Chapter 3
"Inside a Day You Will Be Talking to It Like an Old Friend": The Making and Remaking of Sinclair Personal Computing in 1980s Britain

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In early 1980 advertisements began appearing in British national newspapers for the latest domestic technology, the Sinclair ZX80 personal computer, available ready built for the bargain price of just £99.95. Personal computing had first emerged in the mid-1970s as an outgrowth of the activities of electronics hobbyists, but its costs and complexities had restricted it to a technically able niche market.[1] The ZX80 was quite different, combining low-cost, nontechnical marketing and neat design to create a more consumer-friendly computer, configured as an affordable introduction to computing. Britain took to the low-cost introductory personal computer enthusiastically in the early 1980s. By 1983 the country boasted the highest level of computer ownership in the world and a booming personal computer industry.[2] This computer marketplace was diverse and the differences between machines gave rise to friendly rivalries between their users. However, the context was common, and the trends that defined early British home computing at their strongest in Sinclair, making it an excellent case study.

Two 1980s popular books, the semiofficial *The Sinclair Story* by Rodney Dale and the more critical *Sinclair and the Sunrise Technology* by Ian Adamson and Richard Kennedy, already provide a view into the company's computer business.[3]

[1] For standard accounts of personal computing's hobbyist roots, see Martin Campbell-Kelly, William Aspray, Nathan Ensmenger, and Jeffrey R. Yost. 2014 [1996]. *Computer: A history of the information machine.* Boulder, CO: Westview Press, ch. 10; Paul E. Ceruzzi. 2003 [1998]. *A history of modern computing*. Cambridge, MA/London: MIT Press, ch. 7.

[2] An oft repeated though apparently unverified claim. For one prominent instance, see the *Conservative General Election Manifesto* (1983). For discussion of the figures behind the claim, see Thomas Lean. 2012. Mediating the microcomputer: The educational character of the 1980s British popular computing boom. *Public Understanding of Science*, first published online on 30 October, 2012 as doi:10.1177/0963662512457904.

[3] Ian Adamson, and Richard Kennedy. 1986. *Sinclair and the sunrise technology: The deconstruction of a myth.* Harmondsworth: Penguin; Rodney Dale. 1985. *The Sinclair story.* London: Duckworth.

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Originally founded by Clive Sinclair in 1961 as Sinclair Radionics, the company's embrace of innovation and economically minimalistic style led to successes, such as the earliest affordable pocket calculators, and failures, such as digital watch kits whose electronics could reputedly be scrambled by the static of a synthetic material shirt.[4] However, this experience of hobbyist and consumer electronics put them in an excellent position to enter the personal computer market as it began the transition from enthusiasts' kit computers to domestic appliances for the general population. For the first few years of the 1980s Sinclair's machines, the ZX80, ZX81, and ZX Spectrum, would be the most popular computers in Britain, and the company struggled to meet demand for its products. As Adamson and Kennedy discuss, the low-cost machines had limitations and problems, but I argue that these should not overshadow their place in computer history. They have become iconic of Britain's early years of home computing. In 2010 the BBC even considered their development worthy of retelling in a nostalgia heavy television comedy drama, *Micromen,* which focused on the rivalry between Sinclair and Acorn Computers. In this essay, I use Sinclair's early computers, the ZX80, ZX81, and ZX Spectrum, as a case study in the early development of personal computing in 1980s Britain and as an example of how user activity can help to shape the representation and form of technology.

Accounts of the early development of personal computing have tended to concentrate on 1970s America, where skilled electronics hobbyists and hackers created the first personal computers for their own interest. As Stephen Levy captures in *Hackers,* there was a countercultural edge to this, an excitement with technology and hope to bring computers to the people, rather than having them restricted to corporate or academic elites.[5] Home computing in early 1980s Britain was more officially sanctioned than it was countercultural. David Skinner has amply demonstrated that the widespread uptake of home computing in 1980s Britain was fuelled, in large part, by a view of information technology as a transforming force.[6] The personal "microcomputer" was seen as an introduction to the information technologies which were anticipated to have sweeping social and economic effects in the next few years. Leslie Haddon has characterized much early home computing in Britain as "self-referential," using the computer to understand it.[7] In a context of "computer literacy," which was prominently supported by the government and media, computers became seen as almost inherently educational.[8] In this environment, activities commonly associated

[4] To save a lengthy diversion into a complex company history, already well covered by Adamson and Kennedy, in this essay I refer to the producer of Sinclair computers simply as Sinclair. In fact Clive Sinclair left the troubled Sinclair Radionics in 1979, to join Science of Cambridge, previously set up as a "lifeboat company" for him. Science of Cambridge became Sinclair Computers in 1980 and then Sinclair Research in 1981. It was bought by Amstrad in 1986.

[5] Steven Levy. 1984. *Hackers: Heroes of the computer revolution.* Garden City, NY: Anchor Press/ Doubleday.

[6] David Ian Skinner. 1992. *Technology, consumption and the future: The experience of home computing*. PhD thesis, Brunel University.

[7] Leslie G. Haddon. 1988b. *The roots and early history of the British home computer market: Origins of the masculine micro*. PhD thesis, University of London.

[8] Neil Selwyn. 2002. Learning to love the micro: The discursive construction of educational computing in the UK, 1979–89. *British Journal of Sociology of Education* 23: 427–443.

with the hacker, such as modifying hardware, programming, and developing an intimate knowledge of the computer, were less countercultural than they were officially sanctioned as part of learning about computers. However, as Skinner and Haddon make clear in their studies of personal computing in Britain, within a few years these original educational hopes were dashed, as video gaming dominated the British home computer scene.[9] On no other home computer was this change quite as dramatic as those of Sinclair, where games became synonymous with the machines, in spite of their original educational characteristics.

The transformation of the Sinclair computer from educational "passport to the future" to games system presents a prime example of how users can shape a technology. In her essay on the development of the TRS80 personal computer, Christina Lindsay outlines how "the user" appears in different stages and guises over the machine's life.[10] Lindsay suggests how these different users helped to shape a computer's development over time, as the electronics enthusiast imagined by designers was replaced by real users with different impressions of the machine. In doing so, she usefully bridges the gap between production and use by suggesting how user activity could contribute to the ongoing development of the technology, a cycle of co-construction over the lifetime of a product. My approach here follows a similar basic model to Lindsay, but expands on it by embedding the Sinclair computer in the wider society around it. I begin by exploring the initial construction of the Sinclair computer and its configuration for educational use. I then explore the actual use of these computers by a variety of different parties. Finally, I demonstrate how as one of these uses, games, came to dominate, the Sinclair computer was reconfigured in response to this user activity.

