Obituary
Robert McNaughton
1924 – 2014

The scientific community receives with sadness the news of the death of Robert McNaughton, a pioneer of theoretical computer science who has shaped our field by his ingenious contributions reported in a large number of lucid and highly influential papers.

Bob McNaughton grew up in Brooklyn in New York City. His undergraduate degree is from Columbia University and his doctorate from Harvard, where his advisor was Willard Van Orman Quine. Several of his fellow Quine students became distinguished logicians: William Craig, Henry Hiz, Hughes Leblanc, John Myhill, and Hao Wang. Starting from his dissertation On Establishing the Consistency of Systems (1951), McNaughton's early work - often in collaboration with Wang - was devoted to set theory and problems of relative consistency. At the same time he made fundamental contributions to philosophy of mathematics (in Philosophical Review) and to the metamathematics of number theory (in Transactions of the American Mathematical Society).

In the late 1950's and early 1960's, at the Moore School of Electrical Engineering of the University of Pennsylvania, he turned to the theory of finite automata and regular languages. An influential paper with his Penn PhD student Hisao Yamada supplied a lucid treatment of finite automata in relation to regular expressions. In the 1960's, he moved to Rensselaer Polytechnic Institute, where he stayed until his retirement.

In the sequel McNaughton was one of the key researchers founding a classification theory of regular languages. This is documented by the monograph (with S. Papert) Counter-Free Automata, in which he tied the class of star-free languages to first-order logic, supplying also several other characterizations, e.g., in terms of permutation-free automata and reset-free nerve nets, and taking up also Schützenberger's Theorem on the equivalence between star-free expressions and group-free monoids. Further topics of this research were the notions of "loop complexity" of finite automata and their relation to star-height, and a characterization (with Kim and McCloskey) of the class of locally testable languages.

By the mid-sixties McNaughton had become an established name in four fields: philosophy, mathematical logic, formal linguistics, and computer science.

For many researchers, McNaughton is best known for his work on automata over infinite strings. In his landmark paper of 1966, Testing and Generating Infinite Sequences by a Finite Automaton, he demonstrated the central theorem of omega-automata theory, namely the determinization of nondeterministic Büchi automata by a transformation into deterministic Muller automata. Often this result is referred to as "McNaughton's Theorem". His ingenious construction motivated research that is pursued until today, aiming at reducing the number of states of deterministic automata and at unifying determinization with other constructions (such as complementation).

At the same time he addressed "Church's synthesis problem", which asks for a construction of a non-terminating finite-state transducer, given a specification of the desired relation between input stream and output stream. It was McNaughton who proposed to study this problem in the framework of infinite games, thus starting a development which has led to a fruitful and active branch of current theoretical computer science. McNaughton's proposal was first presented in a 1965 MIT technical report Finite-State Infinite Games. Also his later paper (of 1993) Infinite Games Played on Finite Graphs and his last contribution in this area, titled Playing Infinite Games in Finite Time (2000), were influential in developing this theory and motivating new approaches to solve infinite games.

Another important area of McNaughton's research, into which he entered in the early 1980's, was string rewriting systems (or Thue systems). One of the outcomes of this research, done together with his doctoral student P. Narendran and with F. Otto, was the concept of "Church-Rosser Languages" or "McNaughton Languages", leading to the JACM (1988) paper Church-Rosser Thue Systems

and Formal Languages. He also made contributions to the study of special string rewriting systems (where one side of the identities is the empty word) and to the termination problem for single-rule string rewriting systems.

Bob McNaughton was a great teacher. His PhD students include John Corcoran, Anthony Dos Reis, David Hannay, Robert McCloskey, Paliath Narendran, Gil Porter, John Spagnuolo, Robert Winder, and Hisao Yamada. For many other former students, among them Aravind Joshi and Samuel Litwin, he was an inspiring mentor and role model. His textbook Elementary Computability, Formal Languages, and Automata (1982) is a masterpiece in clarity, supplied with many brilliant exercises.

All those who knew Bob McNaughton will keep precious memories of him as a warm-hearted and generous person. The community of theoretical computer science will miss his pioneering leadership and masterful creativity.

John Corcoran, Paliath Narendran, Wolfgang Thomas