European Consortium of the project THAILand (Telematics, Hypermedia and Artificial Intelligence), funded by the European SOCRATES programme, for the definition of a Master Curriculum in Telematic Studies.

At the end of the 1990s, he moved to the newborn University of Insubria (Varese-Como, Italy). This gave him the opportunity to establish first (2000) the Research Center ‘Informatica interattiva’ (CRII)—meaning both ‘informatics in interaction’ and ‘interactive informatics’—and then (2004) the Department of Computer Science and Communication (DICOM), where he was Head until the Department was dissolved, at the end of September 2011.

From March 2000, as a full-time Full Professor, he started the undergraduate curricula in Computer Science and Communication Sciences. It was there that Federico Gobbo met him, through the interest of Marco Benini, who was working first in the Research Center (CRII), and then in the Department (DICOM). Federico held both a Master Degree in Communication Sciences and a postgraduate Master Degree in Information Technologies for the Humanities (MICSU, in Italian): in Elio’s perspective, Federico’s profile was apt for joining the Department as a junior researcher, working in particular with him and Marco Benini.

With Federico’s cooperation, Elio decided to open a course for graduate students about Computing and Philosophy, and also a course for undergraduates about the History of Computing for students in Computer Science and Communication. This course was very innovative in the Italian panorama, because it could be followed by students with background in Humanities and in Computer Science at the same time.

During this experience, they made an experiment of collaborative learning and philosophical writing among students using a wiki, so as to implement a learning-by-doing and ‘hands-on’ approach,
which was appreciated for its novelty, as wikis were not used for discussing philosophy online at that time [28].

Thanks to Elio’s support, Matteo Vaccari and Federico Gobbo could open the European Summer School in Agile Programming (ESSAP), a particular approach to software engineering which Elio appreciated as its roots can be traced back to the common sense reasoning of the early days of software engineering of structured programming.

In his last years of work, his main research interest was in the area of Computing & Philosophy—again, science and humanities together.

The night of 3 October 2011, Elio passed away. He had an incurable illness since at least 2008, but he never missed a day’s work, except for the very last months. He was positive and optimistic all the time, and was always looking forward to the future.

In our last conversations on the phone, we were not even able to understand how near the end was, because Elio talked as usual about life, future frontiers of computer science and possible new projects. It is said that we should live every day of our life as if is was the last one. Elio managed to do something greater and nobler: live his last days (in the full consciousness of the end) as if they were not the last ones, looking forward to the future.

To us, Elio was the perfect modern counterpart of the Reinassance scholar: inquisitive, interdisciplinary and always looking beyond the easy and the obvious. He was a great mentor to us, and we will never forget him or the invaluable example he gave us.

Elio was known by many of his colleagues and students as a very serious person, calm and steady, almost without emotions. We know better than that: the long discussions we had with him for years showed us his real passionate nature. Discussing with Elio has been an important part of our apprenticeship as researchers: Elio was in fact very demanding, and required us to be precise, concise, deep and argumentative in presenting our ideas and opinions. Approximation and superficiality were not accepted, as extraneous to scientific methods. Federico and Stefania met each other after Elio’s death, and, as Elio’s last achievement, they ‘recognized’ each other as similar, ‘birds a feather’.

2 Research

2.1 Program development and analysis, Petri Nets

In his first period, Elio was deeply involved with the foundations of programming and with programming methodologies, that he studied in cooperation with Fiorella De Cindio, Giorgio De Michelis, Mario Ornaghi, Anastasia Pagnoni and Carla Simone. In particular, [24] investigates the possible introduction of control constructs more powerful then do-while, [25] tries to provide correctness conditions for programs with jumps, considering the pragmatic aspect that jumps can be needed even in structured programming in connection with error handling. Program construction by refinement [36] was another of Elio’s relevant interests. During his period in the telecommunication industry, Elio’s research work mainly concerned the Specification and Description Language (SDL), introduced for unambiguous specification of the behaviour of telecommunications systems, that became a CCITT (International Telegraph and Telephone Consultative Committee) recommendation in 1976, and thus a standard in all major companies. SDL was essentially a language to specify and describe the logic of functional processes in a fashion independent of implementation techniques, based on a finite-state machine approach. Works [10, 22] propose to adopt Petri Nets for the formal representation of SDL specifications, in order to allow analysis and verification of telecommunication software systems. Elio’s group also developed a practical verification methodology that was actually used in Italtel Laboratories.
2.2 Meta-reasoning and reflection in artificial intelligence

When Stefania joined Elio’s group, it was the time when a growing interest in meta-reasoning and meta-programming had arisen, under different perspectives (see, for instance, [1–3, 29, 30, 38]).

A seminal approach to meta-reasoning and ‘reflection’ in the context of the Horn clause language (and thus of Prolog) was introduced by Bowen and Kowalski [8]. They proposed to describe Horn clause syntax and provability in the logic itself by means of a careful version of the default metainterpreter (specified via a predicate Demo defined by a set of axioms Pr), where all these aspects are made explicit. Connection between the object level and the metalevel was provided by linking rules called Reflection Principles (this terminology was inspired by the work of Feferman in symbolic logic [27]) for upwards and downwards reflection, i.e. for shifting control from the object level (plain Prolog program) to the meta-level (the metainterpreter), and vice versa.

