The Imitation Game

The film is set at Bletchley Park, where German codes were cracked repeatedly during World War II. It centres on the story of Alan Turing, a brilliant mathematician who, as a professor in Manchester shortly after the war, was prosecuted for homosexual activity in 1952, and died in 1954 shortly after his conviction and a non-custodial sentence of oestrogen injection. And it features his relationship with Joan Clarke, one of the very few women employed as a mathematician at Bletchley Park, to whom he was briefly engaged to be married.

Benedict Cumberbatch plays Turing as a somewhat autistic individual, maybe drawing on his recent experience of playing Sherlock Holmes, while by contrast Keira Knightley plays Joan Clarke as an attractive, articulate, socially observant and highly intelligent women, who helps Turing in his personal relationships with the other 'Hut 8' mathematicians. The film follows the development of the mechanised 'bombe' machines, which were designed by Turing and others to make feasible the seemingly impossible task of searching for the keys of the Enigma machines used by the Germans. The keys were changed on a daily basis, with different keys too for the codes used by different sections of the German military machine, and for each key there were around 159×10^{18} possibilities.

The story is told in flashback during an interview of Turing by a fictitious detective Robert Nock, who (and this seems a little unlikely) has read Turing's 1950 paper 'Computing machinery and intelligence', and asks Turing about the 'Turing test' and 'imitation game' that are described in that article.

I had to see this film; it has a big personal connection to me. My father, David Rees, was a Bletchley Park mathematician, a 'Hut 6' man, recruited from Cambridge by his undergraduate supervisor, Gordon Welchman, just a few months after the war started. My mother was another Joan, 7 years younger than Joan Clarke, and never at Bletchley, but also a Cambridge 'Wrangler' (i.e. classified first class in her examination), also a research mathematician, and a junior teaching fellow at Girton College until, facing the same choices as Joan Clarke, she prioritised marriage and family. Neither Joan was awarded an undergraduate degree by the University of Cambridge; women were only allowed 'titular degrees' until they were finally allowed to be members of the University in 1948, although they studied alongside the men, and took the same examinations.

And anyway I'm a mathematician myself, with interests in decision problems and computability, and of course I'm familiar with Turing's work. And this is, I think, a very British story, and I am glad to see it told. So I went to see the film, together with my 14-year old daughter, and some friends. It turns

out that the sister of one of them knows the grand-daughter of Commander Alastair Denniston, the naval chief who headed the British Government Code and Cypher School (at Bletchley Park during World War II) from 1919 until 1942. Cmdr Denniston doesn't get a sympathetic treatment from the film, and the British press has reported his family's unhappiness with that. I would say that the film's portrayal of Cmdr Denniston is one of a few examples of dramatic licence used by the film makers to make a complex story a bit more digestible for a non-technical audience.

But back to the film. I was fascinated. It raised questions for me, and I had to find out the answers. So I checked the literature, and I went and saw the film a second time. I still found it beautiful and moving.

Really the film is about Turing, the man, the magnitude of his personal achievement, and the sadness of his end. Repeatedly we are told: 'Sometimes it's the people no one imagines anything of who do the things no one can imagine'. The achievements of the Bletchley Park team were incredible. But undoubtedly the team could have not achieved what it did without a few key individuals, and certainly Turing was one of those.

Of course a few details were changed. Does it matter? I think not, but I felt the need to check them out.

Turing didn't need to apply for a job at Bletchley Park. He and Welchman were simply there from the outset. And similarly, like many other younger mathematicians, Joan Clarke was recruited by Welchman, who had taught her at Cambridge. Turing didn't stand all alone in his work on the bombe. He worked with Welchman from the beginning to develop an idea brought to them by a Polish team. Indeed the idea of the diagonal board, which speeded up the operation of the bombe, was Welchman's (not Hugh Alexander's, as in the film). And it was Turing, Welchman, Alexander and Milner-Barry who wrote, in 1941, to Churchill asking for (and getting) more resources, not Turing alone.

