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1 The success of *The Imitation Game*

Winner of an Oscar, movie of the year by AFI Awards, the best thriller by Empire Awards – these are just a few awards of many which the movie *The Imitation Game* has won¹. Britain's best actors and actresses are part of this film, e.g. Benedict Cumberbatch as Alan Turing or Keira Knightly as Joan Clarke. It is a movie about the life of the great mathematician Alan Turing. The key element of the film is the time of Turing's life when he was part of a team of cryptanalysts, who were decoding Enigma. This is a cryptographic device used by the Germans in World War II. The British codebreakers around Alan Turing tried to decipher it, so Britain could gain an advantage in the war. In addition to the decryption of Enigma, the film shows Alan Turing's youth with the focus on his friendship with Christopher Morcom who was his first love. The movie also portrays the difficult time for Turing after the war because he was gay and society dealt with homosexuals as criminals back then.

The film is based on reality but there are some differences to historic facts to create a more interesting and exciting movie.

2 The Enigma and Alan Turing's life compared with the portrayal in *The Imitation Game*

This paper is going to be about the Enigma and it shows a comparison between Alan Turing's life and the portrayal in *The Imitation Game*.

2.1 The Enigma – a cryptographic device

During and after World War I, messages were often sent as morse code via radio. As they could be intercepted by everyone, the German military had to encrypt their messages with a reliable method. They decided to use the device Enigma (Schmeh 123).

In 1918, Arthur Scherbius filed a patent for Enigma. After 1923 the device could have been bought by everyone². But in 1926 the German Navy started using Enigma and as a consequence it was taken off the market because they didn't want anyone to have a look at their encryption device (Hoffmann 68). Gradually, more German

¹ https://www.imdb.com/title/tt2084970/awards?ref_=tt_awd (download on 24 October 2020)

² Rakus-Andersson (p. 419) mentions that the Dutchman Hugo Koch invented Enigma in 1919 and later, Scherbius just bought the patent, improved the machine and then tried to sell it.

military branches started using Enigma for the en- and decryption of messages, e.g. the German Army in 1928³ (Bischoff 98).

2.1.1 Structure and functioning of Enigma

Enigma is a 12-kilogram battery-powered machine which from the outside resembles a typewriter. It was kept in a wooden box, so that it was protected and could be used anywhere, e.g. at the front lines.

Underneath the cover is the most important part of Enigma. There are three wheels which rotate and can be inserted in different orders. There is also one reversal rotor, called reflector, which is immovable. On top there is a keyboard which is used to type in the letter to be encrypted. The keyboard is connected to the wheels. There are also 26 letters that can light up which show the encrypted letter (Rakus-Anderson 422). At the front of Enigma there is a plug board with six (ten since 1939) cables to increase complexity and security⁴ (Birrer 4 and Hodges 2014:221).

When a letter is entered, an electrical signal goes from the keyboard to the plug board. If the letter entered is connected to another letter by one of the cables at the plug board, it will be switched to the connected letter. If there is no connection by plug, this step will be missed out. Then, the signal goes to the first rotor. Due to the different wiring of the wheels, the signal goes through all three rotors, back through the reflector in a different way and arrives at one of the 26 different positions. Each position is once more connected to the plugboard where the letters might be exchanged again and after that, the signal goes to the lamps and the encrypted letter lights up⁵ (Birrer 1-4)

For example, to make sure that not every C is encrypted to a B in one message at the same start setting, the first rotor advances one position after each entry of a letter. Each wheel has 26 possible positions. After every complete rotation of the rotor, the subsequent wheel advances one position. Thus, the ensuing C in a message is encrypted to another letter.

To decrypt a message, you had to know the code. The German military had code books for everyone who worked with Enigma. The code was changed every day.

³ In Klaus Schmeß's book *Nicht zu knacken* (p. 126), 1929 is mentioned as the introductory year of Enigma in the German Military. This seems to be unlikely because the statements of Hoffmann and Bischoff correspond and agree with the information from *Secret Days* (Briggs 182).

⁴ See appendix one.

⁵ See appendix two.

The code determined the correct order and initial position of the wheels and the cable connections at the plug board. For every wheel, there were 26 different positions, which stood for the 26 letters (Birrer 2-4). In addition to the daily code there was a message key which consisted of three letters. They determined the initial position of the rotors. The sender of the message chose three random letters, encrypted them with the daily code twice and then, the resulting six letters were sent to the receiver. The receiver decoded the letters with the daily code and, like the sender, used the message key for the following message.

From 1938 on, there were five different rotors of which three were selected to use. To ensure the receiver of the message used the same rotors as the sender, this had to be recorded in the code books (Bischoff 98-99).

Different German military branches used different settings. This meant that the Luftwaffe didn't use the same daily key as the German Army. The system of the German Navy, the Kriegsmarine, was the safest one. They didn't choose three rotors out of five, but three out of eight. Another difference was that the reflector wasn't fixed. It could also be set in one of 26 positions (Singh 181-182).

