



History of Computing Collection

Personal Reminiscences

Roger Hindley

Logic in the 1960s and 70s at Swansea University

Here are some notes about logic in Swansea University in the 1960s and '70s; they are as coherent as I can manage at a distance of over 30 years.

I started at Swansea's Pure Mathematics Department on 3rd September 1968. The head of that department, Professor Jeffrey Weston, was interested in the foundations of his subject and in promoting expositions that were rigorous, one might even say pedantic, and perhaps believed that having a logician on his staff would help encourage this approach.

Before 1968, Swansea already had two lecturers in the Philosophy department with interests in formal logic. Hugh S. Price had done extensive reading in logic, including modern logic and Wittgenstein, although I think his main interest was the Greeks. Peter Robertson, whose background was in Applied Mathematics, had a side-interest in the foundations. Both of these later attended and spoke at seminars in which I was involved, as did also Ralph J. Cook of the Pure Mathematics department, an algebraic geometer with a side-interest in logic.

The mathematics library in Swansea was well supplied with modern logic books and journals. This was partly due to Jeffrey Weston, but probably also to the second professor of Pure Mathematics, Gabriel Dirac, a controversial personality who resigned in 1968 after much trouble. (Dirac knew Georg Kreisel, by the way.)

In 1967 the Computer Science department was founded. Its head was Professor David C. Cooper, whose interests included computability theory. David Cooper obtained finance for a research group for 3 years from 1968. Its members were Robin Milner, Malcolm Bird and Martin Weiner, and they were assisted by a programmer, Ann Pleasants, who commuted from Cardiff, where her husband was a lecturer in mathematics.

At the end of 1970 Robin Milner moved to Stanford university, and his later achievements are now well known (F.R.S. 1988). In 1971 Malcolm Bird became a lecturer at Westfield College, London, having solved a then well-known decision problem, see [Bird73]. Martin Weiner left the academic world at about the same time.

In September 1968 I was joined in Swansea by Bruce Lercher, of the State University of New York at Binghamton, who came for a year's sabbatical, and Jonathan P. Seldin, who joined the Mathematics staff as a temporary lecturer. We worked on various problems in combinatory logic, and gave a series of lectures on lambda-calculus and combinators which was published as [HLS72] and later evolved into the textbook [HS86].

A very intermittent seminar was run on logic and theoretical computing; talks were given by several of the above people.





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Some examples:

- 1968, Sept. 23: Martin Weiner, on Henkin's 1950 paper on the completeness of type theory.
- 1969, April 24: Haskell Curry, on set-theory based on combinators.
- 1970, April: Malcolm Bird, on McCarthy's theory of computation.
- 1970, April: Robin Milner, on the theory of programs in Engeler's 1967 paper "Algorithmic properties of structures".

Also in the 1970s, Swansea was the venue of two one-week Lambda-calculus conferences. The first, in 1974, was very informal, and few records remain. The second, in 1979, was reported in the E.A.T.C.S. Bulletin, [Lam79,1] and [Lam79,2]. Reports and photograph accompany this note.

Courses

In 1968, the Computer Science department did not yet offer degree courses, but David Cooper and I began to teach a full-year course of two lectures per week for the final-year Pure Mathematics students: "The Mathematical Theory of Computation". (Syllabus accompanies this note; the course was taught in only 2 years: 1968—69 and '69—70.)

On 2nd December 1968, the Science Faculty approved a Computer Science lecture programme for first-year students, to start in 1969.

From 1970—71 onward, David Cooper and I taught separate full-length courses to the final-year students, each in his own department.

Syllabus of Final-year logic course syllabus (Pure Maths. Dept., 1970—71, 40 lectures)

Introduction (paradoxes, philosophy, history, mathematical tools). Propositional logic semantics (truth-tables, functional completeness theorem, equivalences, conjunctive and disjunctive normal forms, Boolean algebra, switching-circuits). Propositional logic proof-theory ("natural deduction" rules, constructing deductions, soundness and completeness theorems proved). Predicate logic proof-theory (first-order languages, "natural deduction" rules, constructing deductions, provable equivalences, prenex formulae, first-order theories, Peano





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arithmetic). Predicate logic semantics (interpretations, satisfaction, models, universal validity, soundness and completeness theorems proved, Löwenheim-Skolem theorem, compactness theorem, a non-standard model of arithmetic). Gödel's incompleteness theorems (outline proof of unprovability of consistency, limitations of formal reasoning).

An advantage of being the only logician in a mathematics department is that one's colleagues will not criticise what one teaches. A disadvantage is that one must continue teaching it year after year! However, in some years the above syllabus was replaced by a course on the Foundations of Mathematics (axiomatic set theory, cardinal and ordinal numbers, axiom of choice, etc.)

In the 1970s, besides logic-oriented activity in the Computer Science department, the Pure Mathematics department put on a seminar-series on Category Theory, given by Francis W. Clarke, Derek A. Waller and Ralph Cook, and a lecture-series on Cohen's independence proof, by myself.

Finally I should mention three impressive Ph.D. graduates in logic: Christopher Harding (1976; topic: forcing in recursion theory; subsequently research engineer in industry), Choukri-Bey Ben-Yelles (1979; type-assignment in lambda-calculus, including a counting-algorithm; subsequently department head in the University of Algiers), and Bhavani Thuraisingham (1979; priority methods applied to system functions and their decision problems; subsequently Fellow of I.E.E.E. and B.C.S., I.E.E.E. Computer Society technical achievement award 1997, currently Professor in the University of Texas at Dallas).

In the 1980s, logic's presence in Swansea was maintained mainly by the Computer Science department (which JVT knows about!) and myself. But support was also given by some of the above-mentioned, and by two lecturers in what later became the European Business Studies department, who had earned Ph.Ds. in logic at Oxford: Alan Prys-Williams and Assad Jalali-Naini.

Roger Hindley 5 July 2008

References

[Bird73] M. Bird "The equivalence problem for deterministic two-tape automata", *J. Comput. Syst. Sci.* 7(2) (1973), 218–236.

[HLS72] J. R. Hindley, B. Lercher, J. P. Seldin "Introduction to Combinatory Logic", Cambridge University Press, London Math. Soc. Lecture Notes Series no.7. 1972.





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[HS86] J. R. Hindley, J. P. Seldin “Lambda-calculus and Combinators, an Introduction”, Cambridge University Press 1986, new edn. 2008.

[Lam79,1] “Lambda-calculus conference, Swansea 1979”, “Open problems, Swansea lambda-calculus meeting”, Bull. EATCS 10 (January 1980), 134—140.

[Lam79,2] “Abstracts of talks of Swansea lambda-calculus meeting 79”, Bull. EATCS 11 (June 1980), 118—144.

