HST

UNIVERSITY OF LEEDS

HISTORY STUDENT TIMES

TECHNOLOGY: IN HISTORICAL REVIEW

CONTENTS

https://en.wikipedia.org/wiki/File:Aldrin_Apollo_11.jpg

TECHNOLOGY IN HISTORICAL REVIEW

Letter from the Editor

This summer marked 50 years since the first moon landing; a 'giant leap for mankind' which marked a penetration in the expected limits of technology. In celebration of this event, 2019/20's first issue is dedicated to looking at technology in historical review.

Our opening feature takes a look at the intricacies behind the Apollo 11 mission before the articles stretch from antiquity to modernity. Our writers explore the contributions of individuals and societies to key technological developments and consider themes of industrialisation, militarisation, the rise of media and the role of women.

It has been an incredible first issue to edit. I'd like to thank all those involved, writers and assistant editors, for their contributions and dedication to supporting the History Student Times. It has allowed us to put together a substantial issue showcasing 21 articles, all students in the School of History.

Toni Stephenson

TO THE MOON AND BACK WITH 36 KILOBYTES: The Technology of Apollo 11

David Ball

On the 16th of July 1969, we took our first steps on The Moon with computing power equivalent to that of a modern-day pocket calculator. Since this incredible achievement, great strides have been made in the realm of computer technology, whilst the world we know has been moulded by the silicon-based circuits which brought the landing into fruition. We will begin, however, with the computer hardware and software of the Swinging Sixties and the problems overcome in using such early computer technology.

The two main limitations at this time were computer size and computer power. Both of these issues were aided by the 1962 development of the 'integrated computer', shrinking its size from that of a large room to a small briefcase. This was thanks to the advancement of compact integrated circuits, meaning computers could be both smaller, and more powerful; essential attributes of Apollo's onboard Guidance Computer (AGC). Unsurprisingly, this advancement did not solve all of NASA's issues with this temperamental technology, which was still in its infancy. It is often said that had developers known the spec of the computers to be used for the mission, they would likely have deemed it impossible. To demonstrate the reality of computational restraints, we can compare the AGC to a 2014 Samsung Galaxy S5, which is around ten thousand times faster, or the new iPhone 11, which has a fixed memory storage of 256GB, over 7 million times greater than the 36KB capacity of the AGC. Limited memory meant programmers had to convey as much information in as little code as possible, provoking innovative solutions. The result was coding that was considerably more advanced than some in use today.

https://www.nasa.gov/centers/marshall/images/content/364215main_KSC-69P-0631_full.jpg

As the project progressed, however, problems with the development of the guidance computer were close to jeopardising the whole mission. Tests in 1966 proved that it simply could not be relied on as the primary mode of navigation for the spacecraft. The solution was to operate the command module remotely using more powerful mainframe computers at mission control. Due to the 1.5 second delay of this communication, the AGC would still be tasked with lowering the landing module onto the moon's surface, which, as we shall see, wasn't achieved without complication.

Today, some of the highest paying roles in tech firms are those of software engineers, while in the Sixties, coding in itself wasn't considered a profession. The process of coding, coined by the team of MIT programmers as rope memory, was equally alien to what we know today. A patchwork of wires would be weaved through small metal cores, a '1' represented by threading the wire through the core and a '0' around the core, forming a physical expression of a computer program. Factory workers, who were predominantly women, would weave these wires by hand, prompting the term 'the little old lady method'. This code, indecipherable to the human eye but easily understood by computers, would be transferred onto six modules in the AGC which stored the program data. Before this could happen, though, the tedious process of writing this code had to take place.

Image: https://en.wikipedia.org/wiki/File:Margaret_Hamilton_-_restoration.jpg

Cue Margeret Hamilton, the team leader for the development of Apollo's onboard flight software, and the first ever software engineer NASA would hire. Her contribution to the project was immense, namely due to her innovative approach to programming which allowed the AGC to take priorities into account, enabling it to complete important tasks and drop others in the event of an overload. Although NASA was not initially convinced this was necessary, they would soon change their minds after the crew on Apollo 8 wiped the data for the course home and had to be sent replacement data during a nine hour ordeal. A similar issue transpired on the Apollo 11 mission after Buzz Aldrin left the rendezvous radar on, subsequently flooding the AGC with signals and setting off computer error alarms at the closing stages of landing. With Hamilton's workaround encoded, the AGC instantaneously rebooted and performed a successful descent onto the moon's surface as Armstrong orientated the craft. Hamilton's contributions were not only fundamental to the success of the mission, but established computer programming as the crucial and complex field we know it to be today.

This narrative did not end when the Apollo 11 crew arrived safely back on earth. Instead, it opened up the floodgates to revolutionary technological developments and marked the beginning of an exponential growth of curiosity and ambition, stretching from Mars to galaxies far, far away. Just fifty years ago, the guidance computer onboard Apollo 11 was tasked with the final stages of the moon landing. Now, we are turning to a combination of AI and quantum computing to plan automated voyages to distant planets. In the words of NASA administrator Jim Bridenstine, 'The moon is the proving ground; Mars is the horizon goal'.

TECHNOLOGY IN THE ROMAN EMPIRE

Joana Teixeira Brandao Bessa Ribeiro

The use of technology in the Roman Empire can be seen through many public projects which the Romans undertook to make their empire strong, advanced and vast – most notably in the construction of buildings, and the development of roads and aqueducts.

The development of concrete and cement has left many Roman structures still standing today; for example the Pantheon, the Roman Forum and the Colosseum. Created with slaked lime, volcanic ash (pozzolana) and volcanic rocks (tuff) which makes it durable to decay, concrete was utilised in many constructions particularly bridges, monuments, aqueducts and buildings. Due to this endurance, concrete was used underwater when building baths, harbours and piers, such as in the Roman baths that can be seen in the namesake southern city of Bath.

Arches were also developed by engineers, flattening their shape to strengthen their support. This allowed bridges and aqueducts to be built with increased reinforcement which made them less likely to collapse. A key part of the Roman architectural style, the triumphal arch was built to celebrate military victories and other achievements of emperors. Some famous examples which have survived today are the Arch of Constantine (built in 312 CE), the Arch of Titus (c. 81 CE), the Arch of Septimius Severus (c. 203 AD) and the Triumphal Arch of Orange (c. AD 20). The later influence of Roman triumphal arches can also be seen from the fifteenth century, as demonstrated by Paris' Arc de Triomphe.

Roads were developed for administrative purposes. They ensured effective governance within a vast empire. The development of a Roman road network was one of the most sophisticated systems in the ancient world. The laws of the Twelve Tables from 450 BC specified that a road should be 8ft straight and 16ft curved which encouraged Romans to develop the practice and standard for road building. They were built with gravel and brick, with a curved design allowing for water drainage. By 200 AD over 50,000 miles had been built, enabling efficient travel via the road highways, quick passing of messages and successful military conquest. The roads included mile markers, signs which showed the distance to a destination and highway patrol of soldiers. This is a similar system to the one we have implemented today. Moreover, roads were vital for the Romans to communicate, collect taxes, trade and move armies. This allowed the empire to remain stabilised, the centre of the ancient world and thus helped with its expansion.

An aqueduct was used to transport water along stone by a pipeline. Evidence of this system is also seen in Egypt, Assyria and Babylon. The Roman aqueduct was developed around 312 BC, civil engineered and aided by gravity. It was a phenomenal technological discovery because it promoted sanitation and public health, as well as providing the Romans with fresh running water from as far as 60 miles away; just nine aqueducts provided the Romans with 38 million gallons of water each day. Most importantly, the aqueduct also led to the creation of fountains, underground sewage systems, public baths and public toilets which boosted sanitation.

The technology created in the Roman Empire can still be seen today which shows impressive ancient engineering with many of these innovations still standing. A lot of our engineering techniques in the modern world can be traced back to this era. Long live the Romans!

WERE ANCIENT TECHNOLOGICAL ADVANCES PURELY USEFUL FOR THE ANCIENT WORLD?

Imogen Bird

Ancient technology and history in general, often has the stigma of being rooted in the past; but the more we explore the ancient world and its technology, the more we understand that the ancient world is not as backwards as we may think; as can be seen through the Roman aqueduct, the Aqua Virgo and its use throughout history. Aqueducts were pivotal for the ancient world in supplying communities with water resources to aid roman life, the uses of which ranged from supplying sewers to villas. In 312 BC, Rome's first aqueduct was constructed due to increased need for water in an expanding city. As the city's population increased so did the need for water and so more aqueducts were constructed. Likewise, as Roman influence expanded into an expansive empire, more aqueducts were built across their empire to assert Roman influence. By the third century AD Rome was supplied by eleven state funded aqueducts; moreover, it seems obvious that aqueducts were crucial to Rome, and more widely their empire. The Aqua Virgo was one of these eleven aqueducts and was completed in 19 BC by Agrippa under Augustus and serves as an example of how important these aqueducts were and continue to be today.