2.1.2 Before World War II: First decryption attempts by the Poles

As Poland directly borders on Germany and German claims to Polish territory were well known, Poland was keen on cracking the German coding system because “[the] military build-up program of the German army forces had to involve the development of secret intelligence operations” (Rakus-Andersson 419). This shows that cryptology was a huge factor for the German military and a crucial point for Poland in order to protect themselves from their neighbouring country.

Poland was looking for young mathematicians who had knowledge of the German language, to work on decoding the system. After a cryptology course at a Polish university, Marian Rejewski, Henryk Zygalski and Jerzy Różycki were chosen (Piotrowska). They started with the decryption of non-mechanical enciphered messages which didn't pose a big problem to them. But their main goal was breaking the Enigma code⁶ (Rakus-Andersson 421-422). After getting a commercial Enigma by accident, the Poles knew the structure of Enigma but not the internal wiring of the wheels because the military version was different from the commercial one

⁶ There are no reliable references about the source from which they knew that the Germans used Enigma.

(Bischoff 99-100). In 1932⁷, Hans-Thilo Schmidt, a civil employee of the Reichswehr cryptography agency delivered documents about the German cryptographic system to the French. They passed the materials on to the Polish mathematicians (Rakus-Andersson 423-424). Due to the information from Schmidt though, they could deduce everything they needed in order to construct an exact copy of the military Enigma. But in order to decipher all German messages, just having the correct Enigma wasn't enough. They also had to develop a method with which it was possible to find out the code settings (Birrerr 5).

At first the Polish mathematicians tried to break the code just with brain power and some small devices. Their work benefited from mistakes by the Germans. They often used simple message keys, e.g. AAA or ABC, which were recognized by Rejewski. The Poles achieved small results and could read a few messages but they realised they had to develop something which made it possible to break Enigma more often (Rakus-Andersson 426-427).

In October 1938, they developed a machine which was called Bombe. It found the daily key within two hours. It took over the long search with which it was possible to find out the code. This device relied on the double sending of the message key. They had six Bombes because there were six possible rotor orders and each machine checked the wheel positions for a specific order. But in December 1938 the Germans added two more rotors, so the three rotors could be picked out of a set of five, and subsequently, there were sixty possible rotor orders (Hodges 2014:218-221). It wasn't possible for the Polish to continue with their work as the costs were too high to build so many new Bombes (Rakus-Andersson 429 and Hodges 2014:221).

The Polish General Staff decided to share some information. Gradually, they told Britain and France everything they knew about Enigma and even gave one reconstructed Enigma to France and another one to Britain in 1939 (Rakus-Andersson 429-430).

2.2 Alan Turing's life: Comparison between reality and the portrayal in *The Imitation Game*

In the following chapter different aspects of Alan Turing's life are going to be compared with the portrayal in *The Imitation Game*.

⁷ According to Birrer (p. 5) it was November 1931.

2.2.1 The decryption of Enigma at Bletchley Park

In 1938, the British secret service MI 6 bought an estate in Bletchley to assemble a team to decipher Enigma. One of the team's men was Alan Turing (Hoffmann 66). He probably contributed the greatest part to the decryption. Part of the estate in Bletchley Park was the Government Code and Cypher School, with Commander Alistair Denniston as its head (Syam). The GC&CS was the department which was responsible for deciphering although it was a ciphering school (Hoffmann 66). Alan Turing joined the team in September 1939 (Sale 444).

In *The Imitation Game* the viewer gets the impression that Commander Denniston is the head of all of Bletchley Park due to his statement that his boss is Winston Churchill, then Prime Minister (*The Imitation Game* Chapter 4). It isn't mentioned that the department which was responsible for the decryption is the GC&CS, of which he was the head in reality. I think that this is one of the many rather uninteresting facts which have been left out because they would be too boring for viewers.

2.2.1.1 The decryption – from the beginning to success

At first the recruited team of British codebreakers continued the work of the Poles. But the method of their machine relied on the message key which was sent twice. If the Germans were to recognize that sending the key twice was a huge mistake, they would likely change their system. So, Turing wanted to build a machine which could find the settings without relying on the double sending of the message key. By studying old messages he recognized that some parts of the message were predictable if he knew when the message was sent. One of these predictable parts was the word *Wetter*. Every morning shortly after 6 am the Germans sent a weather report (Singh 170). Another term which was often used was *Oberkommando der Wehrmacht*. These predictable phrases were called cribs (Schmeh 133). Due to these findings Turing designed a new machine with the help of the mathematician Gordon Welchman in early 1940 (Singh 176 and Hodges 2014:230). This machine was very expensive but Bletchley Park spent £100.000 on this device. Turing and Welchman didn't construct the machine themselves. Instead this was done by an outside factory who delivered the machine in May 1940. This machine was much slower than they had expected. It took up to one week until it found the key. So, they had to improve its efficiency. Unfortunately, it took months until the production of the new version was finished. Meanwhile, the Germans decided to no longer

send the message key twice. The method of the Poles which was improved and used while Turing and Welchman were designing a new machine wasn't helpful anymore and the rate of decrypted messages dropped starkly. The new machine was much more efficient. If a fitting crib was discovered, the machine could find the key within one hour. The cryptanalysts still had to guess a crib at its exact position. This was the prerequisite for the machine. A weakness of Enigma, which helped to find a crib, was that a letter could never be encrypted as itself (Singh 174-177). If their machine found the right key, it was then used to decrypt messages and translate them into English. But this wasn't the codebreakers' job (Bischoff 103).