And the whole idea of the bombe was that it was able to rule out a high proportion of the possible key settings and hence make the problem of finding the key of the day tractable (using ad hoc hand arguments on the remaining possibilities) precisely by deriving contradictions from the assumed existence of particular words (such as 'Wetter') in the original plaintext. This certainly wasn't a relevation that speeded up the performance of the machine a few years after its original construction. And the fact that some operators were lazy or foolish and made 'silly' choices for information visible in the preamble of messages that allowed the cryptanalysts to guess a small set of candidates for the secret keys was a separate issue, not, so far as I know, particularly related to the bombe.

But again, these are details. I don't think they matter. The basic facts of the story remain the same, even if sometimes the order of events has been changed, and characters modified or interchanged. After 30 years of secrecy immediately after the war, a body of literature now exists that explains the techniques used at Bletchley Park, and chronicles the successes and failures.

Maybe it is more important to ask how accurately the portrayal is of the two central characters, the opportunities that were available to them, and the choices they were both forced to make in their lives.

Some have told me they found Benedict Cumberbatch's portrayal of Turing a little irritating, his suggestion of autistic traits somewhat overplayed. Others have complained that the film does not make enough reference to his acknowledged homosexual activity. I personally have no complaint on either score.

But how did I find Joan Clarke? She doesn't surprise me. There's footage available of her in a 1992 BBC Horizon documentary that supports Keira Knightley's portrayal of her, in which she reports that when Turing talked to her about his homosexuality the day after the start of their engagement in the spring of 1941: 'Naturally, that worried me a bit, because I did know that was something which was almost certainly permanent, but we carried on.' She certainly seemed to know what she had got into. And the film suggests that her relationship with Turing was a true meeting of minds. The engagement held for a few months, Joan wore a ring (though not at work), and the two met each other's families, and apparently planned a conventional future which included children. But the engagement ended in the summer of 1941, reportedly by mutual consent, because of Turing's belief that a marriage could not succeed, because of his homosexuality.

Of course we were meant to laugh at some of the sections of the film that showed the social constraints of the time; the vocabulary, the accents (yes, people from certain social classes really did talk as if they had to carry hot potatoes in their mouths; even in the seventies we had elocution lessons at my nice girls' school). But it wasn't all funny. It is shocking that although many, many women were employed at Bletchley Park (about 3/4 of a total of 10000) only a handful are acknowledged to have been cryptanalysts. Many women were employed as members of the WRNS to operate the bombes; this was certainly unpleasant, hot, noisy work. Others with backgrounds in language were employed alongside the cryptanalysts to analyse messages once they had been decrypted. Some men and I think also some women, who were employed for the vital hand search for the keys (still a massive job even with the bombes) were not mathematicians but had been selected for acknowledged, excellent problem solving skills. Now, nearly 70 years after it all ended, it is hard to check all the facts, find out who was involved in

what. But still of the handful of women named in the literature, I could find only one other listed as a graduate mathematician.

Joan Clarke's entry to Bletchley must have been much the same as my father's. She too had been taught by Welchman as an undergraduate (he'd taught her geometry in her third undergraduate year), and it was he who recruited her. She'd started her study in Cambridge in 1936, with a scholarship to study at Newnham College, one of only two colleges in Cambridge that took women at that time. Joan was a truly excellent student, achieved first class marks in both parts I and II of her undergraduate degree, and was awarded the prestigious Philippa Fawcett Prize on graduation (named after a Newnham student who in 1890 had been placed above all the men in the year in her final degree examination, subsequently becoming a college lecturer and published researcher in fluid dynamics). As the war broke out Joan had just been awarded a scholarship to finance her studies for the one year Cambridge postgraduate certificate Part III mathematics, which prepares students for doctoral study; she was allowed to finish this before moving to Bletchley Park. But when she arrived at Bletchley, despite the way in which she had been recruited, she was given only routine clerical work to do with other women. And when she **was** promoted, it was to a linguist's grade, this being, as I understand, the only grade open to her as a woman. She, and the other female codebreakers, were also paid less than the men.