Although many Roman aqueducts were destroyed after the fall of the Roman Empire, their use continued throughout the middle ages and continue to supply water today, albeit with some modern technological advances. In 1453 Pope Nicholas V renovated the Aqua Virgo in Rome as part of his mission to improve the cleanliness of Rome and its citizens. Throughout much of the middle ages, water supply in Rome was dependent on wells and the poor water quality of the river Tiber, which often produced waterborne diseases. As a result, the restoration of the Roman aqueduct provided a slightly safer option of water, even if the issues of disease still somewhat remained. During this restoration, additional channels were added to the aqueduct which led to its new name, the Acqua Vergine. Such change then allowed it to supply much of the famous landmarks of Rome from the Renaissance.

Today the Aqua Virgo/Acqua Vergine still supplies much of Rome's pure drinking water and is famous for its alleged healing qualities. It supplies many of Rome's' main fountains such as the Trevi Fountain, the three fountains of Piazza del Popolo, and the north and south fountains of Piazza Navona, as well as many of the drinking fountains across the city.

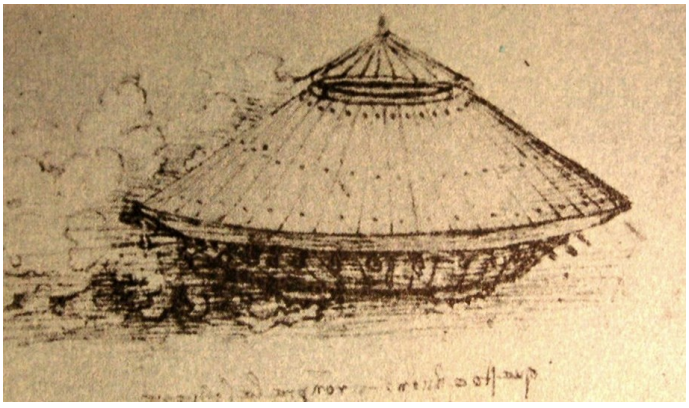
Ultimately it is clear that the aqueducts constructed by the Romans provided a foundation for water supplies throughout subsequent history. The technological advances of the Romans allowed future generations to be supplied purer water with greater ease. Much is owed to the Romans and their construction of aqueducts in a time when Rome was advancing. Yet it needs to be stressed that many other areas of Roman society still remained ancient compared to the technological innovation of aqueducts, and aqueducts themselves were far from being perfect.

DA VINCI: A GENIUS BEFORE HIS TIME?

Known for producing the most famous and iconic painting on the planet, Mona Lisa, no individual embodies the period of the Renaissance more so than Leonardo Da Vinci; an artist, but more importantly a mathematician, scientist, engineer, architect and inventor. His notebooks provide us with an insight into ideas for technological progress and innovation that were well before his time. Some 7,000 pages, are filled with personal, observations and carefully drawn sketches which serve as living records of a mind that possessed the ability to reach beyond the world that surrounded him. Da Vinci wrote about technological concepts and illustrated objects and designs he was curious in exploring further to understand how they worked through experimentation.

Da Vinci did not possess the technology needed to bring his sketches to life as it simply did not exist or was too expensive meaning his impact on technological advancement in the fifteenth century was limited. His lack of Latin meant he couldn't converse with the academic world or generate scholarly discourse as well as the added hurdle of the printing press being still in its infancy However, his lack of formal education meant he was not preoccupied with past conceptions of technology and its limits, particularly the medieval idea that experimentation was full of errors that would not progress further than the formation of theories. Most of his ideas and inventions were inspired by nature and observation that enabled him to foresee possibilities in human flight, mechanical warfare and submarine travel.

Da Vinci generated over 500 sketches and wrote 35,000 words on the topic of flight in his Codex on the Flight of Birds, 1505-06. Here, he studied birds and generated ideas on potential flying machines, bird flight, wing design and the properties and nature of air. He designed flying machines called ornithopters that had manually powered wings, imitating natural flight, and were based on his study of bird's wings and muscles. One design is based around a man lying on a wooden surface whilst pushing two pedals in an alternating motion to produce the movement of wings, with a hand crank for increased energy output. Prompted through observation to consider what made bird flight possible in order to design a flying machine, Da Vinci hinted at the idea of gravity two centuries before Isaac Newton, coming to understand that a bird's up-and-down motion was to do with propulsion. His ideas surrounding lift, the pressure on top of the wing being less than the pressure below the wing as air flows around it which enables flight, are a partial precursor to the modern concept of drag. His studies planted the seeds of human understanding of aerodynamics and aeroplane development centuries before it came to be studied again in depth in the early twentieth century.



In fifteenth century Europe gunpowder was in its infancy and Da Vinci was one of the first to anticipate the likelihood of a battlefield dominated by heavy and light artillery, technology that didn't occur until the late nineteenth and twentieth centuries. Da Vinci's sketches show a concept similar to that of a modern tank which could penetrate through defences with cannons arranged in 360-degrees, again taking inspiration from nature with the cover of the tank being based on the protective shell of the tortoise. However, his design has a major flaw as the cams turning the wheels would work in opposite directions. This is thought to be linked to Da Vinci's pacifism, as he abhorred war. The covered tank would not be built and used until the First World War, in September 1916 at the Battle of Flers-Courcelette, when the British deployed their new weapon in the guise of a water tank; only possible due to the availability of the internal combustion engine, technology that wasn't available in Da Vinci's era.

Was Da Vinci ahead of his time? The late fifteenth century was the beginning of the Scientific Revolution in Europe. Most of what was known in this period was inherited from ancient philosophers, like Democritus, or was based upon superstitious thinking. Da Vinci was working on ideas a hundred years before the likes of Francis Bacon and Galileo published ideas surrounding technological advancement through science and experimentation. His impact on society is hard to determine, even though he is now considered an important contributor to the Scientific Revolution, as his technological ideas were not publicly accessible, limiting the ability of future generations to improve his ideas and make his creations a reality. Many interpret his work as an anticipation of later discovery and beneficial to technological pioneers in the future; but one has to consider whether his ideas and impact became available to the public too late to affect technological advancement, whilst crediting his experimental methods and imagination that allowed him to generate ideas well ahead of the time.

George Helliwell

https://en.wikipedia.org/wiki/Leonardo%27s_fighting_vehicle#/media/File:Leonardo_tank.JPG

BRITISH INVENTIONS THAT CHANGED THE WORLD

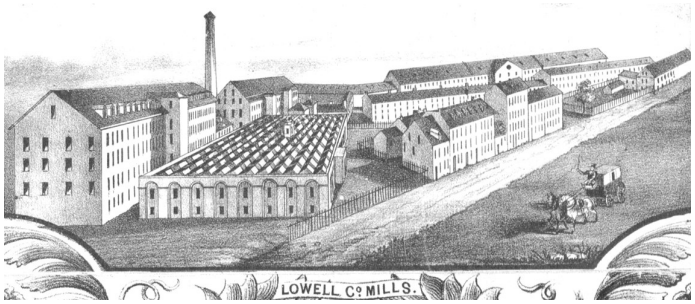
Alice Harrison

The cotton loom, invented in 1785 by Edmund Cartwright, was a steam-powered device that mechanised the process of weaving threads into cloth. The 18th Century invention significantly reduced the need for humans to oversee the weaving process. The American Industrial Revolution, some years later, was a natural continuation of the progress that had happened in Northern England in the latter part of the 18th Century. The Northern powerhouse was a conglomerate of cites like Manchester, Leeds, Bolton and Liverpool. When Samuel Slater opened the first industrial mill in Pawtucket, in the United States in 1793, it capitalised upon the blueprint that had been produced by the English pioneer of the textile industry, Richard Arkwright. For the United States, this marked a shift from manual labour-based industry to machine-based manufacturing leading to an increase in overall production and economic growth within the country.

The 19th Century textile mill in Lowell, Massachusetts has historically been known as the 'cradle' of the American Revolution. Developments and improvements in transportation were required to move finished goods, and this led to the building of railways, locomotives, and the construction of a 5.6-mile-long canal system, all of which assisted distribution. The Waltham-Lowell system was considered to be more refined, faster and significantly more efficient than the British system. It pioneered the use of a vertically integrated system, which meant there was complete control over all aspects of production, from initial spinning, through to the weaving, dying and cutting.

Lowell can be considered the catalyst that would eventually lead to America becoming the major global power that it is today. By 1850, Lowell and the Boston Associates, who were the key financiers, controlled one-fifth of America's textile production. This allowed them to diversify and expand into other fields of commerce such as finance, insurance, and the stock market. .

American cotton mills generally relied upon a large number of single women to help run their operations. By 1840, the Industrial Revolution was at its peak, and 80% of Lowell's workforce was female. At this time female-dominated sectors were highly uncommon. However, it provided conditions where women could earn a wage and be allowed access to housing, medical care and education. After a period of uncertainty, due to wage disputes, the women of Lowell organised a series of strikes and formed a labour union called the Factory Girls Association in 1834. Early attempts at strike action failed, and ultimately it was the creation of the Female Labour Reform Association, in 1845, that gave women the power they needed to pressure the government into passing legislation. Their main aim was to improve working conditions in the state. The introduction of women's right to vote in 1920, can trace its roots back to the efforts of the women at Lowell.



