Lean, Tom. "Computer Literacy." *Electronic Dreams: How 1980s Britain Learned to Love the Computer*. London: Bloomsbury Sigma, 2016. 89–114. *Bloomsbury Collections*. Web. 26 Apr. 2023. <<http://dx.doi.org/10.5040/9781472936653.0007>>.

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Computer Literacy

In January 1982, millions of people across Britain tuned in to watch the first episode of a new BBC television series: *The Computer Programme*. What was this thing called information technology, why was it suddenly important and what should people know about it? asked presenter Chris Serle as the show began. For the next 25 minutes viewers found out, through an eclectic mix of material that included everything from data processing centres and online booking of plane tickets to Stonehenge and an old lady's computerised sweet shop. In the best traditions of the BBC it was informative, entertaining, educational and very much intended as a public service.

Back in 1978 the stark warnings of the BBC documentary 'Now the Chips Are Down' had helped to start a debate on what microprocessors and widespread use of information technology would mean to Britain. It had also raised awareness of how limited understanding of these new technologies was and how unready the nation was to make the most of their opportunities. *The Computer Programme* was part of the BBC's answer to the 'challenge of the chip', but it was just one element of a much grander plan. The BBC's Computer Literacy Project was a far-reaching scheme of television and radio programmes, books, a BASIC programming course and even a tie-in home computer. The idea behind this comprehensive effort was to demystify information technology for the public and to encourage people to have a go at computers for themselves.

The Computer Literacy Project was wide ranging, but was just part of an even larger campaign waged by the British state to cajole Britain into the computer age. As we will see several times in this story, information technology held ideological attractions to the Conservative government of the day. When

Margaret Thatcher came to power in 1979, large parts of British industry were still owned and run by the state, such as British Leyland, British Coal and British Aerospace. To critics on the right wing of politics, state industries were bloated bureaucracies, dominated by unions, unproductive and unable to adapt to new conditions. By contrast, many of the companies making the information technology revolution happen were innovative and enterprising small firms, run by entrepreneurs. Clive Sinclair's business success over the early 1980s was all the more marked because the demise of Sinclair Radionics in the 1970s was associated, to an extent, with the heavy hand of state control via the National Enterprise Board. 'Let the vision of the inventor, and the flair of the businessman, create the wealth and jobs of tomorrow,' declared Thatcher in a 1982 speech on information technology, in which she praised home computers as an innovation stemming from personal initiative.¹ The sudden success of entrepreneurial British computer companies was symbolic of the prosperity claimed to be achievable for the enterprising and technology-savvy in Thatcher's Britain. Yet there was more to this interest in information technology than mere political spin.

Just as *The Mighty Micro* and 'Now the Chips Are Down' had brought the microprocessor revolution to public attention at the end of the 1970s, various advisory bodies were reporting to the government on the subject. Of particular concern were the economic effects of computerisation and that British businesses and workers were unprepared for the mass use of information technology and automation. In the wake of 'Now the Chips Are Down' the Manpower Services Commission, responsible for employment and training across Britain, asked the BBC to report on the impact of information technology and microelectronics. 'A couple of us went round looking at various countries and what they were doing about micro electronics,' recalls David Allen of the BBC's Continuing Education Department. 'Around the world there were a lot of people, especially in education and in trade unions, who were really worried about computing. They were worried about what it

was going to do to employment – particularly to middle-ranking white collar jobs, such as clerks. They were worried it was going to be in the hands of an elite and imposed on people. The Germans were calling the chip the job killer.’ While there were opportunities for new industries and services built on the new technologies, travelling around other developed nations, such as Japan, Sweden and Germany, it was clear that Britain had fallen behind in adopting microelectronics. ‘We had some interesting visits to Japanese factories that were absolutely terrifying,’ remembers Allen. ‘You could see massive factories full of computer-controlled machine tools being used to speed up and improve production, and being exported to every other country in the world rather than here. There were ubiquitous robots when we had almost no robots in British industry at all.’

The BBC report painted a worrying picture of the microelectronic future.² In the paperless office a few electronic word processors might replace the typing pool, data banks reduce the need for filing clerks and information systems strip out layers of middle managers. Manufacturing jobs that required experienced craftsmen could be deskilled by computer-controlled tools. Traditional jobs would be lost on a large scale and workplaces disrupted by the shift to a more efficient and faster moving economy. The sum of all these changes might be a polarising effect. Society could become split between a prosperous and technology-literate, elite and the second class citizens who were left behind. At the extreme, information technology threatened to turn Britain into a dystopian society of technological haves and have-nots. The best way of avoiding it was seen to be making people aware of the opportunities of new information technology and educating them in its use.

Meeting the challenge of the chip

From the late 1970s, policymakers were advised that people needed to be taught not to fear information technology, but to understand and exploit it.³ With a suitably skilled workforce,

the potential microprocessor crisis could become a chance for national economic renewal; Britain could benefit from this new industrial revolution rather than be overwhelmed by it. Before the 1970s were out the Labour government had already started to lay the groundwork for the first technology literacy schemes. The effort started from the top, with the Microelectronics Application Programme (MAP) aimed at alerting business and industry leaders to the possibilities of microprocessor technologies. After Margaret Thatcher's election in 1979, the scope was widened and the profile raised as schemes targeted groups across society. Headlining the Conservative government's commitment to making the nation computer literate was the creation of a minister for information technology, initially Kenneth Baker, to show that the government was taking the challenge of the chip seriously. Baker, occasionally referred to as 'Mr Chips' in the press, became the public face of a wide-ranging set of information technology education schemes and a dedicated supporter of computer literacy.