3.1 The Challenge of the Chip

Rising unemployment, high levels of inflation, a decline in traditional industry, and troubles with the trade unions had made the 1970s an unhappy decade for Britain. Matters reached their nadir with the widespread strikes of the 1978–1979 "Winter of Discontent." With the country apparently in crisis, Margaret Thatcher's Conservative Party entered government in 1979, promising dramatic changes to create a more enterprising Britain. Meanwhile, another potential source of change was coming to prominence. In 1978, the BBC broadcast *Now the Chips are Down,* an influential documentary examining the expected impact of the microprocessor and

[9] Haddon, *The roots and early history of the British home computer market*, ch. 7; Skinner, *Technology, consumption and the future*.

[10] Christina Lindsay. 2003. From the shadows: Users as designers, producers, marketers, distributors, and technical support. In *How users matter: The co-construction of users and technologies*, ed. Nelly Oudshoorn and Trevor J. Pinch, 29–50. Cambridge, MA: MIT Press.

the cheap computer power it offered, an event often seen as the moment when "microchips" came to greater public attention in Britain.[11]

From its opening awe at what microchips could do, to unsettling conclusion that Britain is ill prepared for their social and economic consequences, *Now the Chips are Down* presents the "chip" in a manner typical of the considerable media attention they received elsewhere in late 1970s Britain.[12] On one hand, benefits, easier lifestyles, greater productivity, and economic prosperity. On the other, the threats of massive unemployment, a technology whose benefits were restricted to a wealthy elite, or a Britain overwhelmed by computerized foreign competition. Yet beyond the inevitability of change, *Now the Chips are Down* offers no firm conclusions about the impact of the chip, a technological uncertainty common to late 1970s discussion of the chip's impact and succinctly summed up by David Skinner as "deliverance or damnation."[13,14]

To realize the opportunities of the microchip and guard against the threats, Britain needed to prepare a position at the vanguard of this new industrial revolution. Reports to the government highlighted the importance of a population educated about these technologies to the future well-being of the nation.[15] The alternative was obsolescence, as *The Mighty Micro*, the best known of a thriving genre of popular books on the implications of the "microchip revolution," warned in the stark language common to these discussions: "For those who are informed [about the new technologies] employment opportunities will be prodigal, while those who remain ignorant, resistant or unwilling to learn will find the world an alarmingly alien place."[16]

As in the USA, personal computing in Britain first took hold with electronics hobbyists, people fascinated by the technology, and its possibilities. With American computer magazines, such as *Byte* available in Britain and the British computer press regularly reporting on computing on the other side of the Atlantic, developments in the USA were influential. To give one example, Bruce Everiss, an accountancy computing manager, was inspired by developments in the United States to open one of Britain's earliest computer shops, Microdigital, in Liverpool:

> I… started reading *Computing* and *Computer Weekly*, the two trade magazines for the computer industry in the UK. And in those there were lots of articles about what was happening with microprocessors and microcomputers in California and America in general, and how

[11] Paul Kriwaczek. 1997. *Documentary for the small screen*, 237. Oxford: Focal Press.

[12] Thomas Lean. 2008a. From mechanical brains to microcomputers: Representations of the computer in Britain 1948–1984. In *Science and its publics*, ed. A. Bell, S. Davies, and F. Mellor, 179–200. Newcastle: Cambridge Scholars Publishing, 190–192

[13] See, for examples, Bryan Rimmer. 1978. Tomorrow's world. In the eye of a needle. *Daily Mirror*, September 21; Kenneth Owen. 1978. Microelectronics: This could be man's greatest leap forward. *The Times*, October 10.

[14] Skinner, *Technology, consumption and the future*, 68.

[15] Advisory Council for Applied Research and Development. 1978. *The applications of semiconductor technology.* London: HMSO.

[16] Christopher Evans. 1979. *The mighty micro: The impact of the computer revolution*, 96. London: Victor Gollancz.

> this was, you know, the up and coming thing and everything…I read about these strange things called computer stores that were starting up. And I thought, 'this is interesting, they're in America now, they'll come to the UK. I should start one.'[17]

In such ways personal computing ideas made the transatlantic crossing, but hardware was harder to import. Although British hobbyists could mail-order equipment from American suppliers, American products were distinctly expensive in a Britain undergoing economic crisis, especially when some manufacturers charged a premium for exported computers. By the late 1970s British computer kits were starting to appear, such as the £200 NASCOM 1 and Sinclair's first computer, the Science of Cambridge MK14. Developed as a cheaper alternative to American imports, the £39.95 MK14 was typical of hobbyist computers.[18] Sold by mail order through electronics hobby magazines, the MK14 arrived as a kit of components for the enthusiast to solder together into a chip encrusted circuit board, complete with calculator style keypad and LED display for input and output. A way for the user to tinker with a microprocessor of their own using complicated hexadecimal instructions, it was computing for computing's sake, a niche technical hobby requiring skills, and interest beyond those of the general populace.

3.2 The Making of an Educational Home Computer

While the MK14 was providing British enthusiasts with an affordable way to explore microprocessors, the first "appliance computers," the Commodore PET2001 and Apple II, were being released in the USA. Unlike hobby machines these shipped as factory-built appliances. Hardware complexities were wrapped in sleek casing, they were equipped with the beginners' programming language BASIC, and were advertised to appeal to wider audiences than just enthusiasts. The overall effect was of a more consumer-oriented product, more user friendly, and with wider appeal, but more expensive. While the Apple II in particular has become iconic of computing's domestication in the USA, with prices starting at around £800 in 1978 it was simply too costly to have the same mass appeal in Britain, whatever its merits as a user-friendly appliance. As Clive Sinclair recalled it there were "some very good machines [already on the market] but pretty expensive, so my idea was, that if we could get the price way, way down, five times down, to £100, we could aim straight at the general public."[19]

What the British mass market needed to develop beyond the hobbyists and the well-healed was a product offering the accessible appliance-like nature of the Apple II, at a price accessible to a wider audience. In 1980 Sinclair released the ZX80, costing £79.95 as a kit or £99.95 ready built, the first complete computer under the

[17] Bruce Everiss, interview (2007).

[18] Adamson and Kennedy, *Sinclair and the sunrise technology*, 69.