They were successful in breaking the keys of most of the military branches but due to the differences of the naval Enigma⁸, its keys couldn't be broken. But the need of knowing coming U-boat attacks, which were executed by the Kriegsmarine, was huge because the number of losses of seamen and British ships was very high. And the food supply of the British population was in danger as it was transported by sea in ship convoys. So, the British decided to steal codebooks from sinking German U-boats. This was successful and they were not only able to break the keys for the days recorded in the codebooks, they could also use the information gained to "bring an end to the intelligence blackout" (Singh 184). This shows the importance of breaking the naval codes for the cryptanalysts to work successfully and to affect all of Britain. But they had to be extremely careful that the Germans wouldn't suspect the decoding. Instead, the Germans always thought that the British achievements were due to misfortune or espionage. The Germans imagined that breaking Enigma was possible (Singh 181-185).

A big sign of appreciation for the codebreakers of Bletchley Park was the visit of Winston Churchill in September 1941, who was the British prime minister during World War II. As the codebreakers recognized that the prime minister valued their work, Turing, Welchman and two other cryptanalysts wrote a letter and asked for more staff and materials after Commander Edward Travis who was Denniston's representative, hadn't fulfilled their requirements. Churchill determined that new staff should be hired. So, by means of a crossword puzzle competition, six new potential codebreakers were hired and in the course of time many more machines were built (Singh 179-181 and Hodges 2014:224).

⁸ mentioned in **2.1.1 Structure and functioning of Enigma**

In February 1942 the Kriegsmarine introduced four instead of three rotors. This presented a disaster for the codebreaking team around Alan Turing. The rescue from this situation was again the capture of codebooks in October 1942 (Hoffmann 69). Due to the knowledge gained they could grasp enough information to be able to decipher messages in the long term. Until the end of the war Bletchley Park's results were decisive for many victories, e.g. Operation Overlord (Bischoff 106).

In *The Imitation Game* Commander Denniston recruits the team around Alan Turing. He presents an example of Enigma to Turing and other cryptanalysts, e.g. Hugh Alexander. Alexander is portrayed as a very clever man and is chosen to be the head of the team of the cryptanalysts by Denniston. The commander passingly mentions that they have got this example of Enigma from the Poles (*The Imitation Game* Chapter 2). It is later said that the Poles have built a machine but it isn't mentioned how successful this machine was until the Germans changed the Enigma (*The Imitation Game* Chapter 4). Turing starts to plan a new machine to decrypt the messages while the others try to break the code with a conventional method which isn't the method of the Poles. I am of the opinion that the filmmakers didn't mention the big achievements of the Poles and their developed method to let the decryption of Enigma look like more of a British achievement. Turing supposes that the few decryptions of messages by the others with the conventional method aren't a big success but luck (*The Imitation Game* Chapter 3). Gordon Welchman, who in reality designed the machine with Turing, isn't part of the movie. I think that Welchman was omitted for the reason that the filmmakers want to present Alan Turing as the hero who achieved everything alone.

In order to be able to build the machine Turing needs more money but Alexander doesn't provide the resources needed. Denniston, who is Alexander's boss, doesn't want to provide these either. So, Turing writes directly to the prime minister, who appoints Turing as the head of the team and that's the reason why he can start building his machine. He also fires two men from the team but hires new cryptanalysts instead. One of them is Joan Clarke, who later plays a major role in Turing's life (*The Imitation Game* Chapter 4-5). But there aren't any references to the fact that Turing had a higher position or that Clarke was hired by Turing in reality.

The machine is built by Turing with the help of other workers, but the other cryptanalysts are frustrated with him just building his machine and not helping them with the conventional method. Turing defends his idea. I assume that they aren't just

frustrated because they don't achieve results, another reason is that Turing isn't very nice to them. But Clarke motivates him to change his attitude towards them in order for them to support and help him. Suddenly, Alexander shares an idea to improve the machine (*The Imitation Game* Chapter 6-8).