The political and economic backdrop to the computer boom was a concerted effort by the state to convince the British public to stop worrying and love information technology. Highest in profile of the government's efforts was declaring 1982 as Information Technology Year. IT82 was marked by events across the country to promote appreciation of information technology's benefits and possibilities. Conferences were arranged for targeted audiences on such subjects as business efficiency and computer-aided design. Exhibitions showcased computing in different environments, such as the home, health care, banks and offices. There were even IT82 commemorative stamps featuring past information technologies, such as hieroglyphics, alongside such modern wonders as electronic bar code readers and personal computers. Much of the effort of IT82 was aimed at businesses and industry, but its value was probably in fuelling a wider feeling that information technology was the next big thing and in raising awareness. At the start of 1982, only two in ten people

had even heard of information technology, according to a Margaret Thatcher speech at the end of IT82. That IT82 raised this figure to six out of ten was presented as a great success.

While IT82 was largely a flag-waving exercise, more comprehensive and systematic computer literacy efforts were directed at other groups in society, especially at children. In particular, the Microelectronics Education Programme provided the resources and expertise to equip schoolchildren with the skills widely thought needed for future workplaces where microelectronic devices were widespread. Yet few schools actually had computers to instruct pupils with. To meet the shortfall, the Department of Industry ran *Micros in Schools*, a scheme to pay half the cost of computers for schools, provided they chose a machine from an approved list. As the only computers on the list were from British companies, it was also used as a way of boosting British industry. The original aim was to provide a micro in every secondary school, a rather symbolic political gesture given the dozens of pupils who would need to share it, but it still gave many children their first glimpse of a real computer.

While the schools schemes safeguarded a computer-skilled workforce for the future, other programmes addressed more immediate skills shortages. The Manpower Services Commission, for instance, helped to set up 170 Information Technology Education Centres (ITEC) by 1986 to retrain people to get computing jobs.⁴ It was no coincidence that many were located in areas of high unemployment. Media reports of the ITECs invariably seemed to feature unemployed teenagers making good, emphasising how they had secured better futures by learning about computers.⁵ To a large extent, the government's support for encouraging understanding of computers was motivated by a view of information technology as a driving force of future economic prosperity. Computer literate youngsters would become productive future workers in the new high-tech society brought about by the information technology revolution. However, most of the population fell outside the direct reach of the government's schemes. With a

revolution imminent, Britain at large needed to be educated too. 'There is a much bigger problem of trying to familiarise people in their twenties and thirties with all this,' lamented Kenneth Baker to the Parliamentary Education, Science and Arts Committee in 1981, 'how do you reach them?' The task of educating the British population at large about information technology would fall chiefly to the BBC's Computer Literacy Project.

Computer programs on television programmes

The Computer Literacy Project fitted well with the government's plans, but it began as a largely independent initiative within BBC Education. The BBC was in a uniquely qualified position to encourage Britain into the information age. Foremost, it was a public service organisation with worthy aims to educate and inform the British public. After stirring interest with 'Now the Chips Are Down', and advising the Manpower Services Commission on microelectronics, groups within the BBC were well aware of the issues raised by information technology. 'There was a feeling that this was something important that was coming along which might effect everybody,' remembers David Allen, project editor of the Computer Literacy Programme. 'We ought to do something about it, and we ought to do something systematic about it for the public as a whole.' The BBC also had a strong background in educational broadcasting. Most pertinently, in the 1970s the BBC Adult Literacy Programme had provided a model for how a nationwide education scheme could work. This combination of learning materials, helpline and television, including a motivational drama starring Bob Hoskins as a removal man who was learning to read, had proved an effective way of encouraging illiterate adults to overcome their frustrations and fears. The Computer Literacy Project aimed to do the same for computing.

The BBC was well positioned for a nationwide educational scheme, but computer education was a new and unfamiliar topic. 'We were starting from absolute scratch,' explains Allen.

'We knew nothing about the subject, but some of us had got hold of early home computers and started to learn to use them. We were just reasonably intelligent graduates working as producers, so we were dependent on the people we could find to advise us.' As a precursor to the project, the 1980 awareness raising series *The Silicon Factor* and 1981's *Managing The Micro* helped producers start to understand the new subject. However, they also consulted widely, discussing their ideas with experts from the computer industry, government departments, universities, schools and elsewhere. As well as pulling together ideas from this web of experts about what people *should* know about computers, the BBC set out to discover what the public actually wanted to know about them. A pilot episode was screened to potential viewers, who were extensively questioned about their attitudes and knowledge of computers. The potential audience was revealed to be anxious about computers, but could also see their advantages and wanted to learn more. Some were technically engaged and wanted detailed information, but the majority just wanted a general introduction to what computers were and what they could do. Accordingly, the tone of *The Computer Programme*, the television series at the heart of the project, was set as a gentle introduction to take the mystery out of the machine.