[19] Clive Sinclair, interview (2008).

symbolic £100 mark. More appliance like than the MK14, the ZX80's complexities were hidden by plastic casing, like the more expensive Apple or PET. The ZX80 sold perhaps 50,000 units, before being replaced by an improved version, the ZX81, where changes in industrial design and internal logic created a sleeker, even more consumer-oriented product. Thanks to greater integration of components, the price of the machine dropped to £69.95 assembled or £49.95 as a kit. This adaptation of the computer to the British home did not just make it affordable and appropriate for novice users, but configured it to support educational use.

Christina Lindsay highlights the importance of the "projected user" during the computer design process, the user whom the machine's creators had in mind. In Lindsay's case of the TRS80, the projected user was the electronics enthusiast, and the machine consequently configured to support such users.[20] In Sinclair's case, the computers were intended for "the man in the street" who knew little about computers, but wanted to learn. As Clive Sinclair remarked: "The idea I had was that people could educate themselves and amuse themselves by understanding what programming meant and doing some programming at home."[21] While other uses were considered, the early Sinclair home computers were configured with education strongly in mind and directed toward a wide and unskilled audience.

Adamson and Kennedy have rather dismissively noted that the ZX80 was little more than a hobbyist computer wrapped up in a plastic case.[22] However, as Paul Atkinson has noted in respect to other forms of computer, a machine's industrial design embodies its wider culture and the intentions of those behind it.[23] That Sinclair's computers had their components and complexities hidden away was fundamental in creating the impression of a complete appliance. This was furthered on the ZX81, whose industrial designer, Rick Dickinson, made it clear about how he was aiming at a more consumer, rather than hobbyist-orientated design, with the domestic environment in mind:

> The product I think Clive [Sinclair] was pushing me towards was much more of a consumer product [than the ZX80] and… I found that very difficult because there were no home computers in the shops… what is a home computer? You know, how would people relate to it? How do you identify it? What should it look like? Should it have a feel of Dictaphone or tape recorder or a feel of television about it? Where will it sit in the home?… It had to reflect some level of hi-tech, it had to be elegant, well considered in its design and its detail… It certainly wasn't hi-fi but it certainly would live in the bedroom or in the lounge, certainly not in the kitchen or the bathroom or the garage.[24]

The ZX machines simply plugged into a television set for display and a tape recorder for data storage, reducing costs, and associating the computer with common household technologies. The existing market of hobbyists was still targeted

[20] Lindsay, From the shadows, 32–37.

[21] Clive Sinclair, interview (2008).

[22] Adamson and Kennedy, *Sinclair and the sunrise technology*, 87.

[23] Paul Atkinson. 2005. Man in a briefcase: The social construction of the laptop computer and the emergence of a type form. *Journal of Design History* 18: 191–205.

[24] Rick Dickinson, interview (2008).

Fig. 3.1 Tinkering Users: the Sinclair ZX81. The small, flat “membrane” keyboard of the ZX81 is readily apparent, as is the minimalistic aesthetic of the machine—a simple black box ready to be plugged into a television display. The BASIC commands visible on the keys indicate the use of a keyword BASIC that allowed commands to be entered at the touch of a key. Creative users tired of the small, unresponsive keypad frequently refitted the machine with a typewriter-style unit or rehoused it in a case with a better keyboard

with technical advertisements in electronics magazines, but at around the same time advertising in national newspapers introduced the computers to a new audience of nonspecialists. Using reassuring slogans, such as “inside a day you’ll be talking to it like an old friend,” Sinclair’s marketing soothed potential unease over letting a computer into the home.[25] Phrases such as “take it out of it’s box, plug into your TV and mains and start,” and “designed with special consideration for the beginner” spelt out the nature of the ZX computer as an accessible introduction to computing in easy to understand language (Fig. 3.1).

Promises to deliver “genuine computer understanding” for both you and your children and to make “learning easy exciting and enjoyable” highlight the educational pitching of the Sinclair machines. Learning to program and understand computing is a running theme throughout the advertisements, such as the emphasizing of the manual as a BASIC programming course. The machine’s features were also configured toward introducing programming. Rather than an expensive typewriter-style keyboard with moving keys, the ZX80 and ZX81 had a membrane keyboard: a flat plastic sheet with small “keys” printed on, overlaying electrical contacts. With just four moving parts, it typifies the minimalistic approach of Sinclair, a way of saving money with neat, innovative design, even if the resulting products were

[25] These examples of slogans are drawn from various Sinclair ZX80 and ZX81 adverts over the 1980–1982 period, found in the popular press.

criticized for their suboptimal nature. While the keyboard's lack of tactile feedback and small size made conventional typing difficult, this was not its raison d'être. As Rick Dickinson remarked of the ZX81, "there was no need to touch type, because data entry wasn't at that level for that particular market. People couldn't touch type, they weren't secretaries."[26] Coupled to a built-in version of BASIC that allowed keyword entry of commands by pressing a single key or key combination rather than typing them out in full, the membrane keyboard, and the computer itself for that matter, was oriented to make programming accessible, a key element of the wider computer literacy culture the machines existed in.

As I have discussed elsewhere, there was a strongly educational context to British home computing in the early 1980s.[27] Having identified the challenge of the chip in *Now the Chips are Down*, the BBC launched the Computer Literacy Project, a comprehensive and high-profile effort to introduce the nation to computing. Supported by a programming course and a best-selling book, the first television series, 1982s *The Computer Programme,* was watched by seven million people.[28] The BBC even developed their own home computer with Sinclair rivals Acorn, the BBC Microcomputer.[29] Like Sinclair's machines, the BBC Micro was designed with education in mind, but without the same degree of extreme economy and minimalistic esthetic.[30] While the ZX machines defined the lower end of the British home computer market, the solid middle-class respectability by association and £400 price tag of the BBC Micro marked its upper reaches. Between the two, a variety of manufacturers offered computers built along similar lines, almost invariably stressing educational benefits at low cost.

Alongside other measures to promote the use of information technologies by business and industry, the British Government launched a number of measures aimed at increasing public awareness of computing. 1982, for instance, was designated Information Technology Year, IT82, with events and exhibitions around the country.[31] There was an element of political spin to these policies. Maureen McNeil has highlighted the ideological role IT played in the Thatcher "reforms." The forward-looking nature of information technology broke from old-fashioned and ugly industrial connotations and its association with efficiency and new

[26] Rick Dickinson, interview (2008).

[27] Lean, Mediating the microcomputer.

[28] John Radcliffe, and Robert Salkeld. 1983. *Towards computer literacy: The BBC computer literacy project.* London: BBC Education.

