Turing today

Pre-print draft, summer 2012. If citing this work formally, please use the version published: *Notes and Records of the Royal Society*, 66(295), 2012, 295-300, doi 10.1098/rsnr.2012.0036.

Andrew Hodges, *Alan Turing: The Enigma.* New edition. London: Vintage, 2012. Pp. xxxi + 586.

Sara Turing, *Alan M Turing. Centenary Edition*. Cambridge: Cambridge University Press, 2012. Pp. xxiv + 169.

George Dyson, *Turing's Cathedral: the Origins of the Digital Universe*. London: Allen Lane, 2012. Pp. xxii + 401.

Simon Lavington, ed., *Alan Turing and his Contemporaries: Building the World's First Computers*. Swindon: British Computer Society, 2012. Pp. xiv+111.

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The international celebrations of Alan Turing's centenary this year mark a profound transformation in status. Thirty years ago, only specialists in computational logic knew of the "Turing machine," the deceptively simple thought-experiment introduced in the mathematician's first major work of 1936; we are now confronted with an entire "Turing industry", paralleling the entrenched Darwin industry which dominated media science coverage around the bicentenary of 2009. The circumstances of this elevation are remarkable: Darwin had his eclipse, but Turing never approached celebrity in his own lifetime, nor for many years after his death, by his own hand, in 1954.

A four-paragraph obituary in the *Manchester Guardian* acknowledged Turing as "one of the pioneers of the electronic calculating machine in this country," but this would have been news to most readers.[1] His crucial wartime codebreaking activities were utterly unknown until the 1970s, when an exceptionally stringent State secrecy began to crumble. His subsequent project to build a practical computer had stalled, through managerial disagreements and delays, eventually re-emerging without his name attached. The ideas of his last years, on the consequences of computers for the philosophy of mind and their use in morphogenesis modelling, were rated by subject specialists as moderately interesting contributions from an outsider, if not downright marginal. Turing's academic reputation rested significantly on his 1930s work on

[1] *Manchester Guardian*, 10 June 1954.

computability theory, the cited reason for his 1951 election to the Royal Society; and this work was chiefly applauded for resolving a confounding problem in mathematical logic. The connection between defining computability and practical computing, less self-evident than a lay reader might imagine, was obscured in a blizzard of transatlantic activity from the late Second World War to the early Cold War, and remains controversial.

One welcome output of the Turing industry is a reissue of the definitive biography by Andrew Hodges. In the complex process of Turing's re-evaluation, Hodges stands out as both agent and chronicler: his concluding "Author's Note" (pp. 530-540) is an impressive historiographic essay, critically surveying Turing's reputation up to the time of first publication in 1983. As in the previous reissue of 1992, the original text appears unrevised with a new preface: where the emphasis in 1992 was on presenting newly discovered sources, however, Hodges here works mainly to assimilate the scope and consequences of his own success. To insist on appreciating Turing as "a figure in world history" (p530) might have seemed grandiose in 1983; today, the position is mainstream.

The two principal elements of the case are those most familiar to general audiences today. The first, now unquestioned, is Turing's central role in the attack on German naval Enigma codes at Bletchley Park, often credited with bringing an Allied victory closer by months or years; the other, inevitably controversial, is his status as the sole, central directing influence on the emergence of electronic computers.[2] It had long been widely accepted that the crucial step in the evolution of digital computers was the definition of the 'stored-program' architecture, in which data and instructions could be handled equivalently; the approach proliferated into general use from a reliably documented sole origin, a widely distributed 1945 report compiled by the Princeton-based mathematician John von Neumann. The stored-program concept, Hodges points out (p. 303), was formally equivalent to an element of Turing's 1936 computability proof; and Turing had spent two years in Princeton as a doctoral student soon after submitting the relevant paper. In 1972, Brian Randell, one of the first computer scientists to undertake the history of his field, had drawn attention to an apparent meeting between von Neumann and Turing, although the evidence remained murky and contradictory for some years; Hodges' treatment draws the connections, finding in the apparently esoteric pre-war work a practical proposition which informed Turing's own designs of 1945, and almost every other computer besides.