Explaining the technical subject of computing to millions of computer illiterates was not going to be easy. The archetypal education programmes of the time were the *Open University* lectures, broadcast at obscure hours on BBC2 and typically featuring bearded academics trying to explain complex subjects with the aid of stock footage and diagrams. BBC Education also produced programming for more general audiences, broadcast in a variety of time slots on both BBC1 and BBC2, *The Computer Programme* was more in this mould, and had to reach out to much wider audiences than those typical for educational programming. It could not just be informative. It had to be engaging and accessible too.

The Computer Programme's creators went to great and sometimes unusual lengths to catch viewers' attention. Each

episode focused on a particular topic, such as computer programming or data storage, but was far from a lecture. Viewers were led step by step through an extended montage of sequences that explored and explained the week's topic in entertaining fashion. How computers followed instructions, for example, was explained via a tooting Victorian steam organ, a beeping 1960s mainframe computer, soldiers on parade, computerised machine tools and studio discussions between the presenters. It was varied and entertaining, using familiar and old-fashioned technologies to explain very new ones. In spite of the importance and urgency of its message, the programme did not take itself too seriously. One episode features a presenter dressed as a cowboy, moseying through a fake Wild West town explaining the impact of the telegraph, as a lead-in to explaining networking. In another we see the show from the point of view of the computer as it looks out of its screen at the presenters as they explain how it works. This light touch was key to *The Computer Programme's* appeal, particularly the interaction between the main presenters: computer expert Ian 'Mac' McNaught-Davis and curious novice Chris Serle. Each week the slightly confused looking Serle asked questions it was thought the audience wanted answered, and the sage-like Mac patiently answered them. It was a simple but effective double act, which used good-humoured banter to make computing less threatening.

Gentle though its explanations were, *The Computer Programme* did not shy away from the impact computerisation would have on the world, showcasing the use of computers in workplaces. It was often cutting edge material at the time. 'In each programme we went out to try and find people using machines to show the way they were using them in their business or in all sorts of things, and not just personal computers,' recalls David Allen. 'There weren't necessarily that number of people out there using personal computers already, so it was quite difficult to find interesting stories.' At least part of each episode would feature Mac and Serle sitting at a computer in the studio trying something related to the

week's topic. Behind the scenes, it took much effort to get the computers working properly amid the stray electromagnetic fields and hot lights of the studio. However, it was a useful way of converting abstract concepts into activities that viewers could picture doing themselves, and for relating the wider world of computing to the machines viewers had at home.

Wide ranging in scope, but gently encouraging in its explanations, *The Computer Programme* was a marvellous way to introduce computers to an audience largely made up of computer illiterates. 'Now the Chips Are Down' had unsettled with stark warnings of a microprocessor revolution, but *The Computer Programme* aimed to help viewers come to terms with the changes at hand. About 7 million people watched at least part of the series, which was repeated and widely recorded for use in schools. Its holistic approach to showcasing computers was much praised, but also had critics among people who wanted more technical instruction on how to use computers. However, *The Computer Programme* was only ever intended as the first step on a longer journey to computer literacy.

Alongside *The Computer Programme* the BBC planned an extensive range of other materials and services. The book of the series, *The Computer Book*, quickly became a best-seller as an introductory guide. For the more technically minded there was a course, 30 Hour BASIC, provided by the National Extension College. The numbers of people who took advantage of these opportunities were huge, suggesting the public's great appetite for learning about computers. Before 1982 was over, *The Computer Book* had sold 60,000 copies, and 30 Hour BASIC over 100,000. For a time the BBC was answering 2,000 letters a week, and 120,000 people used the telephone helpline to find other sources of information, such as colleges and computer clubs.⁶ There were further television series too. *Making the Most of the Micro*, the second major series, was more technical and designed to offer more direct help to new computer users. A two-hour live special, *Making the Most of*

the Micro – Live, was followed by *MicroLive*, which ran until 1987, covering new developments. There were also more specialist series, such as *The Electronic Office* and *Computers in Control*, about robotics. Yet the most important additional element of the project was not a programme or a book, but a computer.

Other brands of microcomputer are available

Encouraging people to give computing a try was crucial to the Computer Literacy Project. 'It's not like an Open University series. It's general programmes that create a general interest, and associated with them you have things that you can do,' explains the BBC's David Allen. 'We thought we must have course material and so on and so forth, so that people could learn to actually do things. This hands-on philosophy was very strong.' The practical philosophy led, via a rather roundabout route, to one of the most influential parts of the whole endeavour. Many television series are accompanied by books and merchandising, but *The Computer Programme* was probably unique in having a branded computer to accompany it. However, at the start the plan was not to develop a computer, but just to provide a standard way of teaching programming.

Because programming was widely seen as key to developing a working knowledge of computers, the BBC was naturally keen to include it. The beginners' language BASIC was the obvious choice to use, but many educationalists and professional programmers hated it for being unstructured. The commands available in a structured programming language, such as Pascal, imposed a certain style on how people could write programs. They were restricted to arranging their code in neat blocks of subroutines and procedures, and to following logical paths. Due to a lack of alternatives to the GOTO command, frequently the flow of BASIC programs jumped around all over the place. Educationalists claimed that BASIC lured people into the sins of bad programming habits and badly structured code. To make matters worse, different computers commonly used different

dialects of BASIC. While the principles were similar, the differences in implementation meant a program written on one machine might not work on another – not ideal for teaching programming consistently and systematically.