[29] Acorn co-founder Chris Curry was an important figure in Sinclair's original move into computing in the late 1970s, before leaving to found Acorn. The rivalry between the two Cambridge-based companies, including a 1984 pub fight between Chris Curry and Clive Sinclair over Acorn attacking Sinclair computers' reliability in advertisements, has already been explored in the BBC's *Micromen.* A serious academic comparison of the two firms is long overdue.

[30] For an idea of the BBC's thinking behind the BBC Micro, see: Radcliffe and Salkeld, *Towards computer literacy*, 13.

[31] Clive Cookson. 1982. The times guide to information technology. *The Times*, January 14.

entrepreneurial "sunrise industries" helped to lay the ground for acceptance of Thatcher's new economic policies.[32] Against the background of decline over the 1970s, the success of Sinclair and other British computer manufacturers, selling not only to domestic markets but oversees too, was trumpeted as a success for British enterprise.

As Adamson and Kennedy describe in detail, Clive Sinclair himself became a high-profile face of technological entrepreneurship in Thatcher's Britain,[33] enjoying something of a reputation as a technological visionary at time. He spoke to the US Congressional Clearinghouse about the potential for information technology in 1984, and his next product announcements were eagerly awaited as a sign of where the future may lie. Curiously, Clive Sinclair was apparently more personally interested in other aspects of the company's work, miniature televisions, and electric vehicles, than he was on computers, but this made little difference to the company's image.[34] "Uncle Clive," as the computer press dubbed him, was a publicly appealing mix of successful entrepreneur and inventor, who harked back to the familiar figure of the lone, sometimes eccentric, British boffin. As such he was the perfect figure for introducing computing to 1980s Britain. He was knighted in 1983, and in 1982 Prime Minister Margaret Thatcher presented her Japanese counterpart with a Sinclair computer, her words making its value as a symbol of British ingenuity clear:

> I was pleased during my recent trip to Japan to be able to present to the Japanese Prime Minister, in the very temple of high technology, a Sinclair Home Computer conceived, designed and produced in this country. Out into the market ahead of its Japanese rival.[35]

Of longer lasting significance than political rhetoric was a drive for computer education in schools to prepare British children for the future. The Microcomputer Education Program helped to train teachers and develop and disseminate the necessary material "to help schools to prepare children for life in a society in which devices and systems based on microelectronics are commonplace and pervasive."[36] The Micros in Schools program gave schools financial support to purchase Department of Industry recommended computers, albeit not including those of Sinclair at first. Although the company's educational discount and later inclusion in the scheme made up for this somewhat, the approved Acorn BBC Microcomputer became the dominant British school computer by 1984,[37] while Sinclair concentrated on the home market.

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[32] Maureen McNeil. 1991. The old and new world of information technology in Britain. In *Enterprise and heritage: Crosscurrents of national culture*, ed. John Corner and Sylvia Harvey, 120–124. London: Routledge.

[33] Adamson and Kennedy, *Sinclair and the sunrise technology,* 9–14.

[34] Ibid., 85–86.

[35] Margaret Thatcher. 1982. *Speech opening conference on information technology*, London.

[36] Department of Education and Science. 1981. *Microelectronics education program: The strategy*. London, Department of Education and Science.

[37] Lucy Hodges. 1985. Average school has nine micros. *The Times*, January 25.

At grassroots levels as well, interest in learning about computers was growing. The number of local and national computer clubs in Britain grew from around 43 in 1978 to at least 235 by 1983.[38] Commonly meeting in community buildings, such as libraries and pubs, these offered many people a hands-on friendly introduction to computing. Many of those joining the clubs were not the hacker enthusiasts who have attracted so much attention as personal computer pioneers, but everyday people who just wanted to learn about computers in a supportive environment. As Jean Farrington, a member of a local club in the Lancashire market town of Chorley, recalled:

> It was the only place you could get any information at all about any of it and we joined as a family… There was a general fear around at one time, in the 80s, that people were frightened of them [computers], fearful of the technology and I was, still am a bit! But they realized that unless they could get on board, they were frightened also of being left behind.[39]

Positioned in this wider social context of curiosity and concern, Sinclair's computers became best sellers as affordable introductions to computing. For good reason did Sinclair advertising imply the importance of computers for the future, such as linking the impact of the ZX computers with the prosperity associated with the Model T Ford, and suggest computers importance in tomorrow's workplace.

The low-cost design and marketing of the ZX machines made the computer accessible in a way that appealed to the pocket, concerns, and level of computer awareness of early 1980s Britain. The machines had something of a reputation for poor reliability, yet this did little to dampen enthusiasm for Sinclair' computers; indeed, overwhelming demand sometimes caused problems fulfilling orders in a timely fashion. The appeal of the computers to a general market was furthered by national bookshop chain W.H. Smith, who started selling the ZX81 off the shelf in their stores for Christmas 1981. Prior to this computers had mainly been sold via mail order or through the small number of specialist computer retailers, which could be intimidating places for the novice. Smith's profitable experiment took the computer onto the high street and reduced it to a box that could be bought without the complications associated with computers, even if Smith's had to give their own staff a basic computer education to be able to sell them.[40] They were soon followed by other major retailers, whose efforts and advertising further the impression of microcomputers as consumer products.

Sinclair's earliest home computers, the ZX80 and especially ZX81, were innovative in redefining computing in a new form suitable for the 1980s British home, with a strong focus on education and programming. Moving further from hobbyist computing, Sinclair's next offering, the ZX Spectrum of 1982, refined this concept, removed the option for kit construction, and added a host of improvements in light of experiences with the earlier machines. The Sinclair computer was

[38] Thomas Lean. 2008b. *'The making of the micro': Producers, mediators, users and the development of popular microcomputing in Britain (1980–1989).* PhD thesis, University of Manchester.

[39] Jean Farrington, interview (2007).

[40] Adamson and Kennedy, *Sinclair and the sunrise technology,* 109–110.

initially configured with educational use in mind, but as Christina Lindsay reminds us, projected and actual use can differ, with consequences for the future development of a technology.[41]

3.3 GOTO Education

In line with the expectations of computer designers, many of the people who first bought computers in the early 1980s did so for educational reasons. For example, a 1981 survey of around 150 users in consumer advice magazine *Which?* revealed that the two most important uses that people bought computers for, were "writing programs" and "helping to learn about computers."[42] Many parents purchased computers for their children in expectation of educational benefits,[43] and Neil Selwyn has made a persuasive case that the activities of IT firms, the media, and Government from the 1980s have enshrined the computer as being inherently educational.[44] A question remains of how much of this educational intent and ethos was actually carried through into use of the home computer, particularly in the case of Sinclair, where gaming eventually became paramount.