When the building of the machine is finally finished, it's too slow and doesn't lead to results. This is a plotline which matches reality. Denniston is very angry that this very expensive device doesn't work. He thinks that the machine is useless and wants to fire Turing. The other cryptanalysts and Hugh Alexander in particular defend Turing and his idea in the following way: "Alan is right. His machine will work and it's probably the best chance we've got" (*The Imitation Game* Chapter 9). This shows that they have changed their attitude towards Turing and that Clarke has been right in her belief that being nice to others results in them contributing. Denniston has a high opinion of Alexander so the team is allowed to keep working on the machine. The Commander wants to see results in less than a month (*The Imitation Game* Chapter 9). In reality there are no references to the fact that the Commander ever doubted the machine, though.

Their breakthrough comes when a female colleague, whose job is to record the encrypted messages, tells Turing passingly about messages which always start with the same five letters. Due to this the cryptanalysts understand that some parts of the messages are predictable, e.g. *Heil Hitler*. They integrate this information into the machine and it works. Now, the machine can find the code which leads to the decryption of messages (*The Imitation Game* Chapter 12). But it is questionable if the breakthrough in the movie is correctly depicted when compared to reality. The woman couldn't have known that the first five letters were always the same because she just records the encrypted messages. Another fact which is incorrect is that the Germans never really sent five letters at the beginning. I suppose that this was a hint to the message key but this just consisted of three letters. Another point which is wrong is that in reality the whole principle of Turing's machine relied on the predictable parts from the beginning. This was the prerequisite for the construction of the machine. In the film, it's just a factor which makes the machine faster and that leads to the breakthrough. Although the breakthrough is not completely correct in the movie, its importance and meaning are presented very well. The relief can be seen in the cryptanalysts' faces and the main theme of the music, which just appears in important scenes, underlines the great meaning of this success. The cryptanalysts

recognize that their breakthrough will have significant effects and are presented as happy as they have never been before.

But now, their job also becomes to decide which attack of the Germans should be prevented and which shouldn't (*The Imitation Game* Chapter 13). However, this wasn't their job in reality. They were just responsible for the decryption. Also, the fact that the machine couldn't decipher every message of every military branch isn't portrayed. The increased difficulty of the Enigma of the Kriegsmarine isn't part of the movie. After the breakthrough the decryption of every message is portrayed as being successful.

2.2.1.2 Effects on the war

After the end of World War II the successful work of the British cryptologists was kept a secret for over thirty years in order to gain an advantage in the Cold War because many Enigma machines ended up in the Soviet Union and were used by their Secret Service (Bischoff 107). In 1974, the decisive contribution that the team in Bletchley Park had made to the victory of the war was published by the release of Frederick William Winterbotham's book *The Ultra Secret* (Birrer 13). Former prime minister Winston Churchill is supposed to have said that the success of the war was only possible through the deciphering of Enigma. But Jürgen Bischoff doesn't share Churchill's opinion and comments on the effects in the following way: "Nur wenige Historiker würden heute wohl so weit gehen, aber alle betonen, dass die Arbeit [...] den alliierten Sieg beschleunigt und so den Weltenbrand womöglich um Jahre verkürzt hat." (Bischoff 106). He is of the opinion that the work in Bletchley Park had a lot of influence on the war but the victory could have been possible without it.

In *The Imitation Game* written insertions give further information about the fact that 14 million lives were saved and the war was shortened by about two years by the successful deciphering as Alan Turing's team is shown burning secret documents. At this point, it is said that the work in Bletchley Park remained a state secret for fifty years. However, this is doubtful, as Winterbotham's book was published in 1974. Further insertions, which say that Turing's machine was a basis for today's computers, highlight the effects of Turing's work on the present time. The use of the epic main theme of the soundtrack underlines the importance of the work in Bletchley Park. This scene constitutes a worthy ending to the film because it

honours the cryptologists and Alan Turing in particular (*The Imitation Game* Chapter 17).

2.2.2 Homosexuality

The fact that Alan Turing was gay had an influence on his life. In different stages of his life he dealt with his sexuality in different ways. In *The Imitation Game* his sexuality is discussed in all three portrayed stages of his life.

2.2.2.1 Christopher Morcom

From the age of thirteen, Alan attended Sherborne School, an all-male public school. Apparently he didn't fit into the system of his school. He didn't have any friends, wasn't very popular because of his enthusiasm for chemical experiments and sometimes, he was even confined under some floorboards by his fellow pupils. A ray of hope appeared when he met Christopher Morcom. He was, like Alan, passionate about science. It was difficult for Alan to approach Christopher because he was a year older than Alan. Schools like Sherborne tried to separate boys of different ages because the "contact [...] was fraught with sexual potential" (Hodges 2014:37). They feared homosexual acts everywhere because these could cause scandals as homosexuality was illegal. But Turing managed to approach him due to their mutual passion for science. They started exchanging their ideas about mathematics. Christopher really took Alan seriously and Alan fell in love with him. After Christopher had turned 18, he applied for a scholarship to Trinity College in Cambridge. It was very likely that he would win one, which would have meant that he would leave Sherborne. This was an awful thought for Alan. But Christopher encouraged him to also try to get into Trinity. So, Alan decided to apply as well. However, Christopher was accepted while Alan wasn't. Unfortunately, a few months before Christopher could leave for Cambridge, he was taken to London, underwent surgery and died on 13th February 1930. This was a big shock for Alan because he hadn't even known that Christopher had been suffering from tuberculosis.