The film portrays Joan as being treated as an equal by the other (male) mathematicians in her team, and certainly by Turing. And nothing I have read suggests to me that this was not the case. She became Deputy Head of Hut 8 in early 1944, and was a particular expert in a technique developed by Turing that became known as Banburismus. Her wartime achievements were recognised by an MBE in 1947 (Turing's by an OBE, a higher ranking honour than MBE), although what had been achieved at Bletchley Park remained completely secret until the first book, 'The Ultra Secret', was published in 1974.

Many of the Bletchley men had successful, even glittering, mathematical careers after the war. Couldn't Joan Clarke have had that too? She might have returned to her postgraduate studies; a few, including Peter Hilton, did (Hilton went to work in Oxford with Whitehead, whom he'd met at Bletchley Park). Others moved without further study to posts in British universities; a small group, including my father and Jack Good, followed Max Newman to the mathematics department in Manchester, where Newman set up a Computing Laboratory, to which he recruited Turing in 1948. But Joan did neither.

To my knowledge Cambridge was the only British university that still barred

female students; Oxford had admitted women in 1920, London in 1878, the Scottish universities in 1892. But life for a female academic would certainly have been very different than for a man. Many of the positions would have been residential posts in women's colleges, in London, Oxford, and Cambridge (and that was my mother's original route, a few years after Joan Clarke, until she met, married and followed my father, ultimately to a post alongside him in a provincial university). In the mid 20th century, a tiny number of brilliant female mathematicians flourished in traditional universities such as Cambridge. For some of them the 'monastic' environment may (or may not) have been made more palatable by their marriages to similarly successful men. But it must have been a curious place to be a woman, with many limitations, and it would not have suited everyone.

It seems that Joan Clarke made a choice. I read that her experience of working alongside such a brilliant brain as Turing made her reluctant to continue as a pure mathematical researcher after the war. So in fact, as many of the other mathematicians also did, she worked, after the war, at GCHQ (Government Communication Headquarters) in Cheltenham, the postwar successor of Bletchley Park's GC&CS (Government Code and Cypher School), where she married a colleague Jock Murray in 1952. When, due to his ill health they left Cheltenham for a period in Fife, Scotland (returning to GCHQ again in 1962), the two of them developed an interest in Scottish history. Joan became expert in numismatics, continuing her numismatic research later in retirement, and it is her achievements there that are celebrated in the obituary I found.

People have asked me if my father featured in the film. No, he didn't. But then he was in Hut 6, not Hut 8. Did he know Turing? He said not really; Turing and the Hut 8 mathematicians worked on the naval code, while the Hut 6 group worked on the Luftwaffe code, which still used the enigma machine, but with a different daily key. And although he and Turing were both involved in the post-war Anglo-American project to develop the first electronic computers, their paths do not seem to have crossed much. In Bletchley, my father played chess, and was in the Bletchley village team, containing Hugh Alexander and Harry Golombek (but not Turing), that beat Oxford University 8-4 in December 1944.

Did my father talk about his time at Bletchley? Certainly not before 'The Ultra Secret' was published in 1974; none of the Bletchley people talked about what they'd done until then, they'd all signed the Official Secrets Act. But actually despite that my sisters and I somehow knew that our father had worked on decoding during the war; I think we'd concluded this from the fact that he was familiar with the German typewriter keyboard, which has a Z where we would expect to see Y (as is quite clear in the shot of

an enigma machine early in the film). And maybe this belief was reinforced by the decoding games we played as children? Of course my father had close friendships with people he'd got to know at Bletchley; two of us had godfathers who were Bletchley mathematicians, but we didn't know of that connection when we were children. Nobody talked, and of course Turing would not really have discussed the secret with Inspector Nock; but that conversation framed the film nicely.

I enjoyed the film. I'd happily see it again.

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