3–Lisp [37] was another important (though very different) example of a reflective architecture: it introduced a metainterpreter for Lisp, or, more precisely, a metacircular interpreter that represents in an explicit way not only the control aspects, but also the data structures of the underlying interpreter. Here, the metalevel is accessible from the object level at run-time through reflection acts specified in the program. The program is thus able to interrupt its computation, to change something with the state of the interpretation (which encompasses the program’s own state), and to continue with a modified interpretation process. This kind of mechanism is called computational reflection. Elio, Stefania and Pierangelo Dell’Acqua were very interested to this approach: they defined and fully implemented for the Horn clause language a reflective architecture conceptually similar to 3-Lisp [9]. This extended Prolog interpreter thus allowed a Prolog program to inspect and modify its own state in a principled way at run-time. We would like to mention Gianni Casaschi, the Master student who contributed to the implementation.

The main joint achievement by Elio and Stefania has been the definition of Reflective Prolog [11, 14, 16]. The objective of this approach was that of developing a more expressive and powerful logic programming language, while preserving the essential features of logic programming: Horn clause syntax, model-theoretic semantics, resolution via unification as procedural semantics, correctness and completeness properties. An interpreter of Reflective Prolog was been fully implemented [23], and experimented in many practical applications.

In Reflective Prolog, Horn clauses are extended with self-reference and resolution is extended with a logical reflection mechanism which is implicit, i.e. the interpreter of the language automatically reflects upwards and downwards. This allows reasoning and metareasoning to be interleaved by the interpreter without user intervention. In this approach, there is no need to axiomatize provability in the metatheory, thus allowing more compact logic programs and avoiding unnecessary inefficiency. The theory and applications of Reflective Prolog (in particular, to case-based reasoning in the interpretation of legislation, which was another of Elio’s interests) were presented in a number of papers, among which [13, 15, 18]. Reflective Prolog was the subject of an invited talk by Kurt Konolige, a very influential researcher in non-monotonic reasoning, at the 3rd International Workshop on Meta-Programming in Logic held in Uppsala (Sweden) in 1992 [31].

Reflective Prolog principles were generalized, and finally evolved into the RCL (Reflective Computational Logic) logical framework [4, 5, 7]—this was joint work with Jonas Barklund, at the time Supervisor of Pierangelo’s PhD thesis at the University of Uppsala, Sweden. In fact, the implicit reflection of Reflective Prolog has a semantic counterpart [11] in adding to the given theory a set of new axioms called reflection axioms, according to axiom schemata called reflection principles. The idea of RCL came from the observation that Reflection principles can specify not only the shift
between levels, but also many other meta-reasoning principles. For instance, reflection principles can define forms of analogical reasoning [21], and synchronous communication among logical agents [6, 12].

Last but not least, Elio and Stefania developed an interest in non-monotonic reasoning, and in particular in the various semantics for logic programs with negation [17, 19, 20]. Elio also contributed to some work in non-monotonic reasoning, co-authored with his former Master student Marcello Balduccini and with Alessandro Provetti.

Finally, Elio moved to the University of Insubria in Varese and Stefania moved to the University of L’Aquila. She is still interested in Computational Logic and its applications to Artificial Intelligence (her main interests are Non-Monotonic Reasoning and Logical Agents). Naturally, their friendship and cooperation did not end there, and Elio and Stefania remained constantly in touch.

2.3 Epistemology of computing and computer ethics

When Elio moved to Varese and established ‘his’ Department, he felt free to explore many theoretical aspects that were set for decades in the background of his work in logic programming and Artificial Intelligence. He initiated a new course in Computing and Philosophy, that was the arena for lively discussions about some of the most compelling challenges of our time, among others: how the Self is reshaped by our avatars? What is the role of social networks in the definition of the social and political agendas? Does distributed computing tell us something new in the quest of ‘thinking machines’? Elio would have appreciated the Big Questions put during the Alan Turing Year in 2012.

During the years 2005–2008, Elio published some research ideas, often together with Federico, in the community of scholars devoted to these topics—collectively referring to the IA-CAP (International Association for Computing and Philosophy) [32, 34]. A main engagement was within the first Computing and Philosophy Global Course, with Peter (Piotr) Boluc, Keith Miller and Vincent Müller, after the encouragement and co-ordination of Gordana Dodig-Crnkovic—all of them well-known scholars in this community. In the preliminary draft of the course description [26], Prof. Dodig-Crnkovic quoted a paragraph of Elio’s [32]:

The internal/external, observer/observed relationship is the basic concept of all virtual worlds... In SL [Second Life, authors’ note] 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 interaction between RL [Real Life, authors’ note] and SL.

This passage is an exemplification of the guiding principle of Elio’s research life: meta-reasoning, circularity, reflection over the object level in argumentation, the fallible solutions of classic paradoxes, oxymorons, the many-faceted values of negation in logic (and in life), as well as the enthusiasm for Escher’s painting, were all part of the same Promethean passion in research which characterized Elio’s love of Science and Life, from the past days of Reflective Prolog to the last days of Philosophy of Computing.

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References


8  Elio Lanzarone: a life for science


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