Their friendship was interpreted differently by each of them. For Christopher, the relationship only became a friendship towards the end. But for Alan, their relation

was much more profound and intense. Christopher was Alan's first love. This explains why Turing fell into a deep hole after Morcom's death⁹.

In *The Imitation Game* the focus of the portrayal of Alan Turing's youth is on his relationship to Christopher Morcom. Alan is presented as a clear outsider in Sherborne School and the viewer gets the impression that Alan is bullied by other students. Christopher appears for the first time when he helps Turing who has been confined under some floorboards (*The Imitation Game* Chapter 4). I assume that the filmmakers chose this element as the start of their friendship because it lets Christopher look like a hero who is admired by Alan because he helps him out of a difficult situation.

In the film their relationship is based on cryptography. They exchange encrypted notes during their maths lessons because the course is too easy for them (*The Imitation Game* Chapter 8). This shows that they are both very smart and talented. I assume that cryptography was chosen as the connective element between these two because it is one of the main themes of the movie although in reality this element was science in general. In reality Christopher motivated Alan to apply for Cambridge as well. But in the movie the way he encourages Alan is different. Christopher says: "But [...] sometimes it's the very people, who no one imagines anything of, who do the things no one can imagine" (*The Imitation Game* Chapter 4). He tries to motivate Alan to achieve something great. His classmates are very mean because he is different, but this shouldn't be a reason to be discouraged. Christopher's quote is later used by Alan himself to motivate others (*The Imitation Game* Chapter 6). It demonstrates that Christopher has a big encouraging influence on Alan. This is another element which the filmmakers used to let Christopher look like a hero to Turing.

Alan's continuing fascination with Christopher can be recognized by the way Alan looks at him. He is depicted like someone who really is in love for the first time and in the movie Alan is even willing to tell him his real feelings via an encrypted note. But on the day he wants to give Christopher the message, Christopher doesn't return to school. Alan is called to the principal's office where the principal tells him that Christopher has died due to his infection with tuberculosis. The principal talks to him openly because he thinks that Christopher told Alan about his illness but he didn't. Alan even claims that they weren't friends although the principal has the

⁹ The information for this chapter is from *Alan Turing: The Enigma* by Andrew Hodges (p. 27-60)

impression, they were close to each other. Alan doesn't want to attract attention to his feelings in any possible way because of the illegality of homosexuality. In Alan's facial expressions the viewer can see a shocked and desperate young man who has lost his love and hero. It's a highly dramatic scene because their friendship ends on the day that Alan wants to express his real feelings (*The Imitation Game* Chapter 11 and 16).

2.2.2.2 The treatment of homosexuality at the time and its influence on Alan Turing's life

Homosexuality had been illegal in Britain for centuries. Homosexuals had already been persecuted since 1533. In 1885 the British government went even further by making homosexual acts in private illegal (Dryden). Peter Wildeblood describes the attitude of the British government and society towards homosexuals during Turing's lifetime in the following way: "The view of the law-and it is shared by many sincere men and women-is that homosexuality is a monstrous perversion deliberately chosen, and that the men who make that choice deserve to be punished for it" (Wildeblood 5). This shows that homosexuality was considered a regular crime and that gay people decided to commit that crime. From today's point of view this attitude towards homosexuals is unacceptable.

This meant that Alan Turing couldn't be completely open about his sexuality but in the right circles he wasn't secretive about it. One of these circles was Kings College in Cambridge where he studied after school (Jacobson). Turing had homosexual experiences with other students and talked about sexuality with them (Hodges 2014:97-99). But in Bletchley Park almost nobody knew about him being gay. And he even made a marriage proposal to his good friend and cryptanalyst Joan Clarke. He did tell her about his homosexual tendencies, though. The engagement ended shortly after, but Clarke didn't cite his homosexuality as the reason for the break-up. However others are of the opinion that it was one of the reasons for the end of their relationship¹⁰. I suppose that Joan Clarke definitely wasn't homophobic, because if she had been, she could have reported him. But she didn't want to marry a man who wasn't in love with her.

