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IN MEMORIAM: KENNETH JON BARWISE
1942–2000

Jon Barwise died of colon cancer on March 5, 2000, in full stride of his remarkable career as a wide-ranging and energizing contributor to mathematical logic and its applications to language and information. With his longtime collaborator and friend, John Etchemendy, he developed computer-based methods for the study of logic[1], for which they shared the 1997 Educom Medal. Among other honors, in 1992 Barwise received an Honorary Doctor of Science degree from the University of Pennsylvania, and in 1999 he was made a Fellow of the American Academy of Arts and Sciences. At the time of his death he was Vice-President of the Association for Symbolic Logic.

On his web-site at Indiana University, Barwise offered advice for doing research, beginning with the following:

> When Abraham Robinson turned fifty, a much younger me asked him to what he attributed his unusual productivity as a mathematician. He replied: *I've made it a policy to move every five years, either physically or in my research.*

Whether he took that to heart or it was a natural proclivity, Barwise made that his own *modus vivendi*. Following his studies at Yale (B.A., Philosophy and Mathematics, 1963) and Stanford (Ph. D., Mathematics, 1967), he was to hold academic positions at Yale, Wisconsin (twice), Stanford (twice), and, finally, Indiana where in 1990 Barwise became the College Professor of Philosophy, Computer Science, and Mathematics. Between times he held visiting positions at UCLA (twice), Stanford, Oxford, and the Center for Advanced Study in the Behavioral Sciences near Stanford (twice). On his web-site [`http://www-vil.cs.indiana.edu/kjbpubls.html`] Barwise lists fifteen books and some ninety articles, the latter conveniently categorized into the areas of Infinitary Logic, First-Order Model Theory, Generalized Quantifiers, Admissible Sets and Generalized Recursion Theory, Situation Semantics and Philosophy of Language, Information Theory, Logic with Diagrams, and Miscellaneous. He had twenty-one Ph. D. students, and helped create and lead several programs and institutes. How did he manage

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[1]Of this work, Etchemendy wrote, "Jon always said that he considered his most important contribution to logic to be his development of new teaching techniques and methods."

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to do it all? Part of the answer, aside from his exceptional intellectual gifts and energies, was Barwise's unusual ability to stimulate and engage others in his various projects; to quote Etchemendy, "he was a one-man conspiracy to make the world into one big collaboration—a place where everyone was as open and generous as he was."

Jon was born in Independence, Missouri, on June 29, 1942, to Kenneth T. and Evelyn Barwise, and evidenced precocity and wit with his creation of $\overline{\text{YY}}$ as the logo for the family name. When he came to Stanford as a graduate student he was rather shy, he stuttered and his first steps were hesitant, but as he grew in confidence all but the stutter disappeared. The 1960s were exciting times in the field of mathematical logic; many faculty, students and visitors were involved and unprecedented interactions developed between the major areas of model theory, set theory, recursion theory and proof theory. Barwise's dissertation ***Infinitary logic and admissible sets*** directed by the undersigned, and influenced also by his studies with Georg Kreisel and Dana Scott, stood out as a paradigm example of this confluence. Years later, Barwise wrote some lively reminiscences in [1996b].

In his thesis Barwise established generalized completeness and compactness theorems for the fragments L_A of $L_{\infty,\omega}$ for countable admissible sets A. The beautiful Barwise-Gandy-Moschovakis (BGM) theorem ([1971]) characterizing the structure of the next admissible set A^+ over a given A, was established during Jon's post-doctoral visit to UCLA. His first regular position was at Yale, as Assistant Professor of Mathematics from 1968 to 1970. There his interaction with Abraham Robinson and Paul Eklof led to a brief concentration on the model-theoretic side of logic; with them he wrote interesting papers on model-theoretic forcing and applications to algebra of the model theory of $L_{\infty,\omega}$ respectively.

In 1970 Barwise became Associate Professor of Mathematics at the University of Wisconsin, and had his first Ph. D. students. Meanwhile, Barwise's work on admissible sets continued to progress, and he arrived at the system KPU of Kripke-Platek set theory with urelements taken to be the domain of a structure M, as providing the proper general framework to present the BGM theorem and other central results. In particular, for $M = \langle A, \in \rangle$ with A admissible, the least model M^* of KPU containing M as a member is simply $\langle A^+, \in \rangle$. The book ***Admissible sets and structures*** [1975], completed at Oxford, is built around this approach to logic and definability on admissible sets. It is still the standard reference for its subject, as much for the quality of its exposition, with its frequent light and humorous touches (cf., e.g., the recipe on p. 69 which calls for raisins or "other urelements"), as for its rich content bringing set theory, recursion theory and model theory together.