Plan of the city of Lowell, Massachusetts

https://commons.wikimedia.org/wiki/File:1850_Lowell_Co_Mills_Lowell_Massachusetts_detail_of_map_by_Sidney_and_Neff_BPL_11051.png

A CLOSER LOOK: THE SAINT PETERSBURG-MOSCOW RAILWAY

Miri Hodnett

Nineteenth century Russia was ruled by an undisputed autocratic leader: the Tsar. This mediaeval-esque way of ruling meant that Russia was largely behind in industrial and technological terms compared to western countries such as Britain and France. Tsar Nicholas I saw the need for better communications between Moscow and Saint Petersburg in order to modernize the country, and so issued a decree for the construction of a railway in 1842.

Peasants made up around 90% of the population, and a large number of these were Russia's rural serf labourers tied to a landlord's estate. 50,000 serfs were involved in the building of the railway, which was opened in 1851, and they were faced with heavy loss of life due to terrible conditions. This inspired Nikolay Nekrasov to write the poem The Railway, depicting the cruelty of autocratic Russia on the serfs building the tracks. The poem describes a 'merciless' Tsar and the replacement of the beauty and peace of the rural landscape with the bones of the workers accompanied by the sounds of pain and strife. It emphasised the need to recognise the importance of ordinary people and their lives rather than worshipping the Tsar as the worthy and almighty leader. Due to the autocratic nature of the country, the poem was censored in an attempt to quell revolutionary unrest.

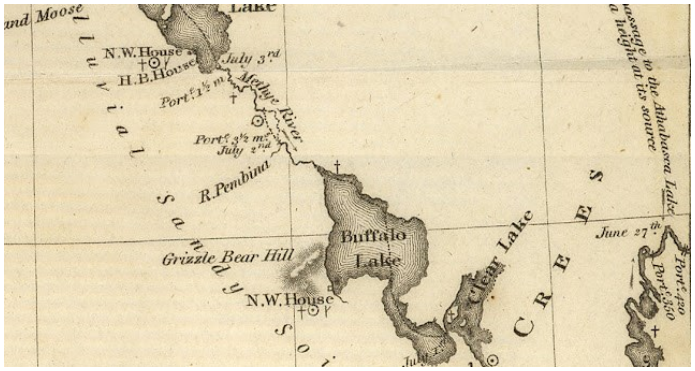
This railway line is interesting as there are legends and rumours surrounding it. First is the Ruler Legend. As the distance from Saint Petersburg to Moscow was around 400 miles, Nicholas saw the need to make the shortest route possible. A rumour was created that the tsar simply placed a ruler on the map and drew a straight line, regardless of any obstacles that may have been in the way. As Nicholas' word was considered rule, the engineers had to perform his wishes exactly. However, historians generally believe this story to be false, created by dissidents of the monarchy to prove that the tsar governed poorly and impulsively.

Legend and rumours surround this railway line, sparking an interest in many – the most renowned being the 'Ruler Legend'. The distance from Saint Petersburg to Moscow was around 400 miles and Tsar Nicholas saw the need to make the route as short as possible. Rumour has it that the Tsar simply placed a ruler on the map between the two cities and drew a straight line, regardless of any obstacles that may have been in the way. Since his word was considered rule, the engineers performed his wishes exactly. Historians generally believe this story to be false; created by dissidents of the monarchy to prove the Tsar's poor and impulsive governance.

Furthermore, the tracks were built with an unusually wide track gauge of 5 ft. It has been disputed that this decision was made purely with defensive concerns in mind; however this has been countered by many who believe it was an economic decision. Nevertheless, the wider track gauge impacted the

Continued on next page >

MAGNETIC El DORADO



Part of John Franklin's expedition map of 1819-1820 from Ile a la Crosse to Methye Portage

George Cooke

What do Iron Maiden, 580 gallons of pickles, Abraham Lincoln's coffin, the gates of hell and some Canadian Inuit have in common? The answer is the Franklin Expedition; a needless journey to study magnetism- a goal which made as little sense as it yielded results. This article is an account of how the cultish Victorian obsession with technology claimed the lives of 130 innocent men.

After the discovery of John Franklin's sunken ships HMS Terror and Erebus (the gateway to hell) in 2016 and 2014 in the Canadian Arctic, the infamous Franklin expedition re-entered the world press after a 165-year hiatus. However, today, as in the mid-17th Century, the coverage of the fateful journey doomed to end in cannibalism and the loss of 130 lives remains somewhat misleading.

The BBC, Guardian and Independent have all run multiple stories about the Franklin Expedition's ill-fated mission to, "chart, search for, and complete the navigation of the Northwest Passage."

The Northwest passage was the white whale of Victorian exploration- so much so that superstar explorers Frances Smith, Samuel Hearne, George Vancouver, and even James Cook all attempted to locate the mythical shipping route through the Canadian Archipelago; all in vain.

This begs the question: why find the Northwest passage at all? A route so elusive that even if John Franklin's crew could somehow achieve what generations of professional explorers could not, the Northwest passage was certainly too difficult to navigate for the average commercial shipping voyage.

Adam Lambert, Professor of Naval History at King's College agrees, stating in a 2017 blog post for the Museum of Greenwich, "By the late 1820s Franklin and other experienced Arctic travellers accepted that even if a passage existed it would be useless for commercial purposes."

Historians now believe the true purpose of John Franklin's expedition was to study magnetism in the North Pole. Both ships carried large amounts of scientific equipment used for studying magnetism and the first search parties headed to the magnetic north pole to begin their search for Franklin and his crew. Furthermore, John Franklin was among Britain's foremost scientists studying magnetism as part of a lifelong ambition to revolutionise navigation using the Earth's terrestrial magnetic signature.

The question then, is how has this seemingly conclusive evidence been forgotten? As the introduction to this article suggests, it is an event that has consistently captured imaginations; Iron Maiden wrote 'stranger in a strange land' about the expedition and Abraham Lincoln was buried proudly with a piece of uniform recovered from one of the crew. (And for those who like closure, the pickles were part of the food they bought with them for the trip, along with large quantities of tinned food sealed with lead; lead poisoning and exposure bearing responsibility for the death of most of the crew.)

After the expedition went missing, and the sinister details of sailors contracting lead poisoning and eating each other began to come to light, things soon got embarrassing for those peddling Franklin as a hero of science and technology. The Victorian press (and Charles Dickens interestingly) were quick to indite local Inuit witnesses as savages spreading lies of cannibalism- instead of accepting the hard evidence. Moreover, renewed scientific examination of geomagnetism prompted by the expedition's disappearance revealed nothing that the invention of the chronometer, more than 80 years prior, had not. In short, the whole expedition had been a waste of time and resources before even setting sail.

Rather than admit this, the Victorian press presented a story of heroic exploration. In fact, a statue of Franklin can still be seen today in Victoria Place, London, bearing the inscription "Discoverer of the Northwest passage" representative of attempts to memorialize Franklin as a hero instead of accepting the incompetent reality. Perpetuating a narrative which, though long dispelled in the world of academia, still holds sway in mainstream media coverage to this day.

The Franklin expedition then stands as a shining example of the Victorian cult surrounding science, technology and exploration. A rich, ill-informed white man in search of glory where none can be found, cost 129 men their lives, and the rich, ill-informed white men back home give him glory all the same.

invading German army during WWII, who needed to use the railway line to transport supplies. The oncoming army were slowed down significantly and had to convert the tracks from Russian to German gauge. Whatever the initial reasons for the wider track gauge, it hindered enemy invasion nearly one hundred years after construction.

The Saint Petersburg-Moscow railway line is therefore a sign of a move not necessarily towards full industrialisation, but towards the recognition of a need for some development of technological advancement in a largely agricultural country. It can be placed both in the history of growing resentment for tsarism among intellectuals, as well as during the German invasion of WWII.

Overall, the Saint-Petersburg to Moscow railway line can be seen as a catalyst in the history of growing resentment for Tsarism amongst intellectuals and ordinary Russians. It is symbolic of the period in Russia's history which was dominated by botched attempts of industrial and economic expansion due to the incompatibility of modernisation with Romanov style autocracy.

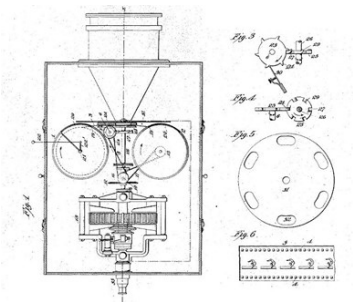
A HISTORY OF FILM IN SEVEN OBJECTS

Hannah Cocker

The rapid development of film over the past century represents one of the most important examples of technological progress in human history. Incorporating the entertainment we consume and the news we watch, film has become central to the way we communicate in the modern era, spurring on wider technological innovations and catalysing social change. With so many developments occurring in such a short space of time, here are seven of the most significant that have taken us from the first motion pictures to the birth of cinema, and beyond.

1) Plates from *The Horse in Motion* (1878)

Developed by British photographer Eadweard Muybridge in 1878, *The Horse in Motion* was the first motion sequence to be photographed. Muybridge set up cameras parallel to a horse racing track; as the horse ran past, a thread would trigger each camera shutter in turn producing a series of plates that were displayed using a zoetrope – a cylindrical device playing a sequence of photos in quick succession, creating the illusion of motion.