Leslie Haddon's idea of "self-referential" computer use, using the computer to understand it, is valuable here. This exploratory use of the computer is clear in the selection of software available for the early Sinclair machines, which often seem of tenuous practical application. We see many programs for such purposes as generating interesting patterns, plotting histograms, displaying "biorhythms," or using the computer as an alarm clock. While of some utility, such software seems more valuable as a demonstration of what the computer *could do* and as a simple way interacting with it and exploring its capabilities. It helped familiarize the computer through association with everyday activities and introduced some potential real-life applications on a small scale, such as telephone directory programs as an introduction to databases.

The importance of programming to the computer hobbyist generally has been established.[45] The Sinclair machines were popular with hobbyists, as availability of kit ZX80 and ZX81s and the use of the machines in electronics hobbies, such as amateur radio, demonstrate. However, the ZX computers had much wider appeal, and in the computer literacy culture of 1980s Britain, programming was an important element of mainstream home computing. In some ways learning programming seems as an act of empowerment, a way of mastering the machine rather than becoming its slave. Programming and learning about computers were closely

[41] Lindsay, From the shadows, 37–40.

[42] Anon. 1981a. Home computers. *Which?*, July, 376.

[43] Gowling Marketing Services. 1984. *The attitudes of parents and children to home computers and software.* Liverpool: Gowling Marketing Services.

[44] Selwyn, Learning to love the micro.

[45] Levy, *Hackers*, chs. 10 and 11.

associated, with programming an element of computer education books, television, and computer club activity. In general, as David Skinner points out it was a common aspect of people's initial computer use.[46]

Sinclair was no exception to this, well demonstrated by articles in *Sinclair User* magazine, notably "User of the Month," which profiled a variety of Sinclair computer users around 1982–1984. Programming features in most of them, among users as varied as pensioners looking for an interesting hobby, to sportsmen optimizing their performance, and to parents anxious about their children's education. Sinclair computing was embedded in a context that encouraged and facilitated programming. It featured heavily in Sinclair magazines, commonly in the form of teaching articles and type-in program listings. Further program listings and more detailed knowledge were available from a multitude of cheap and easily accessible books.

As David Skinner has revealed, there are different ways of programming and people engaged with it to a different extent.[47] It could be just about typing out listings from magazines and books into the computer to get a program to run. The process could be time consuming and laborious, particularly on the small keyboards of Sinclair machines. Type-in listings were often error ridden or might be mistyped, leading to bugs in the program which the user would have to hunt down. For some it just added to the difficulties in getting the computer to do something useful, but for others bug hunting could be a "challenge and a useful learning exercise."[48] Programming was not just the means to an end, but could be an end in itself. It can be seen as a mental pursuit akin to a crossword or other puzzle, as another user remarked, "it is the sheer logic of it which appeals to me."[49] As Skinner points out, programming did not necessarily have to lead to some finished end product. It did not have to have practical value beyond the practice of programming, as another Sinclair user recalled:

> I think the biggest challenge for me was attempting to write a rudimentary word processor. God knows why, I didn't have a printer. Never managed to succeed but it was an interesting side project.[50]

Advanced users could go even further than BASIC and start experimenting with more complicated lower-level languages, programming in assembler, and machine code; though such was the wide appeal of programming, that guides on machine code were even produced for children. Whatever the depth of an individual's programming activity, it was a commonplace practice, unrestricted to any particular subculture of home computer users. With little ready written software available at

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[46] Skinner, *Technology, consumption and the future*, 254.

[47] Ibid., 255–257.

[48] J. Johnson. 1983. Letters: Illustrations waste space. *Sinclair User*, June, 17.

[49] Claudia Cooke. 1983a. User of the month: Retiring to the sea, the ship and his Sinclairs. *Sinclair User*, April, 48.

[50] Mark Patterson, correspondence (2005).

first, it was also something of a necessity. Initially a commercial home computer software industry did not exist on any meaningful scale, and users themselves became software producers. Most of the program listings printed in magazines were sent in by readers, and a cottage industry emerged of home produced software cassettes sold via the small ads pages of computer magazines.[51] This activity quickly became more organized as skilled home programmers began to set up small businesses themselves, employing others from similar backgrounds or publishing the submissions of others.[52] Many of these programmers were teenagers, some of whom rose to national attention, as newspapers began reporting their allegedly massive salaries as a demonstration of how knowing about computers was bringing prosperity.[53] The wide availability of ready written software would eventually become a game changer. It meant that users did not *have* to learn to program for themselves to use the computer. In time, this would challenge the original conception of an educational computer. However, education was not the only thing the Sinclair computers were capable of.

3.4 "Serious" Use

The drawbacks of Sinclair computers, such as reliability problems and design compromises, which cut costs at the expense of usability or capability, have frequently been highlighted by commentators. In all fairness, such problems were far from unique to Sinclair, but the machines were undoubtedly built to be cheap. To keep costs down, the ZX machines had basic features, even compared to many contemporaries. The ZX81 had just 1 kilobyte of random access memory (RAM), enough to hold about half an A4 page worth of text, limiting program size. The keyboard was a common target of criticism, described by consumer guide *Which*? as "small and tiring to use."[54] The display was low-resolution monochrome, it had a single nonstandard interface port, and it lacked such basic refinements as an on/off button. The machine had no sound, though enterprising users learned to play music, after a fashion, by connecting the cassette recorder output to a speaker. While the Spectrum had a color display, improved membrane keyboard with moveable rubber keys, a beeper for sound, and larger 16 or 48 kilobyte memory, it too lacked the refinement of more expensive machines. For example, while the BBC Micro was inferior in some respects to the Spectrum, such as smaller 32 kilobyte memory, the "Beeb's" better graphics and sound, full typewriter-style keyboard, and impressive expansion

[51] For a good example of the mechanics of this activity, see Chris Bourne. 1985. Fool's gold from the funny farm? *Sinclair User*, January, 138.

[52] For an atmospheric insight into the early British home computer software industry, connected with Sinclair's rival Acorn but typical of the time, see Francis Spufford. 2004. *Backroom boys.* London: Faber and Faber, ch. 3.

[53] Lean, From mechanical brains to microcomputers, 195–196.