Hodges is most impressive in couching such technical claims amid a richly described wider context. Indeed, his book should be a standard counter-example to the common moan that only trained academic historians can produce nuanced, resonant history. Hodges is himself a mathematician by profession, but his connection to Turing arose through his activism in the Gay Liberation movement of the 1970s, as he investigated the hormone-based "treatment" endured by Turing and others of his generation. Hodges evidently feels a strong kinship with his subject, but is careful to avoid degrading his sympathy into hagiography (he acknowledges Turing as a hopeless manager of people, often unrealistic in his bargaining for professional support); rather, he uses it to tie together perceptively the complex threads of the sexual, social and scientific. This is particularly evident in his handling of Turing's downfall, across

[2] Hodges' position on this point is spelt out more succinctly on his accompanying website: "Who invented the computer? Alan Turing's claim", n. d. Online at [http://www.turing.org.uk/turing/scrapbook/computer.html].

the years 1952-54, which plays out against a backdrop of growing Cold War insecurity and Anglo-American mistrust.

Hodges explicitly proposes Turing as a man "ahead of his time" in both his personal life and research, but in doing so shows a reassuring awareness of the dangers of anachronism and the subtle power of actors' categories. This holds as much for Turing's personal life as for his research. In one private document, for instance, Turing used the word *gay* in what may be its modern-day sense – at that time, somewhat established in the United States, but almost unknown in his homeland. Hodges argues cautiously (p. 448, n.) that Turing was probably aware of emerging efforts to crystallise a new identity, open and matter-of-fact, shorn of the moral and medical baggage of the conventional term *homosexual*. This would have set him apart from the established sexual cultures, both elite and street, in which he attempted to move. Thus, we begin to see why, under police suspicion in 1952, he did not dissemble – as almost any man in his position would – but volunteered a statement using a precise form of words which would lead, as night follows day, to prosecution and conviction for "gross indecency" (pp. 457-8). Turing's decision was neither premeditated martyrdom nor rank naivety, but a fundamental insistence on meeting the world on his own terms, be they of their time or not.

The comprehensiveness of Hodges' research has in some ways restricted the opportunities for further writing on Turing. Though an evident doorstop, running beyond 600 pages, the book sits happily in the general-interest market, acclaimed as an absorbing read with few mathematical hieroglyphics. The difficulty of producing a competitor volume was illustrated in 2006 by the novelist David Leavitt, who filled out a compressed version of the established story with more personal commentary on Turing's cultural resonances: the resulting biography was unquestionably shorter, but not notably more compelling. Jack Copeland, perhaps the most active Turing scholar in recent years, has preferred to express himself through commentary on primary material, an approach which naturally leads the focus towards the technical and mathematical; other authors likewise provide technical studies aimed at specialists, or else use Turing as a lens to explore the considerable number of fields in which his influence may be found.[3]

It is unsurprising, then, that this centenary year has not brought forth a new biography. There is, however, an old one: Cambridge University Press has revived the remarkable short memoir compiled by Turing's mother after his death, originally issued in a tiny run by Heffers of Cambridge in 1959 and long prized as a collectors' item. A middle-class daughter of Empire in her seventies, with no mathematical or scientific background, Sara Turing was driven by a conviction that her son's work held a crucial significance she could not altogether put into words. Her text laid down many standard elements of the Turing legend in their definitive form: the dazzling mind, racing ever onward; the dirty-fingernailed disregard for personal niceties; the routine impenetrability, which could give way to urgent clarity when Alan really wished to communicate. The account of Turing's childhood, in particular, charms; it also foreshadows, with its repeated mention of potions, chemicals, and witches' brews.

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[3] David Leavitt, *The Man Who Knew Too Much*, London: Weidenfeld and Nicholson, 2006; Jack Copeland, *The Essential Turing*, Oxford: Oxford University Press, 2004; Charles Petzold, *The Annotated Turing: a Guided Tour Through Alan Turing's Historic Paper on Computability and the Turing Machine*, Indianapolis: Wiley, 2008; Christof Teuscher, ed., *Alan Turing: Life and Legacy of a Great Thinker*, Berlin: Springer, 2004.

Awkwardly, this "Centenary Edition" presents no sign of a professed editor, and little editorial intervention to provide context. There is a foreword, contributed by Martin Davis, one of the most influential computation theorists of the present day, who notes briefly the major omissions in Sara Turing's account – she knew nothing of his war work, and said nothing of his sexuality – and does his best to untangle briefly the mystification surrounding Turing's death. (The memoir is the standard source for assertions that his poisoning by cyanide was an accident, heartbreakingly depicting a careless overgrown schoolboy muddling his home-brewed chemical experiments. This theory, recently credited by Jack Copeland, discounts an admittedly terse pathologist's report observing that Turing had drunk a significant quantity of cyanide solution.) Primarily, though, Davis's foreword is the usual potted history of Turing's life and achievements. The novice reader will find all this useful (and any author who can passably explain Turing's work on the *Entscheidungsproblem* for general audiences deserves praise), but it is not enough.