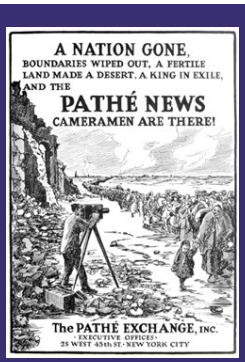


2) Blueprint for Thomas Edison's 'Kinetoscope' (1893)

Often believed to be the pioneer behind the first moving pictures (a discredit to both Le Prince and Edison's employee William Dickson, who designed the invention), Edison's unveiling of the 'Kinetoscope' to the public in 1893 represented the first commercial exhibition of film. An early precursor to the projector, the Kinetoscope was designed for individual viewing, with one person looking through a peephole.

3) Advertisement for Pathé News covering the events of the First World War (1915)

By the early 1900s, film production companies were emerging in the US and Europe, with Pathé becoming the biggest in the world by 1905. Founded in France by Charles Pathé, the company garnered a reputation for innovation, with 1910 seeing the creation of Pathé News, a British-based producer of popular newsreels. Critically, the First World War marked the first time newsreels were used to cover major stories. Following the introduction of conscription, the British government recognised the value of film in keeping the public engaged in the war effort and boosting morale, a watershed moment in the development of news media.



https://commons.wikimedia.org/wiki/File:The_horse_in_motion_-_as_shown_by_instantaneous_photography_-_with_a_study_on_animal_mechanics_founded_on_anatomy_and_the_revelations_of_the_camera_-_in_which_is_demonstrated_the_theory_of_quadrupedal_(14762111651).jpg

https://commons.wikimedia.org/wiki/File:Path%C3%A9_News%E2%80%94A_Nation_Gone.png

https://en.wikipedia.org/wiki/List_of_Edison_patents#/media/File:Kinetoscope.jpeg

4) Lobby card for Warner Bros. film The Jazz Singer (1927)

Despite rapid progress in producing motion pictures, production companies struggled with sound synchronisation during films' silent era. However, this all changed in 1927 with the release of The Jazz Singer, the first film to feature synchronised dialogue. Although silent pictures did not disappear overnight, the revolutionary use of sound in the film, coupled with the picture's popularity, marked the ascendancy of talking pictures, or 'talkies'.

5) Title card for Snow White and the Seven Dwarves (1937)

Up until this point, animation had traditionally been produced as short films of around three minutes length – such as Walt Disney's incredibly popular Steamboat Willie (1928). With the acquisition of Technicolor's new 3-strip colour film process in 1932, allowing full-colour animation, Disney began to aim higher, commissioning the first feature-length animated film in 1937. A predicted flop, Snow White and the Seven Dwarves became the highest-grossing film of all time (obtaining over $140 million in today's money), a testament to the creativity of the studio which would establish itself as the undisputed king of animation and an industrial juggernaut.

6) IMAX film and 3D technology (1985)

3D motion pictures were nothing new in the 1980s, with stereoscopic 3D technology dating back to the turn of the century. Having fallen out of fashion since the 1950s, 3D underwent something of a renaissance with the development of IMAX 3D, used in the production of pioneering documentaries on outer space. Incorporating new technology that reduced eye strain, and a much larger field of view, the use of IMAX increased throughout the 1990s, even being used by NASA astronauts to document space exploration. This highlights the broader impact of the film industry beyond creating movies.

7) Motion-capture head-rig used on the set of Avatar (2009)

In development since the mid-1990s, motion-capture was arguably perfected in the production of James Cameron's Avatar, which began shooting in 2007. Actors were fitted with head rigs and suits that tracked their every movement and facial expression. This footage was then fed into Cameron's own invention, the virtual camera system, the first camera able to show an actor's digital counterpart in computer-generated surroundings in real time. Cementing Cameron's reputation as one of cinema's greatest visionary directors, Avatar remains the pinnacle of modern creative cinema and arguably remains unmatched.

In recent years, however, developments in film technology have been met with controversy, in marked contrast with the blind faith in progress held a century ago. The growth of digital recreation technology – used famously in Star Wars: Rogue One to 'bring back' dead actors – has raised a number of ethical concerns. Dubbed 'digital necromancy', the technology is set to make headlines again with its use in The Whitney Houston Hologram tour in 2020, asking us to confront the very real moral implications of technological advancement. With the rapid expansion of the film industry over the past two decades, seeing the record for highest-grossing film broken not once, but twice, the future of technological innovation in cinema is bright, but should be approached with caution.

LOUIS LE PRINCE: The First Tragedy of Film

Joe Everitt

When considering the pioneers of cinematography, the Parisian Lumière brothers and American Thomas Edison spring to mind. However, it was here in Leeds that a little-known Frenchman developed the world's first motion camera. In 1888, just a stone's throw away from Leeds University campus, Louis Le Prince produced a single lens camera at his workshop on Woodhouse Lane. This invention predated the work of Edison and the Lumière brothers by several years and, but for his mysterious disappearance in 1890, Le Prince would have gone on to secure his place in the history books as the father of cinematography.

Le Prince moved to Leeds from France in 1866 to work as a designer and translator for the Whitley Partners, a company which manufactured brass items. Shortly after this he began experimenting with motion pictures. In 1888, he completed the single lens camera which would bring him tantalisingly close to international acclaim.

He tested this new device at the Whitley family home in Roundhay, Leeds. Le Prince filmed his son dancing and playing the melodeon and shot a second scene showing the Whitely family in their garden. The third and most famous scene recorded by Le Prince was taken later that month, and showed traffic crossing Leeds Bridge. These were the first moving images ever recorded. Over the following months he perfected the technique of projecting these images. All that was left for Le Prince to do was share his new technology with the world.

In 1890, Lizzie Le Prince leased a venue in New York City for the premiere of her husband's invention. The stage was set for Le Prince to make his name. However, just weeks before he was due to depart for New York, he boarded a train destined for Paris and disappeared without a trace. Could a rival inventor have ruthlessly murdered Le Prince to prevent him from showcasing his work? Others have suggested that he committed suicide having become overwhelmed by the pressure of his quest to perfect the moving image. While his family were convinced of foul play, the absence of a body, crime scene or clear motive meant that there was no evidence to support this claim.

It took more than five years after the disappearance of Le Prince for the Lumière brothers and Edison to develop devices capable of capturing and projecting motion images. Edison's first success was the Kinetoscope. This device was built in 1891 and displayed a moving image through a peephole. It wasn't until 1896 that he matched Le Prince's feat of projecting a motion picture for multiple viewers to watch simultaneously. The Lumière brothers turned their attention to moving images in 1892 and projected a short film using the Cinematograph in 1895, six years after Le Prince had planned to premiere his work. However, unlike Le Prince, Edison and the Lumière brothers successfully demonstrated their inventions to the public, which secured their popular status as the pioneers of cinematography.

While the fate of Le Prince is shrouded in mystery, the time it took for the likes of Edison and the Lumière brothers to match the sophistication of his single lens camera and projection system is testament to his brilliance. Not only does this provide a strong case for recognising him as the inventor of the moving image, but it also cements Leeds' status as the birthplace of cinematography. The current transfer of the Channel 4 offices to Leeds is just the most recent chapter in this city's rich history of cinematic tradition stemming from the work of Louis Le Prince.

Louis Le Prince, c. 1880s.

https://commons.wikimedia.org/wiki/File:Louis_Le_Prince,_1880s.jpg

RADIO WARS: Jamming to The Beatles

Millie Scott

The Cold War was by no means a conventional war. Historically remembered for the near-nuclear destruction of the entire world, the cultural significance of this conflict is often overlooked. The United States and the Soviet Union were engaged in a political, economic and ideological fight to assert their own notions of modernity throughout the world. Looking beyond the traditional boundaries of Cold War history, from the corridors of the CIA to the dance floors of the Soviet Union; this was a cultural conflict. A war of the airwaves.

The first generations of jazz and rock 'n' roll fans in the Soviet Union engaged in the cultural consumption of western music by tuning in to the signals of international radio broadcasters. These foreign broadcasters developed slowly over the years as technological advancements allowed stations such as the Voice of America, Radio Liberty and the BBC to travel through the iron curtain into the homes of Soviet citizens.

In the late 1960s while the Soviet youth were jamming along to the Beatles, the Soviet authorities were engaging in their own form of jamming; the process of sending out signals of interference to drown out foreign broadcasters. The westernisation of youth, now increasingly facilitated by this growing form of mass media, was viewed by Soviet authorities as a dangerous corruption of socialist values. Dating back to the early 1920s, jamming radio signals was not a new phenomenon. Although, when on February 3rd 1948 the Soviet Union began the process of jamming Voice of America transmitters, it took on an entirely new purpose. The Cold War now also turned into a war of the radio waves.