[54] Anon. 1981b. Home computers. *Which?*, August, 439.

capabilities added up to a package that seemed of higher quality, particularly given Sinclairs' poor reputation for reliability.[55] The ZX machines' limitations have led to them being written off as "serious" computers, only useful for games or introductory use. For example, Leslie Haddon remarks that "Sinclair's earliest home computers were distinguished by the degree to which they had virtually no practical uses or benefits apart from being a vehicle for learning to program."[56]

Technological determinism would suggest that the machine's limitations should have limited their utility. However, these perspectives ignore the potential for Sinclair users to reinterpret and reshape their computers as they saw fit, and there are several indicators that the machines were used for more than just learning about computers. A 1984 survey of 2000 small businesses with computers revealed Sinclair machines were used by 9 %, the same share as Apple, and only 3 % behind market leader Acorn.[57] Applications software was available in some quantities for the machines, not just simple calculators, but feature rich programs, such as the popular *Tasword* word processor and *Masterfile* database. *Sinclair User's* "User of the Month" feature provides useful case studies of people putting these cheap and apparently limited computers to surprisingly sophisticated applications.

The 1970s programmable calculator had been used as a precursor to fully fledged personal computers.[58] In the early 1980s we see the situation reversed, as people made use of microcomputers as sophisticated calculators. From small businesses, there are stories of how ZX81s and Spectrums were used to calculate payrolls,[59] check taxes,[60] or work out engineering stressing calculations.[61] Outside the office, micros were used in hobbies, such as amateur archeology[62] to help calculate measurements of dig sites, or by canoeists to determine the optimum course across streams.[63] There still seems an element of exploratory use in many of these cases, as people found out what a computer could be useful for. However, in other examples the programs seem of more genuine utility, such as a ZX81-based antiques dealer's business system, combining databases for stock control and financial records with the ability to analyze the data to produce financial reports.[64]

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[55] Ralph Bancroft. 1984. What the retailers said when they looked at the spectrum. *The Times*, December 4.

[56] Haddon, *The roots and early history of the British home computer market*, 125.

[57] Bill Johnstone. 1984. More small firms buy computers. *The Times*, June 14.

[58] Paul Ceruzzi. 1999. Inventing personal computing. In *The social shaping of technology*, 2nd ed, ed. Donald MacKenzie and Judy Wajcman, 66–68. Buckingham: Open University Press.

[59] Claudia Cooke. 1983b. User of the month: Taking the strain out of calculating wages. *Sinclair User*, August, 78–79.

[60] Claudia Cooke. 1983c. User of the month: Leading athletes quest for gold is boosted by ZX-81. *Sinclair User*, September, 84–85.

[61] John Heritage. 1984. Sinclair business user: A systematic start. *Sinclair User*, July, 120.

[62] Chris Bourne. 1984. Digging up the past. *Sinclair User*, August, 110–111.

[63] Nicola Serge. 1984. User of the month: Paddle your own canoe with the ZX81. *Sinclair User*, February, 58–59.

[64] Alan Proctor. 1984. Sinclair business user: ZX-81 in the antique shop. *Sinclair User*, November, 163–164.

Key to the use of simple computers for complex tasks was the availability of add-ons, peripherals, and upgrades, which allowed users to expand the capabilities of basic machines. While Sinclair produced around half a dozen key peripherals, many more were produced by a cottage industry of small manufacturers. At least 500 different peripherals were available for the ZX Spectrum: interfaces to adapt the machines' simple user port to standard interfaces, disc drives, enhancements for graphics and sound, and all manner of specialized gadgets.[65] While a few needed soldering or had other technicalities to grasp, many simply plugged into the computer's user port, a simple way of improving the machine. Sinclair membrane keyboards were often replaced by typewriter-style units,[66] and memory upgrade "RAM packs," from a variety of suppliers, became virtually standard kit on the ZX81. Illustrating the occasionally quirky nature of the machines in use, "RAM pack wobble" wiping the contents of a loosely fitted ZX81 memory upgrade could cost hours of programming effort. The range of solutions suggested in computer magazines, readers' letters advocating Blu-Tack or Velcro, adverts for specially made computer holders, and improved wobble-free RAM packs are insightful into the homespun ingenuity of users and to how peripheral suppliers helped to negate the ZX machines' drawbacks.

In keeping with the wider encouragement to learn to program, many of the users profiled in "User of the Month" relied on application software written themselves, frequently far beyond simple programs. Using a ZX81 or Spectrum for serious computing could be a complex task, requiring multiple add-ons and the additional complication of getting software to work with them all. While it certainly was not countercultural in the context of computer literacy, such efforts could share the fascination with technology typically associated with hacking. One user, for instance, boasted with pride of never having bought a commercial program, preferring to write software himself.[67] Another remarked on the "application that boarders on obsession" required for serious programming.[68] Most of those profiled reckoned that after the initial outlay in time and learning the computer made a positive difference. For example, a Methodist minister, who used his Spectrum to match circuit preachers with churches, reckoned that his timetabling program, after taking month to write, did a morning's scheduling work in 15 minutes.[69] While Sinclair's machines did not make ideal serious computers straight out of the box, with user innovation they could become useful small systems and were far from restricted to "self-referential" computing in the hands of determined users.

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[65] Paul Jenkinson. 2007. Spectrum hardware page. http://www.worldofspectrum.org/hardware/. Accessed 15 Oct 2007.

[66] Franco Frey. 1984. Dk'tronics revisited. *Crash*, October, 52–53.

[67] Cooke, User of the month: Leading athletes quest for gold is boosted by ZX-81.

[68] Proctor, Sinclair business user: ZX-81 in the antique shop.

[69] Flo Barker. 1984. Programs lighten the load of a methodist minister. *Sinclair User*, January, 102–103.

Fig. 3.2 Responding to Users: Sinclair ZX Spectrum. The larger size of the "Speccy" improved the computer's usability compared to the ZX81 model, notably through the raised "dead flesh" rubber keys that gave computer users better tactile feedback. The machine, now with a simple sound generation and color display, was better optimized for entertainment uses than its predecessors, but BASIC programming remained a prominent part of the design

3.5 Just a Toy Computer?

Today the Sinclair computer is not primarily known as an introductory computer, or valuable electronic office aid, but as a computer game system. Sinclair had anticipated that games would be among the uses of their home computers, but seem to have been surprised to the extent to which this occurred.[70] The low price and small size of Sinclair's computer put them dangerously close to expensive toys, and many were purchased for children. In his discussion of how the home computer turned into a games system, Leslie Haddon draws attention to how the software industry and magazines turned computer games into a desirable commodity for computer users, particularly children and teenagers.[71] The extent to which this happened actually varied considerably across the market. Acorn's educational user base, for example, insulated them from such changes, but the transformation of Sinclair into a games system was dramatic (Fig. 3.2).