The solution was for the BBC to try and specify its own version of BASIC, as close to a standard as it could be when there was no actual standard, but also to include features more commonly found in structured languages. This widened its educational value by adding features to teach good programming practice, but retained the essential ease of use of BASIC. ‘We came up with this thing called Adopted BASIC for Computers, ABC,’ recalls David Allen. ‘We had a meeting with all the manufacturers that we could find and the DTI (Department of Trade and Industry), and we tried to persuade them to implement this ABC on their machines.’ When it was not possible to reach an agreement with the manufacturers, the BBC began to consider other options for getting the computer language it needed to support the series. ‘We were really stuck,’ recalls David Allen. ‘This is why we got the germ of the idea of getting a computer that we could use systematically for the series and for people who wanted to follow the series seriously.’

In typically thorough fashion, the BBC consulted widely on what sort of features its computer should have, but the necessity of having a specific machine to go with the series put the corporation in a tricky situation. The BBC could not make the machines itself and would need to collaborate with a computer company to get them designed and built. However, at the time the BBC saw itself as a largely non-commercial and impartial organisation that tried to avoid endorsing specific brands of product. If the machine did well the BBC could be accused of interfering in the computer market, while profiting from royalty payments. No matter how many other brands of computer were available, the company selected would gain a major stamp of approval and much free publicity from the partnership. But what if the computer were made by the government, not by a private company? As luck would have it,

in a Britain where the state still owned large parts of industry, there was just such a machine under development, the Newbury Newbrain.

The Newbrain had its origins somewhere in an early computer project at Sinclair Radionics in the late 1970s, long before the ZX80 had been conceived. After Clive Sinclair parted company with Radionics when the company was taken over by the National Enterprise Board, the project continued at the government-owned Newbury Laboratories. When first announced in 1980 the Newbrain was quite an advanced machine. It had generous provision for plugging in peripheral devices, a key concern to the BBC, and its small built-in display made it easily portable. Suitably modified with ABC, the Newbrain could have been the technical fix to the BBC's problems. Just as importantly, Newbury's government backing dodged the problem of endorsing one commercial rival over another by matching a publicly funded computer with a public service broadcaster. However, like many other computer schemes of the time, it ran into technical problems that delayed it until after the BBC needed it, by which time it was arguably a dated design anyway.

With pressing deadlines overcoming commercial concerns, the BBC started the search for a new machine already under development, which could be adapted to meet its unique needs. 'Newbury having failed to come up with anything, John Coll* and I sat in an office between Christmas and the New Year, that funny week when nothing much happens,' recalls David Allen of late 1980. 'We drew up a specification. It was only two or three pages: we want colour, we want sound, we want graphics, we want a fully positive keyboard, we want this that and the other, we want ABC on it.' The specification was

*John Coll was a member of MUSE (Micro Users in Secondary Education), a user group for teachers, which was one of the advisers to the Computer Literacy Project, and he later became a presenter on subsequent series.

sent out to British computer manufacturers, and an increasingly desperate BBC waited to see what they had to offer.

The machine with two brains

After months wasted waiting for the Newbrain, a small team from the BBC Computer Literacy Project set out to visit Cambridge in early 1981. There had already been some preliminary discussion with manufacturers, but they were going to see for themselves what the British computer industry had to offer. The Cambridge area was home to several microcomputer companies at the time, of which three were in the running to supply the BBC. Out in nearby St Ives was Tangerine Computer Systems, producer of the hobbyist Microtan 65 computer, and with other projects in the works. Sinclair Research, with a prototype of the new ZX81 to show, could be found above a parade of shops. And tucked away in shabby offices above the Eastern Electricity Board showroom was Acorn, whose computer designers had just had a remarkably busy week.

Acorn had dabbled in a range of computer market sectors by 1981. The System 1, a cheap kit computer, had found favour with hobbyists; the more expensive and more versatile System 2 and System 3 rack-mounted computers had been aimed at industrial and laboratory users; the appliance-like Atom had broken Acorn into the home computer market, but they had problems deciding what to do next. 'The Atom was a modest success so the company determined that they'd like to do something better and we had a long argument over many months over what it would be – practically everybody wanted something different,' recalls Sophie Wilson. Would the successor machine be a home computer a scientific computing workstation, a control computer or something else entirely? 'Steve and I wanted something we could be proud of,' remarks Wilson. 'Nobody could decide what to build next. Obviously we kept working, churning out things for the System range and writing new software for the Atom. It wasn't a period of stasis, but in terms of design forward motion we had nothing.'

And then they hit upon the idea of a machine that could do it all, the Acorn Proton.

The original scheme for the Acorn Proton was essentially two computers in one. Acorn would build a professional version of the Atom, running a faster version of the tried and trusted 6502. This machine would then be used as an input/output (I/O) interface to control a more powerful machine containing a *second* processor. As a whole it could be a powerful scientific computer, or the I/O unit could be sold on its own as a basic home micro or as a controller. 'So with that Frankenstein mash-up compromise we had a forward strategy,' recalls Wilson, 'when Chris Curry discovered the BBC computer Literacy Project. And jointly Hermann and Chris sprang on Steve and myself the notion that the BBC would come and look at our prototype. The prototype we hadn't got.'

