LOGO: a serious language

Brian Harvey has a long connection with Logo: he was part of the team that developed the original Apple Logo, and then the Atari Logo cartridge. He was also active as a writer; even after seven years, his 'Why Logo?' in the August 1982 issue of Byte makes good reading, and he has been a teacher of computer science and Lecturer in Media Technology at MIT. His doctoral dissertation was in Science and Mathematics Education.

With that background, it was natural that he should write the three volume series Computer Science Logo Style, although one could be forgiven for wishing that they had appeared some years earlier. Harvey’s aim throughout was to enable people, not just students, to learn some of the fundamental ideas of computer science in an entertaining manner.

The first volume is subtitled Intermediate Programming, and is aimed at older high school students. Unlike most Logo books, Harvey’s is almost devoid of graphics as it introduces the concepts of procedures, variables, predicates, planning and debugging, as well as the notion of recursion vitally important in Logo. Harvey provides four Chapters 5, each explaining recursion from a different perspective: the combining method, the ‘little people’ method, tracing, and the ‘leap of faith’ view.

There are no formal exercises at the ends of chapters. As Harvey explains, he dislikes such a ‘school-like atmosphere’, preferring to ask questions like ‘What do you think would happen if you tried such and such?’ Harvey’s teaching style may well raise a few eyebrows. In an appendix headed ‘Hints for Teachers’ he writes ‘...after about two hours of instruction I just sit in back reading the newspaper and waiting for someone to ask a question.’ (p 306)

Throughout, Harvey promotes the ‘programming by exploration’ approach, rather than formal top-down and bottom-up methods. He clearly follows the ‘Programs are for people to read, and only incidentally for machines to execute’ dictum of his mentor, Hal Abelson. Logo and English illustrate each other.

Volume 2, Projects, Styles, and Techniques, follows the same readable and conversational style. There are ten projects or case studies, ranging from cryptography, through games (tic-tac-toe and solitaire), to pattern matching, with a version of Weizenbaum’s ‘Doctor’. Along the way there is some mathematics (Fourier transformations and Diophantine equations) and some programming utilities. The successive projects show increasing complexity: the version of ‘Doctor’ for instance being much more refined than the simplistic version in Abelson’s Apple Logo, in fact it is so complex that it had to be shortened to work as an Apple Logo // version.

The subtitle Advanced Topics for the third volume means what it says; this is university level computer science. Harvey begins with automata theory, along with discussion of algorithms and data structures. Harvey does not prove Kleene’s theorem by mathematical induction, he uses a Logo program to translate regular expressions into finite state machines. The final program is a version of a well known AI program, Daniel Bobrow’s ‘Student’, which solves mathematical problems posed as English sentences.

The central portion of the volume is a discussion of program language design and implementation, with Logo and Pascal being critically compared. Each volume concludes with appendices comparing various versions of Logo and noting any changes that may be needed to make the programs work. As well, the programs for Volumes 2 and 3 are available on disk for Apple Logo //, IBM Logo and Macintosh Logo.

Considering the size and complexity of some of the programs, they are a good investment, and in a school situation they may be copied freely.

In the Introduction to Volume 3 Harvey writes ‘I’ve tried to discuss the concerns of theoretical computer science by using the language of concrete Logo programs that embody those concerns. This is an ambitious goal and I’m not sure how well I’ve succeeded.’ I think he succeeds brilliantly. Volume 1 should be read by all computing teachers in high school, primary school even, and Volumes 2 and 3 by those teaching senior high school through to tertiary level.

Harvey, B Computer Science Logo Style: Intermediate Programming, MIT Press, 1985
Harvey, B Computer Science Logo Style: MIT Press, 1986
Harvey, B Computer Science Logo Style: Advanced Topics, MIT Press, 1987