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IN MEMORIAM: WILLEM JOHANNES BLOK
1947–2003

Willem Blok died on November 30, 2003 from injuries sustained in an automobile accident earlier that day. Blok made deep and significant contributions to algebraic logic and universal algebra. He is especially known for his many innovative applications of universal algebra to the study of deductive systems. His groundbreaking work has shaped the development of several areas of mathematics.

He was born and educated in Holland. In 1973 he began his doctoral work with Ph. Dwinger as supervisor. In his thesis, on varieties (equational classes) of closure algebras, Blok put to use the then recent results of B. Jónsson on congruence distributive varieties, and of R. McKenzie on varieties of lattices and splittings in the lattice of all such varieties. With these tools he developed powerful methods for analyzing the subvariety lattices of many congruence distributive varieties. Thus the thesis, published in 1976, contains a wealth of new results on varieties of closure algebras and related algebraic systems.

In the mid 1970's he began exploring varieties of Heyting algebras and closure algebras and their connections to intermediate and modal logics. The techniques he had developed in his thesis could be used to settle various questions concerning, for example, the number of extensions (i.e., axiomatic strengthenings) of these logics. He also studied the degree of incompleteness of a normal modal logic, that is, the number of normal modal logics sharing the same class of validating Kripke frames. He proved the surprising and beautiful theorem that the degree of incompleteness of a normal modal logic is either 1 or $2^{\aleph_0}$. This dichotomy is sometimes called the Blok Alternative. This early work on modal logic shows his fascination with the exact connection between algebra and logic, a fascination that he maintained throughout his career.

In 1978 Blok spent a pivotal year as a postdoctoral fellow at the University of Manitoba. Here he met D. Pigozzi and P. Köhler, who were also visiting there, and they began joint work on algebraizable logics and on varieties with equationally definable principal congruence relations.

These investigations led to the well-known Blok and Pigozzi monograph *Algebraizable Logics*, which appeared as an AMS Memoir in 1989. This work

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presents and makes precise an 'algebraic counterpart' for a logical system. Here a deductive system S is algebraizable if its consequence relation $\vdash_S$ is essentially the equational consequence relation $\models_K$ of a quasi-variety K of algebras. If S is algebraizable, then K is uniquely determined. K is called the *equivalent algebraic semantics* for S. Blok and Pigozzi provide an intrinsic characterization of algebraizable logics in terms of an operator that assigns to each theory of S a congruence relation on the algebra of formulas. A main theorem here is that S is algebraizable if and only if this operator is one-to-one on the lattice of theories of S and also preserves directed unions. The result is wide-ranging in its applicability and has been especially useful when it comes to demonstrating that a logic is not algebraizable. Another major result, and one that shows a striking interplay between algebra and logic, is: If a variety K is the equivalent algebraic semantics for a logic S, then S has a deduction-detachment theorem if and only if K has equationally definable principal congruence relations.

Following the year at Manitoba, Blok continued to live in Canada, holding positions at Simon Fraser University and the University of British Columbia. In Vancouver he met his wife Mary. In 1982 they moved to Chicago where he joined the Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago. He remained on the UIC faculty for the rest of his career.

In Chicago, a steady stream of PhD students, post-doctoral fellows, and visitors came to work with him. He in turn visited many other institutions as he was frequently invited to give workshops and lecture series all over the world. He also held extended visiting positions at the University of Canterbury in 1989, at the University of Natal in 1997, and at the Institute for Logic, Language, and Computation in Amsterdam in 1998.

In recent years Blok worked in several areas. He continued to explore algebraizability. He investigated general problems in universal algebra such as the structure of free algebraic systems and algebraic properties of quasi-varieties. Since 1990 his research also focused on residuated ordered algebraic systems. These algebras appear in the algebraization of a diverse collection of logics, e.g., relevance and entailment logics, many-valued logics, linear logic and other substructural logics or resource conscious logics. He settled many open problems here, especially those dealing with finite embeddability and decidability.

Blok, through his published work but also through his many personal contacts, played a central and influential role in the fields in which he worked. He authored more than fifty publications; these papers include landmark contributions to modal logic, abstract algebraic logic, and residuated ordered structures. He significantly transformed the direction of research in these areas.

Blok's cheerful demeanor and warm personality were appreciated by all who knew him. He was an engaging conversationalist; discussions with him had a lively give and take and were often enlightening. The wide range of his interests, and the intensity with which he pursued them, is another memorable characteristic. A talented violist, he played regularly in string quartets in the Chicago area and was known for the sensitivity of his playing and the depth of his musical knowledge. Birding and travel were two other passions and were often combined in the many trips that he took to exotic places. Thus he made several expeditions to Alaska in which he and a companion would be dropped off in the wilderness by a bush pilot. There they would canoe alone, for weeks at a time, to the shores of the Arctic Ocean.

The vitality of the man and the intensity and enthusiasm he brought to everything that he did only magnify the sense of loss caused by his sudden and tragic death at age 56.

JOEL BERMAN