It was an extraordinary situation. The biggest, most prestigious microcomputer contract in Britain was open to anyone who could satisfy a desperate, but somewhat particular, customer. The cheaper half of the Proton design was a reasonable fit for the BBC's needs, but Acorn did not have anything like an actual computer to show them. 'We only had skeleton ideas in our heads,' recalls Wilson. 'There wasn't even a line on a piece of paper saying what we were going to do and how we were going to do it.' With time short, Acorn's management turned to rather unconventional means to motivate its designers. The weekend before the BBC was due to visit, Hermann Hauser rang up Steve Furber with the proposition that Wilson thought it was possible to show the BBC a prototype by Friday. 'Hermann rang me and said "the BBC are coming on Friday, Sophie thinks we should show them a prototype. What do you think?"' recalls Furber. 'And I said, "well, it's a bit unlikely, but if Sophie's willing to have a go I will."'

Unbeknownst to Furber at the time, Hauser's conversation with Wilson had been just the same. 'No we can't do that, it's impossible,' answered Wilson, only to be told, "'Well, I've been

talking to Steve, and Steve thinks it can be done.” “Oh, well, I think it’s impossible, but if Steve thinks it can be done we can give it a go.” It was the start of a busy week for all involved. ‘We turned up at the office on Monday morning, discovered the deception really quickly, but decided to go on anyway,’ explains Wilson. They began sketching out circuit plans while Acorn’s chief engineer Chris Turner searched for the parts to build it, not a trivial task given the fact that some of the components had to be imported specially. With no time to create a printed circuit board for the prototype, Ramanuj Banerjee, ‘the fastest wire gun in the west’, was borrowed from the university computer laboratory to connect the board-mounted components together using a wire wrapping gun. From then on it was an all-out effort to get the thing working, with the team gradually working its way across the prototype fixing its bugs.

By 2am Friday morning, with the BBC only hours away, the machine was still confounding efforts to make it work. Wilson escaped to snatch a few hours sleep in optimistic preparation for programming the prototype for the BBC demonstration. The others carried on working through the night in an increasingly frustrating search for the problem, but then they had a stroke of luck. Connected to the prototype was an Acorn System series computer to aid the testing and development process. ‘There was a big earth cable to try and keep the [electronic] noise down and Hermann said, “Why don’t you just disconnect that?” And the machine annoyingly sprang into life,’ recalls Furber. ‘We were very tired and very, very much out of ideas, and this one just happened to work.’ In a timescale that Furber describes as ‘basically silly’ Acorn delivered, more or less, just what the BBC was looking for. ‘They were all asleep under the benches and the machine was working,’ recalls Wilson, who arrived in the morning to set up the software for demonstration to the BBC. ‘It was clearly impossible,’ explains Wilson. ‘You don’t build in five days a working thing with five circuits in it that you haven’t even envisaged. It was a massive piece of luck that it did work.’

The Beeb

The prototype Proton became the basis for a collaborative effort to develop what became known as the BBC Microcomputer, better known simply as the BBC Micro or 'the Beeb'. Most of the direct development was the responsibility of Acorn, but with ongoing input and monitoring by various BBC experts throughout the process, such as BASIC expert Richard Russell and BBC Engineering Designs engineer David Kitson. Almost all early 1980s home computers were designed and marketed with learning about information technology in mind, but none had so much thought put into its educational value as the BBC Micro. Acorn BASIC and the ideas for ABC were adapted by Sophie Wilson to produce BBC BASIC, rich in features, easy to learn and structured to encourage good programming discipline. In a subtly user-friendly touch, the machine printed MISTAKE messages instead of ERROR when something went wrong. Ready-built, user-friendly and supplied with a well-written manual* and welcome tape of introductory software, the Beeb was easy to use for beginners and potentially very powerful too.

The hardware was impressive. It had a full-sized keyboard, sound and a colour display, with several different modes to display text or high-resolution graphics. Cheaper computers were very limited in what devices could be plugged into them,[†] but the BBC Micro was endowed with an array of

*However, presumably because of the hasty development of the machine, some early users would be frustrated by a lack of information as the first 6,000 BBC Micros were shipped with provisional manuals and a postcard to request a free upgrade to the final manual when it was ready.

[†]The ZX81, for example, had connectors for a television, a cassette recorder and a single 'user port' into which anything else you wanted to plug in had to be connected. The BBC Micro had a serial interface, user port, analogue interface, 1MHz bus, the Tube, Econet, printer port, disc drive connector, cassette recorder connector, auxiliary power output, television connector and two different sorts of video output.

different sockets for just about anything it was possible to think of plugging into a computer at the time. 'We wanted a machine that could control equipment, that had A to D [analogue to digital] conversion, that could produce sound,' recalls the BBC's David Allen. 'We were interested in versatility, that was the whole point, teaching people that computers could do a whole range of things.' There were also a couple of unique Acorn features that were far ahead of most other machines on the market. Acorn benefited much from its links to Cambridge University, particularly through Andy Hopper, one of Acorn's directors and also a lecturer with research expertise in networks. As the rest of the industry was only just getting tooled up to make small stand-alone computers, the BBC Micro had the option of networking. Through 'Econet', BBC computers could connect together onto a local network to share files and printers, a very useful feature in a school environment. The second unique feature, the Tube, went back to Acorn's original scheme for the dual processor Proton, by allowing a second processor to be attached. The Tube turned the BBC Micro into the front end of a more powerful computer better suited for specific tasks, like business computing or laboratory work. The BBC Micro emerged as an astonishingly versatile machine, but it came at a premium price.