In 1952 someone broke into Turing's house and he reported the burglary to the police. During the investigation it came out that he was having an affair at the time

¹⁰ <https://www.youtube.com/watch?v=MB2e9R7bXCk> (download on 10 October 2020)

and he was convicted for gross indecency. He could choose between going to prison or a chemical castration. He chose the hormone therapy. The treatment caused problems, e.g. he grew breasts, suffered from depression and due to this, he had to go to a therapist. He died on 7th June in 1954 by cyanide poisoning (Bryant). It is often said that he committed suicide as a consequence of the chemical castration. But the treatment ended over a year before his death. At that time his mental health state hadn't been conspicuous. Other reasons for his death are also imaginable. It could have been an accident during an experiment or the secret service could have killed him in order to ensure that cryptanalytic secrets were still safe because homosexuals were seen as a risk to national security. None of these possibilities can be ruled out¹¹. But his biographer, Andrew Hodges, is convinced that Turing committed suicide. His problems hadn't been solved as, of course, his sexuality hadn't changed and the state was still of the opinion that he represented a risk to national security. Hodges mentions that Turing wanted his family to think it was an accident, though (Hodges). In my opinion all of these possibilities are imaginable but the suicide seems to be the most likely explanation.

In *The Imitation Game* Alan Turing's sexuality and the attitudes of society towards homosexuals are an important part of the film. But not all parts of his life are portrayed in the movie. His time in Kings College, where he wasn't secretive about his sexuality, isn't part of it. Nevertheless, the engagement to Joan Clarke is portrayed. The decisive factor why he proposes to her is that her parents don't want her to work anymore and she is pressured to find a husband and marry him. Turing however wants her to continue working at Bletchley Park because he is of the opinion that she is a great cryptanalyst. The proposal is very spontaneous and he just makes a ring within seconds (*The Imitation Game* Chapter 10). This shows that the engagement doesn't have any romantic aspect. It is just a necessity to keep Clarke in Bletchley Park. But later he ends the engagement and encourages her to go to her parents. Turing is being blackmailed about his homosexuality and if he doesn't help the officer who blackmails him, Clarke is going to be endangered because of this. In order to convince her to leave, he tells her about his homosexuality and that it is the bargaining chip the blackmailer would use against him. She doesn't want to leave so he denies his amicable feelings towards her and claims he doesn't care about her and has just needed her for the success of their work. Although she is

¹¹ <https://www.turing.ethz.ch/alan-turing/turing-s-death.html> (download on 10 October 2020)

shocked by his statement, she still stays in Bletchley Park because the work she is doing, means a lot to her. After this fight Turing's last years in Bletchley Park are very lonely (*The Imitation Game* Chapter 14-15). This is a very dramatic end to the relationship between Clarke and Turing. I would guess that the engagement is portrayed far more dramatic than it actually was. There aren't any references to the blackmail episode and a fight between Turing and Clarke in reality. But it might be too boring for the viewers to see a tolerant and peaceful ending of an engagement, the purpose of which wasn't love.

The period after the war in the movie deals exclusively with the burglary and its consequences. The police notice the burglary and they try to talk to Turing. But he isn't interested in finding the burglar because nothing has been stolen. The police officers think that this looks suspicious and that Turing wants to hide something. At first, they suspect that he is a Soviet spy but then, they find out that he has paid for a male prostitute. One of the officers seems to be disappointed that he isn't a spy but for the others this seems to be a big crime anyway. One officer says that "[homosexuality] is bloody disgusting" (*The Imitation Game* Chapter 9). This quote shows that the attitude towards homosexuals during Turing's lifetime in reality is exactly as it was portrayed in the movie.

Turing is convicted for the crime of gross indecency and it is reported in the newspaper. Thereupon Clarke visits him at home and finds him in a very bad condition. There are no references that this visit has ever taken place. I assume that the filmmakers wanted to have a conciliatory end between those two and that's the reason why they added the visit to the script. He tells her about his hormone therapy. The only highlight in his life seems to be his decryption machine which he calls Christopher. In reality his machine had a different name. In my opinion this name was chosen by the filmmakers because it demonstrates that Christopher has always been the most important part of his life although he has been dead for many years. In one of the insertions at the end of the film the viewer is informed about Turing's death. It is said that he committed suicide. I think that it is said that suicide was the reason for his death because Andrew Hodges claims it as well and the movie relies on Hodge's biography of Turing.

2.2.2.3 Turing's rehabilitation

In 2009, their prime minister, Gordon Brown, apologised in the name of the British government for the hormone treatment. He said that Turing deserved appreciation for his achievements and that he was very sorry for what happened to him. Turing also received a posthumous royal pardon in 2013. The former justice minister, Chris Grayling, who requested the pardon, is of the opinion that Turing really deserved this mercy by the Queen for the injustice of his conviction, his work at Bletchley Park and his influence on science (O'Malley). It is also planned that Turing will be featured on the new £50 note by the end of 2021. He prevailed against other candidates, e.g. Stephen Hawking or Ada Lovelace (Riley).

In *The Imitation Game* Turing's rehabilitation is shown in one of the written insertions. The royal pardon by Queen Elizabeth II is mentioned as it honoured his achievements. This is the only information about Turing's rehabilitation. The apology by Gordon Brown isn't mentioned. I assume that a royal pardon is more impressive for the viewer and highlights the scientist's achievements better than an apology even if it's from the former prime minister. Of course, the feature of Turing on the new £50 note could not have been mentioned as the decision hadn't been made when the movie was released.