Games playing quickly emerged as a prominent use of the ZX81. Games were a good demonstration of what the computer could do and many of the listings printed in magazines were for game programs. Indeed, home programmers learned how to make effective use of the machine's tiny memory to an extent where there was even a one kilobyte version of chess. From the computer press and a flow of programs and suggestions sent in directly from users, Sinclair was aware of the growing

[70] Clive Sinclair, interview (2008).

[71] Haddon, *The roots and early history of the British home computer market*, ch. 7.

importance of gaming. The design of the ZX Spectrum was thus configured with games more in mind.[72] As Clive Sinclair and Rick Dickson, respectively, remarked:

> Because of the games development the Spectrum was a logical next step: we improved the keyboard and we put in color.[73]

> Color was a pretty logical progression… I suppose it was a question of just think what you can do with color if it was a games product; it gives you so many new dimensions… I think by then Clive had probably accepted that it was a games product predominantly.[74]

As in Lindsay's case of the TRS80, the conception of the configured user had begun to change in response to actual users.[75] The Spectrum still possessed all the educational qualities inherent in its predecessors, and its greater capability was just as easily turned to other uses too. However, low-cost, high-profile, and color graphics also made it a particularity attractive games machine to younger users and an increasingly organized software industry. Unlike other forms of software, there is a disposable quality to games. After completion a game could simply be replaced by another one, a potentially lucrative cycle of software consumption. Analysis of the most comprehensive listing available of Sinclair software, from the website *World of Spectrum,* shows that in 1982 a little over 200 games were commercially released for the Spectrum and around 60 utilities. In 1983 there were around 170 new utilities compared to nearly 800 games, a discrepancy that grew.[76] Accompanying this came glossy advertising of games and the promotion of star programmers, which started to overshadow other forms of software.

Like other types of 1980s home computing, gaming actually had technical aspects too. The BASIC commands PEEK and POKE allowed memory locations to be examined and altered. PEEKing and POK(E)ing was a common facet of Sinclair gaming, as users explored programs in the hope of finding ways of modifying the game or cheating. Other users enjoyed the challenge of hacking into commercial releases to circumvent copy protection, wrote their own games from scratch or keyed in games from listings, making their own modifications as they went along, and altering commercial releases. As user Mark Patterson recalled of his childhood Spectrum use:

> In those days, you could play a game and think 'wouldn't it be great if you had a gun in *Manic Miner* [a popular game]' then go to work trying to build a level from scratch where you can go ahead and shoot the bad guys instead of jumping over them.[77]

Although programming was enjoyable for some, for others, it was a means that delayed the ends of playing the game. The ready written products of the games industry offered instant gratification, or at least in the time it took to load a cassette. There was little educational value in such activity, and the culture that went with it was more about consumption than education. Leslie Haddon has revealed elements

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[72] Haddon, *The roots and early history of the British home computer market*.

[73] Clive Sinclair, interview (2008).

[74] Rick Dickinson, interview (2008).

[75] Lindsay, From the shadows.

[76] Thomas Lean. 2004. *'What would I do with a computer?' The shaping of the Sinclair computer 1980–1986*, 99. MA thesis, University of Kent.

[77] Mark Patterson, email (2005).

of masculine competitiveness in the culture of computer gaming among younger micro users.[78] At school, computer clubs and at home, young users, largely boys, traded hints and tips, gossiped about their game experiences, swapped pirated software, discussed the latest releases, and compared high scores – we even see them being compared in the letters pages of magazines. There was rivalry between the owners of different platforms and competition to own the largest games collections, new releases, or complete series of titles.

Consumption of entertainment software was fueled further by computer magazines. While the Sinclair magazine market had originally catered for a range of uses, with programming, gaming, and general interest publications, it became increasingly dominated by games coverage. *Sinclair User,* for instance, began as a general interest publication, with a pronounced programming and exploration element. By the later 1980s it was a gamer's magazine, altered by the change in the market, advertising revenue from software houses, and competition from game-focused rivals, such as *Your Sinclair* and *Crash.* The supportive context of the Sinclair computer thus shifted from supporting education to gaming. The computer code listings previously contained in magazines were replaced by cover-mounted cassettes of ready to run programs and reviews of commercial software.

In the context of computer literacy, the use of computers for such frivolous purposes as games was a misuse of their potential for some. In the computing press we see hints of frustration that people were not taking their home computers more seriously and that the concentration on games had left the serious user unsupported, as a reader lamented in *Sinclair User*:

> The Spectrum is a sophisticated, powerful machine having the capabilities of the minicomputers of a decade ago [which were] properly used as tools for serious applications. So why is the £130 home computer not similarly used in the same roles? Unfortunately they have become saddled with the image of toys. It is clear that the potential serious user of a Spectrum…is dissuaded from buying the computer.[79]

As the computer market matured, so too did the buying public. By 1984, prospective customers were likely to have some experience of microcomputing, and there was a gradual shift toward more sophisticated "real computers" rather than introductory machines.[80] Consumer electronics manufacturer Amstrad demonstrated this shift when they joined the home computer market in 1984. Dismissing Sinclair's products as "pregnant calculators" Amstrad head Alan Sugar demanded a professionally styled "real computer," modeled on those customers might encounter at airport check-in desks.[81] Even if the resulting Amstrad CPC464 was not that much more powerful than a Spectrum in many respects, it certainly looked more like a serious computer. Despite considerable user interest, Sinclair's own attempt at a business machine, the sophisticated £400 Quantum

[78] Haddon, *The roots and early history of the British home computer market*, ch. 8.

[79] G.A. Rooker. 1983. Letters: Technical uses need promoting. *Sinclair User*, October, 19.

[80] Bancroft, What the retailers said when they looked at the spectrum. Peter Large. 1984. Indian summer of cheaper micro. *The Guardian*, December 20.

[81] David Thomas. 1991. *The Amstrad story*, 123–124. London: Pan Books.

Leap (QL), was a failure, brought down by a mix of technical and production problems and confusion over whether it was a home or professional computer.[82] This failure, along with that of Sinclair's ill-fated C5 personal electronic vehicle, contributed to Sinclair's sale to Amstrad in 1985, who continued to produce the Spectrum and to further develop it.

One of the surprising things about the popularity of the Spectrum for gaming was that it was not especially well suited to such use from a technical standpoint. In original 1982 form, it lacked an interface that could directly connect to most joysticks, its sound was limited to a simple beeper, and its display suffered from an inherent technical issue known as "color clash" which caused screen colors to get mixed up in animations.[83] These drawbacks in an entertainment product were mitigated by add-on joystick interfaces from the cottage industry and programmers learning to lay out graphics to avoid color clash. However, as Spectrum gaming expanded, Sinclair, and later Amstrad, reconfigured the machine to enhance its suitability for gaming.