The text cries out for annotation: how many twenty-first-century readers can possibly know what it meant for a female mathematician of the nineteenth century to be "bracketed with the seventeenth wrangler" (p. 8)? The lack of useful notes is puzzlingly underlined by useless ones: an unidentified hand twice advises us (pp. 32, 153) that a hypothetical billion pounds of 1932 would have been "worth many times more than it is today!" For context, therefore, we must turn back to Hodges, whose evaluation of one of his principal sources (pp. 531-3) may surprise. Sara Turing's apparently intimate account of her son is largely compiled from letters and other written sources: she was, he concludes, projecting a genuine closeness the two had begun to enjoy, towards the end of Alan's life, onto a boarding-school childhood of which she knew little. Hodges also detects an "extraordinarily obsequious attitude to anyone of rank or office, which meant that by implication she put her son at the level of a promising sixth-former." The memoir's tone is not as stridently snobbish as this may suggest; to market it largely unmediated as a popular introduction, however, is clearly problematic.

The volume's frustrating lack of editorial seriousness shows in other ways. One real strength is the inclusion of a previously unpublished essay by John Turing, Alan's brother, but we are told nothing of its provenance. (It was prepared from a manuscript, apparently begun in the 1960s and completed some time after the Bletchley Park revelations, ultimately to be found by John's son in the obligatory drawer.) John's often blunt text is absurdly indicated on the title page as an "Afterword" to his mother's memoir, which he discusses in rather scathing terms. We are similarly left in the dark about Lyn Irvine, who contributed the 1959 foreword: a journalist, Bloomsbury peripheral, and wife of Turing's colleague Max Newman, she understood him better than most. The 1959 pagination has not been preserved, unhelpfully for anyone who might wish to cite the text. At the time of writing, CUP advertises the book as containing an index: there is none. Nonetheless, the edition stands as the only accessible source for material essential to Turing scholarship.

A more telling indicator of the current power of Turing's name is its appearance on the covers of books which are largely about other people. *Turing's Cathedral* by George Dyson, a popular historian of technology, tells of the creation and use of an early computer, built from 1945 to 1951 at the Institute of Advanced Study (IAS) in Princeton, the environment in which Dyson himself (son of the physicist, Freeman Dyson) was raised. Among a large ensemble cast, ranging from meteorologists to fringe evolutionary theorists, the closest thing to a lead character is John von

Neumann; Turing is largely confined to a single chapter, the thirteenth of eighteen. This survey is interestingly marshalled but breaks little new ground, beyond reporting one telling detail: in the IAS library, the binding of the volume containing his computability paper has "disintegrated from having been handled so many times" (p. 259).

Dyson's real aim is not institutional or personal biography but a philosophical-cum-prophetic meditation on the nature of organised information. Unfortunately, this is not always easy to discern: there are clear signs that the book, ten years in the writing, has slipped his control. Though consistently readable, the text is decidedly baggy, often ambling good-naturedly into unexpected territory which turns out to have little to do with the intended focus. Only in the final chapters does it become clear that Dyson is rehearsing an update to the thesis of his 1998 book, *Darwin Among the Machines*, which assesses networked computing as an emerging form of intelligence in its own right. From genetic sequencing to search engines and social networks, Dyson suggests, code concepts are converging, and may radically redefine the nature of decision, thinking and being in transhuman terms.

This explains the book's title, which is not merely a response to the opportunity of the centenary. In his classic 1950 paper on machine intelligence, Turing (an atheist) dismissed with rigorous piety the objection that for humans to build a thinking being would challenge the prerogatives of the Almighty: the act could be viewed, like the established method of procreation, as merely providing "mansions for the souls that He creates." On a 2005 visit to the headquarters of Google – then commencing major operations in the project which became Google Books – Dyson decided that if the human body was a mansion, "Google is Turing's cathedral, awaiting its soul."[4] Turing would probably have been fascinated by these speculations. Turing, however, did not live to witness the emergence of a culture of grandiose futurological predictions about digitally organised intelligence which have, for more than half a century, fallen persistently far short of the mark. As ever, *this time*, things may be different; but I am not greatly moved by Dyson's statement, for instance, that "'Android' phones with Bluetooth headsets are only one step away from neural implants" (p. 308). Such steps have often proved impossible to climb.