At the end of the Preface to [1975], Jon thanked his family for their patience, above all his wife, Mary Ellen, saying "on this our eleventh anniversary, I promise to write at most one book every eleven years." Breaking that promise right away he thereafter authored, coauthored, edited or co-edited an average of one book every 1.67 years! The first was ***The handbook of mathematical logic*** [1977], the mother of all handbooks in logic and related fields.

Stimulated as much by his love of literature as by philosophical questions about the source of mathematical notions expressed by strong logics, Barwise began to shift his attention to generalized quantifiers, first in mathematical and then in natural languages. Returning to Wisconsin from a second visit to UCLA, he met the linguist, Robin Cooper, who was very helpful in guiding him through the confusing literature and ideas in linguistics relevant to his interest in natural language semantics. Their work together resulted in a fundamental and oft-cited paper [1981] on generalized quantifiers in natural language (e.g., "most", "many", "two", etc.).

At that time, for linguists interested in a formal treatment of natural language meaning, the only serious candidate was the higher-type possible-world semantics of Richard Montague. Barwise saw problems with that approach, and began by investigating the so-called naked infinitive (NI) perceptual reports which Montague semantics did not handle (e.g., "Jack saw Jill fall down"). A key part of his ideas are that scenes, and situations more generally, are to be represented as partial structures; for, as he wrote, "what we see are limited parts of the world." Returning to Stanford in 1979, Barwise began an increasingly significant working and personal relationship with John Perry, whose specialties include the philosophy of language. The ground-breaking ***Situations and attitudes*** [1983] was the major result of their collaboration; it motivated and outlined the proposed new situation semantics for natural language. Meanwhile, Barwise and Feferman were engaged as co-editors of ***Model-theoretic logics*** [1985]; in his introductory chapter to that volume, Barwise made a strong pitch for an ecumenical view of logic which increasingly colored his research activities.

He returned to Wisconsin in 1981, but was soon attracted back to Stanford to become the first director of the Center for Study of Language and Information (CSLI), an institute designed to bring together researchers in linguistics, philosophy, computer science and neighboring fields. Much of the group research that he led in the early years of CSLI lay in settling the foundations of situation semantics and expanding it to a more general situation theory as a tool "to understand meaning and inference within a general theory of information, one that takes us outside the realm of sentences and relations between sentences of any language, natural or formal." ([1989], p. 37). This became one of Barwise's central preoccupations for the rest of his life, and with its extensions to visual inference and other forms of heterogeneous reasoning (as in [1995]), represents more than half his publications. A continued tangential interest was in the use of non-well-founded set theory to model circular phenomena ([1996a]).

Besides the Vice-Presidency, the ASL benefited greatly from Barwise's energies and ideas over the years, first as Secretary from 1975–1978, then as member of the Executive Committee for 1984–87 and 1994–97. He was slated to give the tenth Gödel Lecture, "Tarski and Etchemendy on logical consequence," at the meeting ASL 2000 held in Urbana at the beginning of June, 2000. Regrettably, he left no text for it other than a very brief abstract, dictated four days before his death.

Adventurous, restless, always ready to take on new projects, from remodeling houses to building research institutes to learning to fly, when Barwise was diagnosed with colon cancer in January, 1999 he began to investigate all aspects of his disease and its possible cures: by conventional or alternative medicine, diet, meditation and prayer. This took him on unexpected intellectual, physical and spiritual journeys; typically, he wrote a long series of moving e-mail reports to a large group of family and friends, describing his experiences, thoughts and feelings. New ways of dealing with his disease and new avenues of expression opened up for him at the Ting-sha Institute in Inverness, California where he went for a week's retreat in November, 1999. There he took up painting for the first time, and his striking efforts are available for all to appreciate at the website `http://www-vil.cs.indiana.edu/Jon's_Gallery.html`; there, too, one can find a link to poetry he wrote telling of his treatment and his alternating hopes and fears. For those who knew him little or not at all personally, it is still possible to make contact with him through these sources and to begin to understand how deep is the loss we have all suffered.

SOLOMON FEFERMAN

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