The machine was released in two versions, £235 for the Model A, with only 16k of RAM and a cut-down range of interfaces, or £325 for the fully featured 32k Model B. Shortly after launch the prices were increased to £299 and £399, expensive for a time when several manufacturers were working on machines for under £200, but further marking it as premium product. Price aside, the Acorn and BBC collaboration produced a computer that was widely seen as outstanding. Guy Kewney declared it the nicest machine he had seen, in his review for *Personal Computer World*, praising its graphics, ease of programming and expandability. Initially Acorn was briefed that the Micro would probably sell around 12,000 machines. They took that many orders by Christmas 1981, before the first episode of *The Computer Programme* had

even aired. 'The success of the BBC Micro astonished everybody involved,' recalls Steve Furber. 'Once the BBC Micro was out there, Acorn's only problem for two or three years was making enough of them.'

Not only was the demand huge but technical problems caused delays. To reduce the cost of the machine, Acorn used Ferranti ULAs to mop up the logic from several chips onto just one. The problem was that the ULA used for the video display, the video processor or VID PROC, kept failing as the machine got warmer, killing the display. It was a particular problem for the machines being filmed under studio lighting by the BBC for *The Computer Programme*. 'The first ones were shot with Steve in the wings with a can of cooler,' recalls Sophie Wilson. 'Every time the director said "cut" he'd dash onto the set and spray the VID PROC with the cooler for the next shot.' It was typical of the sort of problems which many computer manufacturers would experience in getting their machines to market in the early 1980s, and took Acorn some months to rectify. Problems with the system software, leading to errors saving and loading data, would also frustrate users of early machines, many of whom thought it outrageous that Acorn charged £10 for a ROM change to fix the problem. For a few companies such problems would have serious financial consequences, but such was the demand for the BBC Micro, and the gold standard of the BBC brand, that the issues did little to dampen enthusiasm for the machine.

One thousand machines came off the production line as *The Computer Programme* was first broadcast in January 1982. By March it was 5,000 a month, still not enough to meet demand. By the end of April the backlog of orders was over 20,000.⁷ The machine was a runaway success, for both the BBC and Acorn. Before the BBC, Acorn was just one of many small computer companies, but after the success of the BBC Micro it became one of the best known. Some of the trust people had in the BBC brand rubbed off on Acorn, suggesting that it was a safe bet to buy a £400 computer from. The BBC's selection of Acorn attracted some controversy among other computer

manufacturers who saw the market upset by a competitor given an unfair advantage. Clive Sinclair claimed that his company could have built a machine that matched the BBC's needs for half the price. The BBC, he complained in a 1982 interview to *Practical Computing*, had no more place making BBC computers than it did BBC branded toothpaste or cars. For its part, the BBC saw Sinclair's machines as too limited to provide the wider education it had in mind. *Computer Programme* producer Paul Kriwaczek called the ZX81 a 'throwaway' product in a *Practical Computing* interview in which he criticised the limitations of the machine. Sinclair was already a well-established player with a particular way of doing things. In Acorn, the BBC found a company at a more formative stage, with an expansive design philosophy that matched its wide-ranging vision for showing people what computers could do.

Just as the BBC had hoped, the sheer adaptability of the Micro meant it found many uses. Thanks to its good quality keyboard it was a solid basis for an office system. The multitude of ways to plug things into it made it useful for running laboratory sensors. Acorn itself used it in the development of advanced microprocessors. There was an additional adaptor for Teletext, which allowed 'telesoftware' to be broadcast to the computer, via the BBC's Ceefax service. The BBC Micro would also become common around the BBC itself, where it was useful for generating graphics and text for television programmes. As we shall see in a later chapter, it was even used to create some innovative games. As home computers went, the BBC Micro was a machine that was suited to almost anything its users could ask of it, but its major impact was in education.

Programming children

In 1986 Acorn celebrated the production of the 500,000th BBC Micro. Impressive though this was, several other machines far outsold it, Sinclair had sold about 2.5 million ZX Spectrums by this point. However, the BBC Micro had an influence out

of all proportion to its numbers due to its popularity in the education market. The connection to the BBC's Computer Literacy Project already gave the machine a sort of official approval as an educational device. This was furthered by the Department of Industry's much trumpeted Micros in Schools scheme, which gave schools half the cost of an approved computer, the other half often met by local authorities or parent-teacher associations. When first announced in 1981, the only two machines on the approved list were the BBC Micro and the Research Machines RM380Z, which was little competition to Acorn's computer.