Jamming was a very expensive process; this 'frequency noise' was achieved by setting up radio stations throughout the Soviet Union to exclusively jam the signals of foreign broadcasters. In 1955 the

THE ROARING TWENTIES AND THE 'NEW WOMAN'

Zoe Glasspool

1920s America saw the birth of a generation of 'new' women who moved beyond the domestic sphere to enjoy political, social and economic freedoms previously reserved for men. Radical technological development coincided with the 19th Amendment (August 1920), providing women with equal suffrage and opening the doorway for improved rights.

After World War One, America experienced an economic boom encouraging investment in new technologies. Huge advances were made in the electricity industry and by 1929, 70% of US households were electrified. Factories were transformed and mass production techniques like assembly lines and standardisation revolutionised American industry. Products were produced quicker, cheaper and more efficiently meaning goods became more affordable so people could purchase items which had previously been regarded as luxurious. Henry Ford's mass production advances exemplify this; he reduced Model T Ford car prices from $850 (1908) to $300 (1924) marking the birth of a new kind of consumer society.

The invention of affordable electrically powered products such as refrigerators, washing machines and vacuum cleaners meant that women's domestic duties fundamentally changed; becoming easier and less time-consuming. Furthermore, with rapid production of cheap goods, advertising evolved. Mass-marketing campaigns encouraged families to 'keep up' with their neighbours by purchasing the latest technological trends. Many of the new products and campaigns targeted women and were displayed within magazines like *'Ladies' Home Journal'*.

Enjoying more leisure-time and increasing visibility in society, women experienced greater freedom. Job roles diversified and millions gained employment as secretaries, clerks and switchboard operators. The 1920s saw the formation of the first generation of independent American women who could afford to participate in the consumer economy and live independently without a husband providing financial security.

These 'new' self-sufficient women are most commonly remembered as 'flappers'; women who opposed traditional Victorian ideals of womanhood. Stylish, youthful and 'immoral', flappers wore make-up, short skirts, bobbed hair, publicly smoked and drank, visited speakeasies, engaged in greater sexual freedom and generally behaved in an 'unladylike' manner.

F. Scott Fitzgerald described how during the 1920s Jazz Age, "the parties were bigger, the pace was faster, the buildings were higher, the morals looser." Dancing became a fun, sociable activity to fill women's newly acquired free-time. African American music spread rapidly across America as people moved to cities. Energetic dances like the *Charleston*, *Black Bottom* and *One Step* became popular amongst the young generations. With fast-pace footwork and exaggerated arm movements, these dances were incongruous with corsets and long dresses leading to changes in fashions and behaviour.

However, these drastic societal changes alarmed the older generations. Horrified by women going out without male accompaniment, night-long parties and females holding men's hands without gloves, groups such as the 'Anti-Flirt League' formed to 'protect' females. Disgust of the 'new woman' and Jazz Age was interconnected and reflected by *The Catholic Telegraph's* statement: "The music is sensuous, the female is only half dressed and the motions may not be described in a family newspaper".

Innovations like cinema and radio gave rise to popular culture. With the economic boom, rising female employment and greater free-time, millions could afford to spend money on leisure; 100 million people went to the movies a week. In 1927 'The Jazz Singer' was released. With synchronised speech and singing, this technological advancement marked the start of a new global phenomenon – "talkies". Movie stars were named, allowing individuals to find fame with many actresses becoming beloved stars. Clara Bow was one of the few who successfully transitioned from silent films to 'talkies', becoming the 'It Girl' and demonstrating women's newfound visibility in society.

Advances in birth control provided greater sexual freedom. Margaret Sanger led this particular women's rights movement by popularising the phrase 'birth control' and opening America's first contraceptive clinic. Women now had more choice over how many children they had and were able to explore their sexuality without fear of unwanted pregnancies. Dumenil argues "the movement toward smaller families, birth control, less restraints in private life" was "permanent", radically altering America.

Throughout the 'Roaring Twenties' technological developments helped to liberate the 'new woman' from the confinements of domesticity. These women caused fundamental societal changes, both in America and globally, as they gained increasing independence. Through "wide-flung rebellion" (Lowry) women destroyed cultural expectations surrounding gender and morality, the legacies of which continue today.

Soviet Union is thought to have spent more money on jamming these western radio stations than on their own Soviet broadcasting shows. This is perhaps telling of the popularity of these foreign broadcasters, as Soviet citizens sought out new and exciting forms of entertainment from outside the regime.

These radio stations were not solely blasting out Yellow Submarine to win over a new generation of Soviet citizens to the western way of life, in many cases they were broadcasting outwardly anti-communist sentiments amidst western rock 'n' roll to the culture-starved Soviet youth. A key example of this is Radio Liberty, backed by the CIA in seeking to promote the collapse of the Soviet regime, this broadcaster was an integral part of the United States Cold War strategy. The music in these broadcasts was viewed as a distraction amidst the more serious campaign of propaganda messages. It could be argued that the lasting impact of western cultural consumption was a key factor in foreshadowing the ultimate collapse of the Soviet Union in 1991.

The fight against the enemy voices of western broadcasters was a continuation of long-lasting Soviet practices to control and manipulate the flow of information in the Soviet Union. Although technological advancements and the tide of cultural change proved overwhelming in the war of the airwaves, Beatlemania in the Soviet Union was an indication that these foreign broadcasters had created a crack in the iron curtain, one which they would continue to chip away at.

‘ADVANCEMENT THROUGH ANNIHILATION’

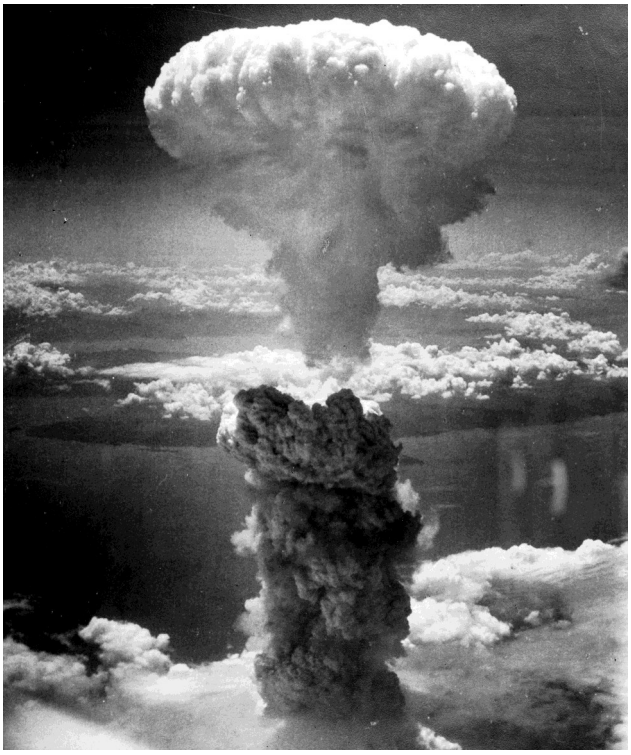
“…and war, Comrades, is a great locomotive of history” – Leon Trotsky

Joe Gazeley

The World Wars and Cold War ushered in a new form of devastating conflict that decimated landscapes and brought a new meaning to the term ‘total war’. These wars brought about an aversion to international conflict, and rightly so; however this has overshadowed some of its perceived benefits. One such benefit of war is the advancement of technology. Now this does not only mean the creation of more efficient means to neutralise the enemy, but also technologies that have improved mortality rates and general welfare.

Details of the advancement in weaponry during war can be tediously minute, but the greatest exception to this is the advent of nuclear warfare. The combined efforts of the USA, UK and Canada on the Manhattan Project led to a new form of international relations and warfare that ultimately shaped the rest of the century. Relations between the collaborative powers shows the potential of such a weapon in the US’ unwillingness to share key information with the UK on the project such as how to extract plutonium from uranium, in order to prevent their use of the information after the war. By October 1946 the US ended nuclear cooperation with the UK.

Churchill, Roosevelt and Stalin at the Yalta Conference, 1945.



Resulting cloud from the atomic bombing of Nagasaki

The utter destruction caused by the bombs of Hiroshima and Nagasaki were clear motivators for each nation to pursue a nuclear arsenal. With the USSR’s development of their equivalent of the fat-man bomb, ‘the lightning’, the centrepiece of the Cold War had been established: mutually assured destruction. Depending on who you ask, mutually assured destruction can be seen as a means to prevent the same scales of warfare seen in the World Wars due to its role as a deterrent, or a cataclysmic force that should be disarmed.

Now to the more humane result of science during periods of war: medicine. With a greater number of patients and previously unseen wounds, comes the opportunity for doctors and surgeons to experiment.