3 *The Imitation Game* – a great film about a special genius

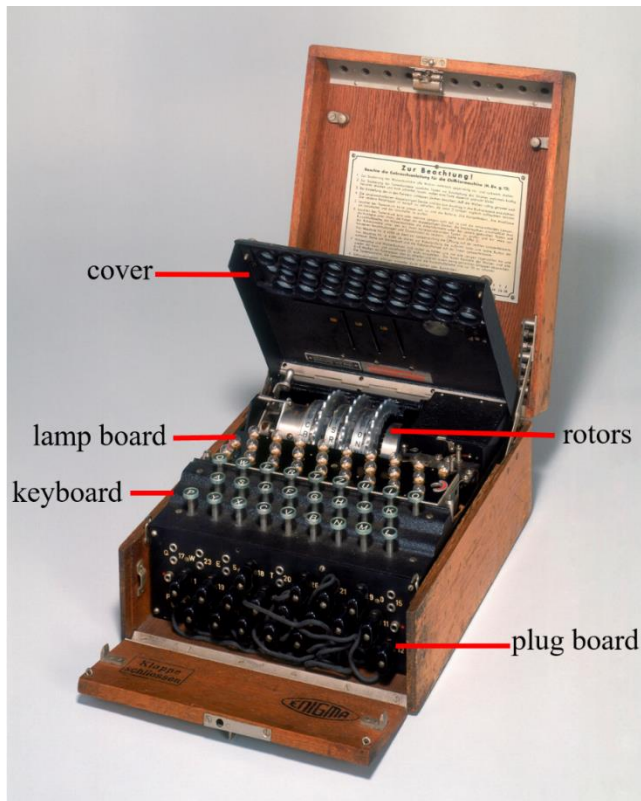
In my opinion the many awards the movie has won are well-deserved. The viewer obtains a correct impression of Alan Turing's life although not all historic facts are accurate. But those facts, which are wrong, are mostly minor details which aren't decisive for the plot. The viewer also gets an idea of the cruelty of World War II and the brilliance of the codebreakers who were responsible for the faster ending of the war. The portrayal of the treatment of homosexuality is unfortunately accurate and lets the viewer think about homophobia and the freedom homosexuals should have today. In my opinion the rehabilitation by important British officials came far too late. But at least Turing finally got the appreciation he deserves.

I really enjoyed watching this movie many times because it portrays World War II from a different view that I hadn't known before. It shows how important secure messages and cryptography can be and that those elements can be decisive in a war. I also really like the acting of Benedict Cumberbatch. He portrays Alan Turing as a special genius and Alan Turing definitely was that kind of person. My favourite

scene is the moment when the cryptologists have to burn the secret documents and the viewer gets information about the effects of their work. I love this scene because it informs about the dramatic ending of the life of a genius and it is underlined by the awesome main theme of the soundtrack. I can recommend this movie to everyone who is interested in history and World War II in particular and loves movies which deal with extraordinary stories and people.

4 Appendix

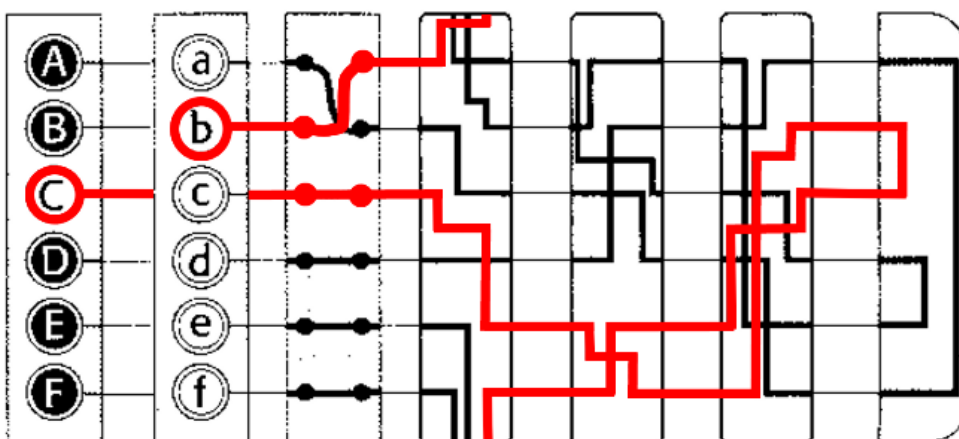
4.1 Structure of Enigma



<https://greatwenlondon.files.wordpress.com/2012/06/enigma-3.jpg> (download on 31 August 2020)
(explanatory notes by Carlotta Lindner)

This picture shows the structure of an Enigma.

4.2 A simplified sketch of an encryption option



Enigma Dokumentation 4 (download on 17 July 2020) (modified by Carlotta Lindner)

This is a simplified sketch of a possible encryption option which encrypts the B to a C. But the sketch only shows six instead of 26 letters.