By the Amstrad developed Spectrum+2 of 1986, the addition of joystick ports, a proper sound synthesizer, and a built-in cassette recorder had created a "software player" orientated towards entertainment.[84] Concurrently the prominence of BASIC was depreciated. The programming oriented membrane keyboard was replaced by a typewriter-style unit without BASIC keywords on the keys, and BASIC was hidden behind a software loader screen rather than being the first thing the user saw on boot up. Marketing paid scant attention to education or programming, but instead emphasized that there were "more games available than you can wiggle a joystick at," to quote one Spectrum+2 advert from around 1986. Even while more powerful computers appeared on the home market, pushing the Spectrum into obsolescence, software houses continued to support the large Spectrum user base. Indeed, experienced programmers who knew the machine intimately could create games of a quality reckoned to exceed early efforts on newer computers, such as the Atari ST.[85] As the cumulative weight of gaming built up over the years, and the machines' design and representation changed to reflect this, the educational origins of the Sinclair computers slipped into memory. The Sinclair computer had changed from introduction to the future to mere gaming appliance.

Even as the emphasis on everybody learning to be a programmer declined, in the face of consumption of ready written commercial games, another form of self-referential use emerged for aging home computers like the Spectrum, albeit on a far smaller scale.

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[82] Adamson and Kennedy, *Sinclair and the sunrise technology,* 153–182.

[83] The Spectrum's color display was essentially a monochrome bitmap image beneath an overlay which divided the screen into blocks of different colors. This saved on memory as it was unnecessary to store information on what color each pixel was, but it could cause color clash where the underlying bitmap image moved from a block of one color to one of a different color, appearing to change color itself in the process.

[84] Between the original ZX Spectrum and Spectrum+2, Sinclair had developed the Spectrum into the Spectrum+, little more than re-cased Spectrum with a new keyboard, and Spectrum 128, with extra memory, improved audio capabilities and other improvements.

[85] James Sumner. 2005. Retrieving micro histories: The strange case of the domestic microcomputer. Paper presented to University College London seminar series, London.

Demos, like earlier home computer software, were a demonstration of what the computer could do, but for artistic rather than instructional ends, for example:

> I modified a screen flipper to create a full screen dancing Dizzy character. Mashed two programs together, one was the screen flipper, and another did the flipping based on sound input through the MIC socket. The character would kind of dance to the music.[86]

Typically combining animations and sound effects to create an audio-visual experience for the user, demo programmers frequently pushed the Spectrum to the limits of its capability, to where one "wouldn't have believed the machine could do this."[87] Sometimes included on magazine cover tapes, demos were also swapped through less visible channels, such as mail-order public domain libraries or personal contacts. This non-mainstream movement had an international following, with prominent groups in Eastern Europe where Spectrum clones would continue to be produced after the machine's official end of production in 1992. Use, as David Edgerton reminds us, continues long after a technology is new.[88]

In the early twenty-first century, Sinclair's computers still have use, both as popular culture nostalgia, well demonstrated by *Micromen*, and within the niches of demo and "retrocomputing" communities, which continue to keep the machine alive, archiving and even producing new software. Indeed, considering the machines' cult status, the popularity of extensive sites, such as *World of Spectrum,* and premium prices commanded for Sinclair products on E-bay, 30 years from its birth the Sinclair computer is, in its afterlife, still thriving.[89]

3.6 Game Over

The history of Sinclair computing reveals much of the conditions that shaped the early British popular computing experience, particularly its original educational emphasis. In the context of computer literacy, developing an intimate knowledge of computing and programming was not just the niche interest of a subculture, but a part of a wider societal move toward computer mastery and common part of home computer use. The demise of this model of computing and the remaking of the Sinclair computer as a video games player demonstrates the importance of users, software houses, and magazines in the ongoing construction of computer technology. In particular, the redesign of the Spectrum to reflect the uses that gamers were finding for it closes the loop between production and use of technology, by demonstrating how producers and users could coproduce a computer over time. That the educational computer died out does not designate its failure, but rather its success in helping a computer-illiterate British society get used to

[86] David Womble, correspondence (2008).

[87] Paul Collins, personal communication (2008).

[88] David Edgerton. 2006. *The shock of the old: Technology and global history since 1900*. London: Profile.

[89] Martijn van der Heide, et al. 2010. *World of spectrum*. www.worldofspectrum.org. Accessed 10 Jan 2010.

the idea of computers. It was simply a concept with a finite lifespan that contained the seeds of its own obsolescence.

Sinclair computing provides an excellent case study of the British home computing experience, but it is only one example, albeit an important one. The British computer market was diverse,[90] and comparative work between different manufacturers and the users of their products is needed to reveal a more nuanced picture of popular computing cultures. Sinclair's computers also had stories outside Britain. The simple, economic model of personal computing inherent in the designs meant that they were widely copied, particularly in the Eastern bloc. Indeed Russian Spectrum clones, such as the Scorpion and Pentagon, expanded on Sinclair's basic design considerably.[91] In more affluent markets, the story was somewhat different. Sinclair's own efforts to market versions of the ZX81 and Spectrum in America through a deal with Timex were of fleeting, but not insignificant, success. According to Adamson and Kennedy, over half a million Timex Sinclair TS1000's, an Americanized ZX81, were sold in the USA in their first 5 months of sales in 1982, on top of 150,000 previous mail-order sales of ZX81s into the States by Sinclair.[92] Faced with a large marketplace of more affluent consumers better able to afford more powerful machines, this flow of British home computers into America seems to have been relatively short lived. However, according to Brian Bagnall's recent popular history of American home computer giant Commodore, the Sinclair concept of accessibly low-cost computing had more traction. Citing Commodore designer Chuck Peddle, Bagnall claims that Commodore's own move from the PET series to a cheaper personal computer, the VIC20, was directly influenced by the ZX80.[93] Such transfers of popular computing ideas *into* the USA, not just from it, demand that we consider the early development of personal computing as more of a global movement than has hitherto been the case.

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[90] For discussion of the extent and reasons for this diversity of computer design, see Lean, *The making of the micro*, 217–232.

[91] Chris Owen. 2010. *Planet Sinclair: Clones and variants*. http://www.nvg.ntnu.no/sinclair/computers/clones/clones.htm. Accessed 10 Jan 2010.

[92] Adamson and Kennedy, *Sinclair and the sunrise technology,* 133–136.

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