From Theory to Practice: The Invention of Programming, 1947-51

Martin Campbell-Kelly
Warwick University

Abstract. This paper describes the development of programming for the EDSAC computer at Cambridge University, beginning in 1948 and culminating in the publication in 1951 of the classic *Preparation of Programs for an Electronic Digital Computer* by Maurice Wilkes, David Wheeler and Stanley Gill. The relationship to earlier programming studies conducted by Herman Goldstine and John von Neumann during 1947-1948 at the Institute for Advanced Study, Princeton University, is discussed. The subsequent diffusion of the Cambridge programming system and its influence are described.

Prolog

It is difficult to reconstruct how one came to choose a direction in life, a particular degree subject or profession. I think this is because big decisions are the result of many small events, some more memorable than others. For me, the most significant event putting me on the road to computer history occurred when I was cramming for my finals as an undergraduate in computer science at Manchester University in 1969. I was working in the Radcliffe Library and happened to come across an obscure, to me, book called *The Preparation of Programs for an Electronic Digital Computer* by Wilkes, Wheeler and Gill (1951). The book was about the programming regimen devised for the Cambridge University EDSAC. It was rather like looking at computing from another civilization, almost another planet. The book was clearly about programming, but not as I knew it. Well—my finals had to take priority and I re-shelved the book. But I never forgot it.

A few years passed and I eventually ended up as a senior lecturer at what was then Sunderland Polytechnic. In those days—it was 1976—computer science graduates were thin on the ground, so it was possible to get a job in an academic department without a higher degree. The Polytechnic, which had aspirations to improve its academic standing, had the enlightened policy of encouraging staff to pursue a PhD degree on a part-time basis. I leapt at the opportunity, and after some deliberation about whether I should do something relevant I decided to pursue the irrelevant—a PhD in the history of computing. It turned out to be not irrelevant at all.

But first, I needed a supervisor. By a life-changing stroke of luck, Newcastle University was just 15 miles up the road from Sunderland, where Professor Brian Randell had recently published *The Origins of Digital Computers* (1973). The book was an instant classic and I recognized it as such. I was quite nervous about approaching Brian, but he invited me for a talk and instantly put me at my ease. We agreed almost immediately that a study of the early development of programming...
would be a great topic, and that I might start with Wilkes, Wheeler and Gill. Brian agreed to be my supervisor and for the next four years we met for the statutory minimum of five times a year. Not much more than 20 hours contact time over that period I suppose. The gist of almost every meeting was “very good—carry on.” Brian was a model supervisor: he never got in the way when things were going well. And they went well practically all of the time. From our first meeting I never looked back.

If that sounds as though Brian did not have much influence on me, far from it. Left to my own devices I don’t think I would have done very well. My heart was in the right place, but I had not a clue about academic rigour, sources, or historical method. Brian was not one to lecture a person, but he was plain speaking and I seemed to pick up a great deal by osmosis besides. It amazes me still that Brian, with no formal training, had such an unerring instinct for doing history. He always called himself an amateur, but I think this may have been a foil to deflect potential criticism; there was never any need. Whenever I made contact with one of my living sources, they already knew who Brian was, had an enormous respect for him, and opened their doors and minds to me.

I submitted my dissertation in June 1980, and Brian asked Maurice Wilkes if he would be my examiner. The fact that Brian asked, and Maurice agreed, gave a terrific boost to my confidence. The examination, which was held in Maurice’s office in the Computer Laboratory at Cambridge University, happened to take place on the same day as a celebration for Maurice’s retirement from the university. He had led and shaped the laboratory for more than half a century and the computer science glitterati was there in number to wish him well. It was quite a day.

A study of the EDSAC programming system was the cornerstone of my dissertation. Brian’s festschrift gives me the motive to look back critically, after an interval of thirty years. How did I—or perhaps we—do? One thing is very clear: the world has moved on. In the 1970s Brian and I made up a good fraction of the active computer historians in the world. Today, there are at least a hundred scholars around the world whose primary avocation is the history of computing, and several research centres and museums have come into existence. The discipline had also matured remarkably: there are new sources, new perspectives, new historical approaches, and dozens of research quality monographs on all aspects of the subject. Looking at my dissertation it seems very much of its era—a product of the 1970s, rather thin on secondary sources, and somewhat “internalist” by today’s standards. Well, fashions in history change and things may look better or worse in thirty years time. However, of one thing I feel sure: thanks to Brian, the facts and the rigor are rock solid.

This paper hints at how I might do things differently if I were starting again. Perhaps I would be a little less of an internalist and I would benefit from the many new secondary sources that have appeared. But I could never hope to match the sparkle of the sea of discovery that Brian sent me out on in 1976.

1 Introduction

The developments described in this paper are bracketed by two documents. The first is Planning and Coding Problems for an Electronic Computing Instrument written by Herman H. Goldstine and John von Neumann (1947-48) at the Institute for Advanced