The RM380Z dated from 1977 and had had some success when there were few other educational computers available. It was big and so robustly heavily engineered that it was popular with the Ministry of Defence as well as schools and laboratories, but with prices starting at around £1,000 the 380Z was even more expensive than the BBC Micro. By 1981 it already looked quite old-fashioned, and did badly against its cheaper and BBC-approved rival. Despite being cut out of Micros in Schools, Sinclair's ZX81 did quite well in the educational market at first, thanks to the company heavily discounting the machines for educational customers. The more advanced ZX Spectrum was later added to the list of approved computers when Micros in Schools was expanded to primary schools. However, Acorn's lead was unassailable in the education market. By 1985 the BBC B was used by around three-quarters of schools. For most of a generation of children the BBC was effectively *the* school computer. It was so robust and well provisioned with educational software that many were still chugging away in school computer rooms well into the 1990s, if not beyond.

Just having machines there for children to use was helpful for familiarising them to computers, but what would computers in schools actually be used for? Educationalists debated at length what place computers had in schools. Should pupils be taught how they worked or just the skills to use them? Or should they be educational tools for computer-assisted learning,

particularly for those with special needs? To the most forward thinking, the computer might dramatically change the way that children were educated, an individual electronic teacher attuned to the needs of each child and causing a classroom revolution. Clive Sinclair's 1982 prediction that computers would replace schools rather than just encyclopedias was not uncharacteristic of the time. Others, however, were more cautious, concerned that unimaginative teaching machines would program children by rote, treating them as empty vessels to be filled with computer-delivered facts to the detriment of a more rounded education.

In the short run, the more dramatic visions of 'schools of the future' where every child had an individual computer tutor were unrealistic given how few computers most schools had, how little software was available and how few teachers understood them. By 1984 the average school had nine machines shared between hundreds of pupils and often living a nomadic existence trundling between classrooms on trolleys. Children would have to wait to take their turn with the machine or crowd around it watching demonstrations. At first, computer education was often left up to maths and science teachers, seen as the natural keepers of a technology long associated with science and numbers, but who were also learning themselves. With little educational software available, teachers often wrote their own programs, with varying degrees of success.

In common with microcomputing in general, programming was an important part of school computing in the 1980s. Educational computing articles of the time have an underlying rational of empowering children, an idea that they should program computers rather than be programmed *by* computers. However, school computing was not as novel as we may suspect. As early as the 1960s, a few secondary schools had got their pupils to punch out programs on computer cards, then posted them off to a university computing department for processing. A few weeks later printouts would return, bringing results for pupils whose programs had worked and disappointing

error messages for those whose did not. 1980s school computing was more hands on, with pupils able to learn programming directly and see the result of their efforts on screen, or even moving around the classroom. Alongside computers, robots began appearing in the 1980s classroom too, such as robotic arms and floor turtles. The floor turtle typically looked a little like an inverted goldfish bowl with a robotic buggy trapped inside it, and was an eye-catching way of demonstrating programming. Commonly programmed through the beginners' language Logo, the floor turtle was armed with a pen and could be instructed to draw pictures on the floor as it trundled along. They were a simple and fun way to introduce computing concepts to children expected to live in a future here robots and computers were commonplace, but far more important than classroom robots was educational software.

Down in Granny's Garden

There was little good-quality educational software available when computers first entered schools. A common complaint at the time was that computer-aided learning programs were drilling rather than skilling pupils. Children were subjected to a range of programs that did little more than pose multiple choice questions or order them to solve arithmetic problems, then beep at them in a disappointed tone when they made mistakes. The computer risked being relegated to the role of educational inquisitor, but fortunately some had more creative ideas about how computers could be used in classrooms. Among them was teacher Mike Matson, who found his initial disinterest in computers overturned after losing a weekend to playing *Adventure* on a friend's machine. 'As a primary school teacher it occurred to me that if something could grab me like that for a whole weekend, could motivate me, then the potential there for kids had to be enormous,' explains Matson. However, after convincing his school's parent-teacher association to buy a computer he found his colleagues less enamoured with the idea. 'When I mentioned it to the staff I couldn't believe the reaction; it was just unbelievable,' recalls

Matson. “‘What the hell is this all about? Do you know how many football shirts we could have bought with that money?’” Anyway, I now had a PR job to do. I had to convince all these staff that this computer, that was going to cost £400, a lot of money then, was going to be worthwhile.’

Matson began learning to program and to write educational software, eventually becoming a computer advisory teacher. Uninspired by other schools software, he created something rather different, an educational adventure game, *Granny's Garden*. The game sent players off on a quest to find the children of the king and queen of the mountains, who had been kidnapped by a wicked witch. Along the way they explored a colourful fairytale world, completing tasks such as solving logic puzzles about feeding dragons, searching for keys and answering questions set by a talking Mushroom, while trying to avoid the attention of the Wicked Witch. The frisson of panic at the appearance of the Witch when they made a critical mistake, complete with purple hat, green hair and blue skin (the BBC's pallet was limited to eight colours), was a shared experience for a generation of schoolchildren. The worst that could happen was that the Witch would ‘send them home’, but this not only marked game over but could mean having to pass the computer to a classmate to have a turn. However, faced with a small number of computers, one of Matson's motivations for the game was that it could be used with a whole class. ‘The main concern was that if you have got one machine in a school, how can everybody use it? Answer: they can't. So what I wanted to do was write something that would allow everybody to participate.’