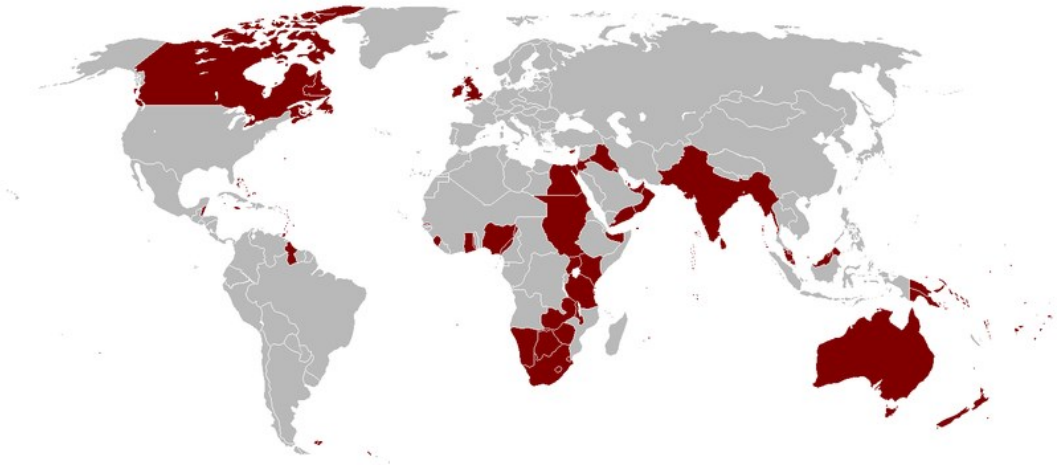
Treatment of infection, as well as surgery, were particularly improved by the disasters of war. The production of penicillin is particularly worthy of highlighting, due to the increased usage it saw during the Second World War. While penicillin was discovered before 1939, the work of Florey and Chain proved its ability to cure bacterial infection. The process of war particularly aided the production of penicillin on an industrial scale. War accelerated this particular ground-breaking discovery by making it applicable in medical practice.

Scientific advancement has been a constant of warfare for as long as it has been waged, albeit advancement was slower pre-industrialisation. Despite these highlighting the opportunity war presents to advancing scientific understanding, such opportunity is only a silver lining of a process that defiles landscapes and torments the memories of those who participate in it.

WEAPONS OF WAR:

The Global Distribution of Imperialist Violence

Annabel Cook



A map of the British Empire at its height in 1921.

The ascension of Great Powers such as France, Germany, and England during the latter half of the 19th century coincided with the mass distribution of military rifles and the introduction of machine guns. The significance of the arms industry in this early setting of globalisation contributed to the violent conquests of colonialism, with both the colonisers and indigenous armies benefitting from military developments to different extents.

The Chassepot rifle, created in 1866, was the first of its kind; a modern bolt action, breech-loading rifle. It was a prominent weapon of the Franco-Prussian War (1870-71) where, according to Walter, 1,037,555 units were produced for the French Army. Despite its many advantages over the Prussian Dreyse needle-fire rifle, such as the range being 1,600 metres compared to the 600 metres of the Dreyse, the defeat of the French in 1871 enabled the capture and distribution of the Chassepot. Although it was primarily used in the Franco-Prussian war, the Chassepot rifle also supported ethnic minorities within China in the Miao Rebellion and Dungan Revolt, as well as Ethiopia in their victory against Italy in 1898.

After the Franco-Prussian War the Mauser Model 71 (M71) not only became the standard military rifle for Imperial Germany until 1881, but more importantly was utilised by other countries in their struggles until 1945. In 1876 the Qing dynasty purchased this rifle in bulk from the German arms company, the Mauser, to stave off the Boxer Rebellion and was employed in the First Sino-Japanese War.

The South African Republic also utilised the M71 in the First and Second Boer War against Britain. This demonstrates that the proliferation of military technology, like the M71, allowed for smaller nations to compete and win against Greater Powers.

On the other hand, the Maxim gun, used between 1886-1959, provided a considerable advantage for the British Empire in their quest for expansion. The Matebele War in Rhodesia was the Maxim gun's debut, and its success dominated the theatre of British colonisation in Africa. This asymmetric warfare, where power clearly rested with the British Empire and its superior military, was aptly summarised by Hillaire Belloc in 1898; "Whatever happens, we have got the Maxim gun, and they have not." However, the effectiveness of the Maxim has been mythologised and its success is owed more to its psychological impact. In the Russo-Japanese War (1904-1906) the Russians had the Maxim gun but still lost, highlighting the importance of effective military technology only in conjunction with other factors, such as strategy, command, military organisation, and logistics.

To conclude, the increased production of military rifles and machine guns in the era of expansion perpetuated colonialism, but also allowed smaller nations to defend themselves. The globalised production and distribution of military technology reduced the discrepancy of asymmetrical warfare which allowed other nations the chance to finally stand formidably against the Great Powers of the time.

THE MYTH OF THE GERMAN *PANZERS* IN THE SECOND WORLD WAR

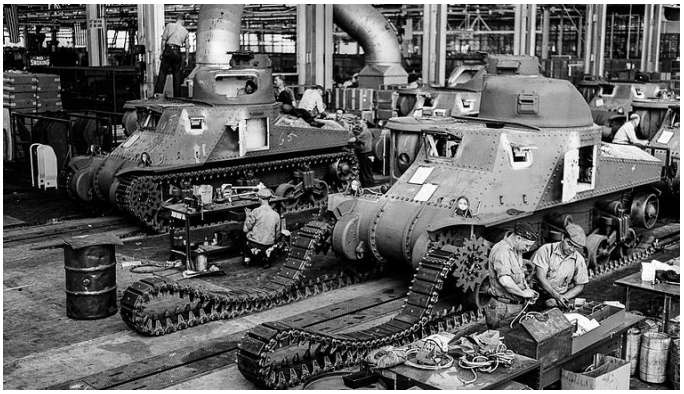
Matthew Hough

It is often stated that during the Second World War German tanks were superior to those of the Western Allies in terms of both armour and firepower, and a simple statistical comparison reveals this to be true. The most-produced German tank of the war, the Panzer IV medium tank, sported 80mm frontal armour in contrast to the 76mm of its Allied counterpart, the M4 Sherman. Furthermore, the infamous Panzer VI 'Tiger' heavy tank, which entered service in 1942, carried an 88mm gun capable of penetrating the armour of any vehicle the Allies could field at the time This was matched by the Western Allies only in the final years of the war.

Allied tanks are often remembered for their numerous drawbacks, most notably the Sherman's propensity to catch fire when hit – a trait which earned it the nickname 'Tommy-Cooker' among German tankers. As such, it would be logical to assume the Germans had the upper hand in tank-on-tank combat. However, this commonly-held simplistic view that German tanks were engineering masterpieces compared to the mediocre efforts of the Western Allies ignores several major issues with the infamous German Panzers.

US Sherman Tank, produced during the Second World War.

The first of these problems, and by far the most significant, did not concern tanks so much as Nazi Germany's industry. A lack of resources plagued Nazi Germany and contributed to Hitler's disastrous decision to invade the USSR in 1941. Thus, Germany's industrial capabilities simply could not match those of the Allies,



Workers assembling M-3 tanks at Chrysler arsenal near Detroit, showing US methods of mass production.

particularly the USA, which produced a total of 49,234 Shermans during the war, while Germany managed a meagre 8,553 Panzer IVs.

Germany's failure to mass-produce its best vehicles meant that it had to look elsewhere to bolster its Panzer divisions. Consequently, it turned to older vehicles and captured ones to fill the gaps in its arsenal. During the invasion of France in 1940, outdated and lightly armed Panzer Is and IIs were deployed alongside Panzer IVs and later in the war, when Germany's supplies were stretched, the inadequacy of the many of the Wehrmacht's armoured vehicles became evident. At the Battle of Arnhem in September 1944, British troops in the Netherlands faced the daunting Tiger II 'Königstiger', one of the heaviest German tanks produced during the war, alongside outdated FT-17 tanks captured from the French and dating from the First World War.

Furthermore, the weight of Germany's heavy tanks proved problematic. During the desperate street fighting at Arnhem, Tiger IIs were deployed against exhausted and lightly -armed British paratroopers. What should have been a slaughter turned out very differently. The Panzers' immense weight, which exceeded 68 tonnes, meant they could only advance one at a time along the damaged streets without causing the roads to collapse beneath them.

Therefore, although Germany's tanks may well have had the edge in combat against their Allied counterparts, tanks are not only designed to fight other tanks. The shortcomings of Germany's industry and the sheer weight of its heavy tanks meant that the Panzers ultimately fell short of being a war-winning weapon.

SHOWERING SMALLPOX: Japan, Britain, and the Testing of Biological Weaponry

Meghan Takwani

Throughout history, technological advancements have led to previously unimaginable societal developments which have broadened the human horizon. However, they have also been the cause of unprecedented suffering and incomprehensible atrocities. Unit 731, the infamous Imperial Japanese Army warfare facility responsible for horrifying live human vivisection, shows the extent to which technology of war has historically been associated with the worst of humanity. However, the reality of biological weapon testing is in fact much closer to home than the traditional eastern aggression rhetoric of the Cold War. Recent unearthing of covert British operations during the 1950s and 1960s reveal operations that, although certainly not as atrocious, can be readily compared to the moral corruption witnessed at Unit 731.

Paranoia during the Cold War led the UK Ministry of Defence to conduct top secret biological weapons testing on ordinary citizens across Britain. Unbeknown to these subjects, they were being exposed to bacteria and viruses engineered to cause immense fatalities and destruction for the purpose of war. While partly done to determine how effective a germ attack would be against the Soviets, these tests also served to see how resilient the average British body was against biological weapons.