A far more down-to-earth application of the Turing hook appears in the almost self-explanatory *Alan Turing and his Contemporaries*, a short introduction aimed at general readers from members of the Computer Conservation Society (CCS), whose activities have historically focused on the restoration, documentation and replication of early British computers. Turing features moderately prominently in a survey of the well-known academic and commercial projects, with some mention of classified military developments. Such studies often tend to be rather narrowly technical and production-focused, but there is helpful attention here to the promotion and use of the machines described.

At one level – though few readers will notice as much – the volume is intended as a conciliatory contribution to a long-running, sometimes acrimonious debate over the relative importance of mathematicians and engineers in which Turing is cast firmly on the mathematicians' side. The rift is historically most jagged at the University of Manchester, where Turing arrived in 1948 to join a group including his mathematical mentor from Cambridge, Max Newman, the accomplished radar engineer Freddie

[4] George Dyson, "Turing's cathedral", *Edge*, 24 October 2005, online at [http://www.edge.org/3rd_culture/dyson05/dyson05_index.html].

Williams and his assistant Tom Kilburn, and a small but functional stored-program computer. There has been considerable disagreement between the partisans of the Williams-Kilburn group, and of Newman and Turing, not only on the relative scale of individuals' contribution but on who was in actual charge of the project, or projects, concerned.[5]

The professional historian may retort loftily that the goal of historical enquiry should not be to assign credit to famous men (I have certainly done so myself, in frustrated moments), but to ignore such disputes is to ignore powerful questions of institutional memory. One historical outcome of the division is the almost total absence of any indication, among the impressive heritage displays within the University's notably engineering-focused School of Computer Science, that any such person as Alan Turing ever existed, an approach which will inevitably be revised as the Turing industry exerts a growing effect on wider notions of computer history. Similar negotiations are clearly at work in the CCS volume, which integrates Turing far more fully into the narrative than past efforts along similar lines, whilst politely refusing to install him as a central figure or necessary passage-point. Ultimately, states the book's principal author and editor, Simon Lavington, "no single individual or laboratory was indispensable to the birth of the Information Age" (p. 79). This judgment, which presumably invokes the inevitability of independent discovery, may not be welcomed by those who place a high value on the uniqueness of Turing's early computational insight. Lavington's priority, however, is more to emphasise that Turing was one of many conceptual and practical innovators, and that the "Information Age" would not exist as we know it but for their combined effect, a position which anyone who values contextual history must applaud.

Reputations are not, and can never be, transparent reflections of merit. They accrue to those who are chosen, or choose themselves, as strong symbolic representatives of some position or culture; and they depend crucially on what can be documented and transmitted. The dawning computing culture in which Turing operated contained many reputation-makers. Kilburn was one; another was Maurice Wilkes, Turing's Cambridge contemporary, who kept in firm managerial control of his own rival project. A third was Vivian Bowden, the engineer charged with selling commercial versions of the Manchester computer, who fatefully turned to the nineteenth-century Charles Babbage, not to the still living Turing, to invoke the essential Britishness of the new machines. Turing made no reputation for himself.

Lavington, Dyson, Davis and Hodges all agree that Turing's significance would have been far clearer had he published something, anything, to join up the dots between his 1930s mathematisation and the late-1940s world of practical electronic machines. Indeed, in Hodges' estimation (p. xviii), Davis's own book, *The Universal Computer* of 2000, is "in essence just what Turing could have written" for this purpose. Yet Turing, it seems, did not *want* to be the 'father of computing', valuing neither the status nor the category. He was more likely to define his ultimate goal as "building a brain" (Hodges, p. 303), a project which coincided with the priorities of the builders

[5] The "engineers' position" is summarised in Simon Lavington, *Early British Computers*, Manchester: Manchester University Press, 1980; and in Brian Napper et al., "Computer 50: the University of Manchester celebrates the birth of the modern computer", 1998-2005, online at [http://www.computer50.org/]. Two distinct opposing views are David Anderson, "Was the Manchester Baby conceived at Bletchley Park?", BCS eWIC series 2007, online at [http://www.bcs.org/upload/pdf/ewic_tur04_paper3.pdf], and Jack Copeland, "The Manchester Computer: a revised history", *IEEE Annals of History of Computing* 33 (2011), 4-37.

and funders and legacy-makers around him for a crucial, but unsustainable moment. Turing's place in history, therefore, is ultimately more a product of our time than of his; yet it has revealing things to tell us about the nature of both.