5 Abbreviation

GC&CS = Government Code and Cipher School

6 Bibliography

6.1 Primary Sources

The Imitation Game. Director Morten Tyldum. Actors Benedict Cumberbatch, Keira Knightley, Matthew Goode. The Weinstein Company 2014.

6.2 Secondary Sources

Bischoff, Jürgen. “Die MASCHINE und das RÄTSEL“. *Geo Epoche Geheimdienste* 67/2014:94-107.

Briggs, Asa. *Secret Days. CODE-BREAKING IN BLETCHLEY PARK*. London 2011.

Hodges, Andrew. *Alan Turing. The Enigma*. Princeton ¹⁷2014.

Hoffmann, Ruth. “DIE BOMBE“. *Der Spiegel Geschichte* 5/2019:64-69.

Rakuus-Andersson, Elisabeth. “The Polish Brains Behind the Breaking of the Enigma Code Before and During the Second World War“. *Alan Turing. life and legacy of a great thinker*. Christof Teuscher (ed.). Berlin 2004:419-440

Sale, Tony. “Alan Turing at Bletchleypark in World War II“. *Alan Turing. life and legacy of a great thinker*. Christof Teuscher (ed.). Berlin 2004:441-462.

Schmeh, Klaus. “4 Enigma-Funksprüche“. *Nicht zu knacken*. München 2012:122-157.

Singh, Simon. *The Code Book. The Science of Secrecy from Ancient Egypt to Quantum Cryptography*. New York 1999.

Wildeblood, Peter. *Against the Law*. Harmondsworth 1957.

6.3 Websites

6.3.1 Websites with an author

Birrer, Alex. “Enigma Dokumentation“. https://www.swisseduc.ch/informatik/daten/kryptologie_geschichte/zweiter-weltkrieg.html (download on 17 July 2020)

Bryant, Christopher. “Turing Centenary: The Trial of Alan Turing for Homosexual Conduct“. <http://www.polarimagazine.com/features/turing-centenary-trial-alan-turing-homosexual-conduct/> (download on 21 September 2020)

Dryden, Steven. “A short history of LGBT rights in the UK“. <https://www.bl.uk/lgbtq-histories/articles/a-short-history-of-lgbt-rights-in-the-uk> (download on 21 September 2020)

Hodges, Andrew. “The Alan Turing Internet scrapbook”. <https://www.turing.org.uk/scrapbook/wondrous.html> (download on 25 September 2020)

Jacobson, Rebecca. “8 things you didn’t know about Alan Turing”. <https://www.pbs.org/newshour/science/8-things-didnt-know-alan-turing> (download on 21 September 2020)

O’Malley, Katie. “Alan Turing: Why was the codebreaker convicted and pardoned for his sexuality?”. <https://www.independent.co.uk/life-style/alan-turing-new-ps50-banknote-gay-codebreaker-mathematician-sexuality-pardon-a9005086.html> (download on 10 October 2020)

Piotrowska, Monika. “Triumph der Mathematik“. https://www.welt.de/welt_print/article1349440/Triumph-der-Mathematik.html (download on 2 September 2020)

Riley, Charles. “Alan Turing, World War II code-breaker castrated for being gay, is the face of Britain’s £50 note”. <https://edition.cnn.com/2019/07/15/business/alan-turing-50-pound-note/index.html> (download on 25 September 2020)

Syam, Nilay. “Bletchley Park: The nerve center of British World War II code breaking”. <https://newseu.cgtn.com/news/2020-05-09/Bletchley-Park-The-nerve-center-of-British-World-War-II-code-breaking-QiYr8qumHe/index.html> (download on 10 October 2020)

6.3.2 Websites without an author

“My Engagement to Alan Turing by Joan Clarke (later Joan Murray)”. <https://www.youtube.com/watch?v=MB2e9R7bXCk> (download on 10 October 2020)

“The Imitation Game – Ein streng geheimes Leben“. https://www.imdb.com/title/tt2084970/awards?ref_=tt_awd (download on 24 October 2020)

“Turing’s death”. <https://www.turing.ethz.ch/alan-turing/turing-s-death.html> (download on 10 October 2020)

6.4 Pictures

Birrer, Alex. “Enigma Dokumentation”. https://www.swisseduc.ch/informatik/daten/kryptologie_geschichte/zweiter-weltkrieg.html (download on 17 July 2020) (modified by Carlotta Lindner)

<https://greatwenlondon.files.wordpress.com/2012/06/enigma-3.jpg> (download on 31 August 2020) (explanatory notes by Carlotta Lindner)

7 Affidavit

Eidesstattliche Erklärung

„Ich erkläre hiermit, dass ich die Seminararbeit ohne fremde Hilfe angefertigt und nur die im Literaturverzeichnis angeführten Quellen und Hilfsmittel benützt habe.“

....., den

.....

Ort

Datum

Unterschrift