At the centre of these covert operations was Porton Down; a chemical warfare institute that ran various invasive experiments on often coerced or misinformed subjects. The Cold War experiments took place mainly in parts of Wiltshire (where Porton Down is situated), Bedfordshire, and Norfolk. A case in which bacteria was released to mimic anthrax through the ventilation system of the London underground network in 1964 is an example of this. Though the government insisted that the bacteria used in such experiments was practically harmless, later research has proven this incorrect. Moreover, numerous birth defects were reported in the areas previously mentioned, leading the public to challenge the government for its recklessness and immorality. Interestingly, a biological weapon test off the coast of Scotland that almost left thousands infected led the government to change its strategy. Deciding that it was unadvisable to carry out further tests on mainland Britain, the government continued its experiments elsewhere; namely in Nigeria and an uninhabited region of the Bahamas.

The lengths that the British government were willing to go to ensure its biological superiority is frankly terrifying. More than that, it is indicative of the dark side of technology seen particularly in the last century. America was willing to pardon those at Unit 731 in exchange for their research. Britain subjected their own citizens to monstrous field testing. To prevent these atrocities being repeated the Biological Weapons Convention of 1972 sought to completely ban the use of biological weapons. The official treaty was enforced a few years later and there are currently 183 signatories to the ban. Nevertheless, the thirst for destruction still stands.

The international biological hazard symbol.

https://en.wikipedia.org/wiki/Biological_warfare#/media/File:Biohazard_symbol.svg

THE RADIUM GIRLS

Faye Gavin

The Radium Girls working at the USRC circa 1922.

On the early autumn day of October 15th, 1927, the body of Amelia 'Mollie' Maggia, who was laid to rest five years earlier in the Rosedale cemetery of New Jersey, was exhumed. Mollie's lifeless body was glowing with 'soft luminescence', confirming everyone's fears.

The excitement and thrill surrounding radium, just under thirty years prior, heavily contrasted the opinions of those who exhumed Mollie's body in 1927. "My beautiful radium", Marie Curie called it when she discovered the element in 1898. Curie became the first woman to win a Nobel Prize and the only woman to receive a Nobel Prize twice, discrediting discriminative Victorian prejudices surrounding educated females. She was also only one of two people to win a Nobel Prize in two separate fields - the first being in physics and the latter in chemistry. When it was discovered by 1903 that radium could be used to treat cancer, rumours began to spread of its amazing ability not only to destroy toxic cells, but also encourage the production of healthy ones. The misinformation led to radium becoming more valuable than gold. People took to drinking radium water and visiting radium spas while many believed it could restore youth in the elderly; however, this kind of treatment was exclusively for the rich who could afford the most expensive substance on earth.

While Marie Curie discovered radium, female factory workers discovered radium poisoning.

In 1917, when young American men went to fight, young American women went to work. However, there was a new industry that offered working class young women exciting new job opportunities to work with the 'miracle element' all while being paid three times more than the average factory job. The job included painting numerals onto watch faces with luminous radium solution whereby they would infamously 'point' the paintbrush between their moist lips to ensure the numerals were small and neat. With our modern understanding of radium today, the concept of putting radium between your lips may seem outrageously dangero us; however, we must consider that in 1917, radium was perceived as a magical element with healing properties. There was glamour and fame to working with radium and those who did w ere known as the 'radium girls' in their local neighbourhoods. Everything radium touched glowed: their clothes, their hair and even their tissues after blowing their noses. Today, it acts as a sinister sign that radium was in their lungs. One employee even painted her teeth with radium to impress her date.

While initially the girls flourished in their new respected jobs, eventually, visible signs of illness began to appear. Some gave birth to stillborn babies, others suffered from chronic fatigue and severe leg pain while the most common effect appeared to be severe tooth decay. This was the case for Mollie in 1922 when she and several other employees experienced serious tooth ache resulting in several tooth extractions. However, for Mollie, the pain was so unbearable that it forced her to quit her factory job. Eventually, her condition became so bad that when her dentist tried to extract another tooth, her whole lower jaw lifted out of her mouth. Mollie died later that year with the supposed cause of death being syphilis. This was a direct attempt by the factory to shame her family and prevent an enquiry into the corporation. The real cause of death was confirmed that very morning in 1927 when she was exhumed from her grave.

Radium has a half-life of 1,600 years and when placed next to human tissue, it fires particles in every direction, killing the surrounding cells. More significantly, the calcium in bones absorbs radium, explaining the chronic tooth ache. The male handlers of radium in the factory wore protective lead clothing, demonstrating that the large corporations were not unaware its fatal properties. The first legal action took place against the United States Radium Corporation in 1925 however the evidence was weak since the variety of illnesses could not be traced to one source. Furthermore, 'radium poisoning' was not an official disease. In court, the victims of poisoning were so ill that none of the five women could raise their arms to take an oath. It was not until 1939 after numerous attempts that the women won their case to receive compensation for their medical bills.

The radium girls hold a special place in history. Their impact spreads from the field of health physics to the labour movement as they gained the right for workers to sue for damages as a result of labour abuse and the improvement of safety standards. Most significantly, the medical field finally gained an understanding of the fatal effect of radium. It can be easily stated that thousands have been impacted by what the world learnt from the radium girls.

THE T ON 'COM-PAT'IBILITY

Devon Hutchinson

Brits and Americans should be thanking Joan Bell for their many awkward Tinder chat up lines and even the more uncomfortable first dates. She is the one responsible for developing the first progressive computer online dating service in the 1960s.

Joan Bell was a working-class woman from the East-End of London, who helped to revolutionize technology in Britain with her commercially-ran computerized dating system: St. James Computer Dating Service: later known as Computer Dating Service Ltd (or Com -Pat for short). Before this, there were other manual matchmakers as marriage bureaus which Bell herself had worked for, however, the transition to computerised dating was revolutionary for the UK and US. Bell was able to transform courtship by allowing people to make romantic connections without physically having to meet one another. As well as, having a long-lasting impact on how people make romantic connections in the present day, with around one in every three relationships in the UK starting online.

In 1964 Joan Bell ran the first set of successful computer match-ups in the UK and the US through surveying men and women and asked what disliked or would not tolerate in a partner. Bell then ran these answers through her time-shared computer and was able to create compatible matches. This allowed people to find a match based on their compatible qualities such as social class and their political orientation, like modern-day match-making websites. This was a very successful service with The Times reporting over seven thousand members being matched by 1967.

It was not until a year later in 1965, that Harvard University students Jeff Tarr, Dave Crump and Vaughan Morrill released Operation Match. These men, like Bell, used a shared computer to test for romantic compatibility. Although, unlike Bell, Harvard University used their status to gain free national advertising such as their participation in the famous US TV show, To Tell The Truth. This enabled them to sell Operation Match all over the world and gain momentum.

Unfortunately, Bell is amongst numerous other women within history and more specifically within the history of technology whose contributions have widely been overshadowed by men or male-dominated institutions such as Harvard University. Historian Marie Hicks even goes as far as to call the history technology the history of 'boys and their toys'. This conclusion is valid when looking at Joan Bell. While researching, it was clear that numerous websites and articles completely missed out Bell and her contributions to online dating.

During the 1960s, women were still fighting to be seen as subjects and not objects, therefore, it is important that in 2019 we remember their achievements and celebrate them as a part of the history of technology. So, the next time you find swiping left and right on Bumble or signing in to your match.com account, remember to thank Joan Bell for your matches.

GENDER ROLES REVERSED: How Women used to Dominate the Computing Industry in Britain

Kate Woodmass

The lack of women in technology has been a much-debated issue in recent years. From the declining number of female computer science undergraduates to Google's James Damore claiming that 'biological causes' explain why women aren't equally represented in technological roles, the gender gap continues to be debated and discussed. It is an especially hot topic in Britain, where only 16% of those who choose to study computer science at degree level are women – a stark contrast to countries like India, where computing classes are often see a 50/50 gender split.

It may be surprising to learn, that up until the 1960s women formed the bulk of the British computing industry. In the Second World War, it was women who operated the computers which were key to cracking codes and making military calculations. Gender roles were integral to the uptake of this largely female workforce, albeit in a reversed version of contemporary gendered perceptions of tech work. At the time, computer work was seen as unskilled and 'easy', hence the volume of women employed in it – a far cry from the male-dominated Silicone Valley image of the industry today.

In the 1960s, a feminised image of the computing industry persisted. 70% of clerical workers were women by the 1970s and therefore continued to be the gender associated with computers, despite receiving lower pay than their male white-collar counterparts. By this point, the feminisation of work involving increasingly complex machines was nothing new. Women working with computers were seen parallel to the increasing number of women in factories since the 1950s, performing simple 'light production work' – despite the fact they were skilled computer programmers. As a result of this, even adverts promoting computer companies in the 1960s often featured women perched on office chairs, to convince male managers that these expensive machines were worth the cheap female labour needed to operate them.