A turn playing *Granny's Garden* was used as a way of stimulating pupils in other educational activities, like writing a story about the Witch or doing arts and crafts projects. Teachers could use the game to tell a story to the whole class and spark discussion about the various puzzles it posed. *Granny's Garden* provided a far more stimulating way of using computers to teach than using the machine to interrogate children with maths problems and questions. Buoyed by positive reactions to the

game, Matson left teaching to start an educational software company, 4Mation, with a friend. As of 2015, 4Mation is still selling *Granny's Garden* to the education market, albeit no longer for the BBC Micro, a remarkable longevity given that the schoolchildren for whom it was originally written are now approaching middle age.

Learning the language of the future

If Sinclair's machines were the Model T Ford of computers, then the BBC Microcomputer was, if not quite a Rolls-Royce, then certainly a trusty family car. The £400 price tag and BBC approval lent it a certain middle-class respectability, and the Beeb was a solidly built, reliable family computer, with an abundance of features for users to explore. Just as Sinclair's machines exemplified the populist mass market end of the British home computer scene, Acorn's marked the respectable upper bounds of it. While many other computers appeared on the market over 1982 and 1983, they tended to be considered between the yardsticks already set out by these two companies and their very different approaches. Yet despite their many differences both machines shared a common idea of being educational, and they were far from alone in this.

Computer design varied widely over the early 1980s. There was no fixed idea of what a computer should look like, what technical specifications it should have, or how it should behave, but most shared a common educational posture. While few designers put quite so much care as the BBC had into making their BASIC educational, they were all designed to make programming easily accessible. The user interface on switching on the machine was normally just a BASIC prompt inviting the user to start entering commands. The pages of any early 1980s home computer manual were mostly taken up by an extensive guide in how to program in BASIC.

Design and instruction were reinforced by marketing. Alongside the inevitable claims of low cost and high capability, the educational value of a home computer was strongly emphasised.

Computer advertising explained that the information technology age was coming and that people risked being left behind if they did not adapt. 'We live in an age of computers. Coming to terms with them is part of coming to terms with the twentieth century,' declared one Commodore VIC-20 advert. 'To you computers are a mystery from the future,' taunted a Dragon 32 computer advert that cautioned parents that their computer literate children were smarter than they were. Unsurprisingly, most adverts suggested that the solution to impending personal obsolescence was buying that particular brand of computer and learning to program it; 'I AM GOING TO TEACH YOU THE LANGUAGE OF THE FUTURE', as one Acorn BBC Micro advert rather forcibly put it. The skills and knowledge that these machines promised to bring were often touted as a route to future prosperity. One Acorn advert even featured a group of formerly unemployed teenagers with the news that 'they didn't have to burden the state much longer', after finding brighter futures through computer education. Yet at the same time as portraying computing as something important whose complications had to be mastered, marketeers had to play down complexities to avoid scaring buyers off and to present computers as accessible. A common advertising cliché was the picture of a family posed with their new computer in a cosy household setting as they learned together. With so much emphasis on computers in schools, manufacturers presented their machines as important for children's futures, almost emotionally blackmailing parents into buying them.

The technical magazines that had nurtured hobbyist computing in the 1970s were joined by new publications aimed at a less skilled audience that wanted to know about computers. By 1984, there were around 115 different computer magazines vying for shelf space in newsagents, several with weekly or monthly circulations of over 100,000.⁸ Alongside general magazines like *Personal Computer World* and *Your Computer* were specialist magazines for particular brands of computer, such as *Sinclair User* and *Acorn User*, with the most popular machines supported by several titles. As well as news, adverts and product reviews, early 1980s computer

magazines often had considerable educational content, such as sections for beginners and introductory articles on programming or computer science concepts. They also helped normalise the computer with features about how the general public was using computers. For a time, pictures of 'everyday' people using computers were commonplace on computer magazine covers. Over 1982 and 1983, the covers of *Sinclair User* featured ZX computers in the hands of everyone from schoolchildren and businessmen to a knight in shining armour and a traditional Morris dancer, suggesting that computing was now accessible to anybody, even Morris dancers. Probably the most explicitly educational magazines were *The Home Computer Course*, a general guide to 'mastering your home computer', and *Input*, an extensive guide to learning programming 'for fun and the future'. Partwork publications to be collected on a weekly basis and stored in matching binders, they were intended to build up into definitive guides to their topics. The final issue of *The Home Computer Course* even came with a certificate to certify that the reader had completed the 'course' of education the magazine had provided.

The interaction of computer producers, the BBC, high-profile government information technology schemes, magazine publishers and educationalists in pushing the computer literacy agenda had a profound effect on the first years of British popular computing. Whatever else it could and would be, the British home computer was originally cast in a way that emphasised its educational value and encouraged people to explore what it could do. Behind this was a hope that computer literacy would have beneficial effects in the long term, be it for individuals or for the national economy. Combined with a growing interest in video gaming and the allure of an exciting and much-hyped new technology, computer literacy was an important force in pushing the British public into an unprecedented home computer buying spree. By the end of 1982 home computing was booming.