So where did it all go wrong for women in computing? Technology historian Marie Hicks has the answer. In her book Programmed Inequality, she points to government efforts to computerise the nation as the reason for the gendered labour shift that occurred in the computing industry in the 1970s. As the government realised just how powerful computers were when used at state level, the status of computer work was raised. Whilst women were initially able to access high level jobs in computing, as the field professionalised, this type of employment was increasingly thought inappropriate. Essentially, computers became the property of high-paying roles which women were deemed unsuitable for, and so they were systematically phased out.

Fast forward to today, and despite initiatives to get girls into STEM, sexism remains rife in the tech industry. Priya Guha, UK lead of tech incubator RocketSpace, has commented on how part of the problem lies in the gendered history of the computer industry: 'we have a historical challenge to encourage girls, let alone women, into careers [such as computing].' It seems we may still have a long way to go until the female computer programmers of the Second World War are not only recognised, but used as an example to girls today.

DNA: "THE SECRET OF LIFE!"

Philippa Luck

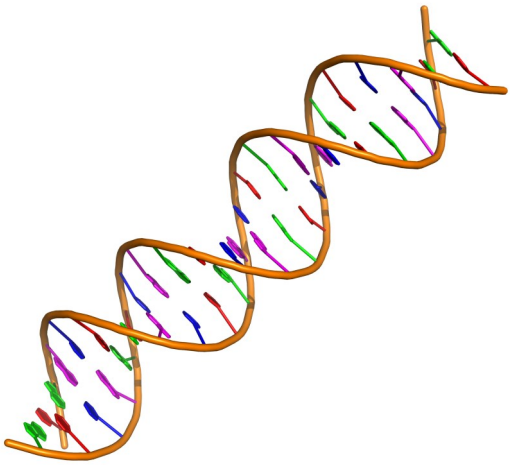
The unearthing of DNA was a milestone in history. Its discovery has played a remarkable role in the development of modern science, agriculture and criminal practice. However, this technology has sparked numerous moral and ethical debates, many of which bear huge relevance today.

The exact time and discovery of DNA itself is debated. In 1953, Chicago-born James Watson and English scientist Francis Crick are widely believed to have discovered the double -helix structure we are familiar with today – bursting out from the now-famous Eagle pub in Cambridge proclaiming to have found "The secret of life!"

However, many different scientists had previously contributed to cell research and scientific practice, with some subject knowledge even dating back to the Early Modern scientific revolution. Prior to Watson and Crick's discovery, scientists were already aware that the story of each living organism lay within the cell nucleus, but it was the duo who uncovered the structural coding that has impacted modern technology so significantly today.

The discovery of DNA is most notable for its explosive impact on medical history. During the 1980s, it paved the way for stem cell research and developments, a major area of scientific advancement. Stem cell research is the backbone of most drug development and research into human diseases including heart disease, cancer, Parkinson's disease, type one diabetes and Alzheimer's disease, to name just a few.

In 1996, this technology also brought to life one of science-fiction's greatest tropes. On 5 July, Dolly, 'the most famous sheep in the world', was born from a cloned adult somatic cell using the process of nuclear transfusion. Keith Cambell, Ian Wilmut and fellow scientists at the Roslin institute in Edinburgh had proved that a single cell could be used to recreate a whole individual. Born from three mothers, one contributing the egg, another the DNA, and the third carrying Dolly's cloned embryo until birth, Dolly the Sheep was living proof of the power and impact of DNA technology. This development was not only a breakthrough for medicine but set the foundations for progress in agriculture, as it underpinned the successful breeding of animals with greater resistance to disease.



A double stranded DNA fragment 22 residues long with alternating ATCG residues

https://commons.wikimedia.org/wiki/File:Double_stranded_DNA_with_coloured_bases.png

In the present day, stem-cell research is now supporting the development of 'meatless meat'. In 2013, the first lab-grown burger was produced in the Netherlands. Today, one US based company have claimed the ability to make chicken nuggets from a single cell from the feather of a chicken. This technology has the potential to solve countless environmental issues if the process proves popular. Chemical engineer Dr Marianne Ellis from the University of Bath, for example, claims this technology could provide "an alternative protein source to feed the world". However, research is still ongoing, and the popularity of cultured meat with consumers remains questionable.

Although ground-breaking, these DNA developments have come at a cost, particularly surrounding the morality and ethics of cloning. Cloning technology developed on animals such as Dolly has since been applied to human reproductive processes, such as IVF. In religious terms, many consider DNA as the essence of individuality – part of God's plan and not something to tamper with, Dolly's legacy may seem miraculous, indeed, she led a long and medically unproblematic life and following her path many other animals have since been cloned, including pigs, horses and even deer. However, the cloning process is largely inefficient and often involves a huge loss of life – Dolly herself was the only lamb to survive out of 277 attempts.

This moral ambiguity, however, is not shared in other spheres of DNA technological practice. The world of crime and justice has reaped great benefits from Watson and Crick's discovery. In 1987, Colin Pitchfork was the first murderer to be caught using DNA analysis - 30 years on, DNA profiling is the foundation of most police investigations and crime scenes. DNA technology in this field has advanced beyond belief, with forensic specialists now able to obtain a DNA profile of an individual from even the slightest surface contact.

Ultimately, Watson and Crick's discovery lies at the heart of a multiple and diverse selection of technologies, illuminating, realising and enabling discoveries and outcomes that at first may have seemed impossible.

THE FIRST COMPUTER

Chloe Vialou-Clark

How many times have you connected to the internet already today? Maybe you've skimmed through your emails or flicked through Instagram? In our fast-paced world of the 21st century, everything springs to life with the touch of a button or the tap of a screen. It is difficult to imagine a time without computers, but we don't have to travel far back in time to see where this technological sensation began.

During the Second World War, Bletchley Park, a picturesque countryside estate, was hidden away in the rural fields of what is now Milton Keynes, Buckinghamshire. Home to Britain's most accomplished and proficient code breakers and linguists from the British Government Code and Cypher School, this secluded mansion was also the site for the world's first computer.

Arriving during the black outs in the dead of night, the teams at Bletchley were put to work, attempting to decipher the Germans' infamous Enigma machine which encrypted messages and was capable of producing around fifteen quintillion possible codes (that's fifteen with eighteen zeros!) In 1942, Bletchley celebrated one of the world's most important, and secret, victories. Armed with the 'Bombe' machine, the code-breakers at Bletchley, including Alan Turing, managed to develop a computing device that was able to decode every single German Naval transmission. Eisenhower reportedly said that their efforts shortened the war by as much a two years and saved millions of lives.

The incredible story of the work at Bletchley Park remained a government secret until the 1970s and is now considered one of the most important technological achievements to date.

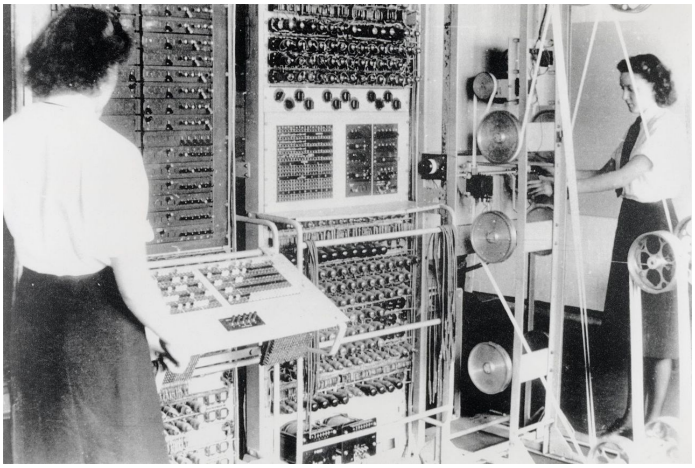
Turing's life and work has been memorialised in the Bletchley Park museum, and of course, popularised through the 2014 historical drama and biopic, The Imitation Game. As Turing's story spread around the globe, audiences were drawn in by Bletchley's workers' staggering achievements; not to mention, the dashing portrayals by the nation's favourites, Benedict Cumberbatch and co-star, Kiera Knightley.

It is easy, however, to get swept up in the romance and drama of Hollywood production. When looking at the film from a historical perspective, there are many gaping holes. Firstly, there is an obvious over-accreditation to Alan Turing. As our protagonist, an enigmatic individual himself, The Imitation Game gives the impression that it was the difficult-but-brilliant Turing that created the bombe machine on his own merit. In fact, the electro-mechanical creation was the result of a group effort from many cryptographers whose names aren't even mentioned in the film. Aside from Hugh Alexander, played by Matthew Goode, Turing's team included Gordon Welchman and Stuart Milner-Barry, both of whom were influential in the development of Bletchley's technology.

The bombe machine, used to decode the daily-changing settings of the Enigma machine, was initially designed and created by Polish scientists soon after the end of the First World War. Turing and Welchman then developed on their original designs to specifically target the German messages. There were a great many of these machines, rather than just one that Turing supposedly created. The first was also named "Victory", not "Christopher", as the film has led us to believe.

The Imitation Game has also brought to life another contentious issue in British history – the illegality of homosexuality until 1967. Alan Turing was one of thousands of men who were forced to hide their sexual orientation from the world. Framing the narrative concisely between his cryptography work at Bletchley during the Second World War and his arrest in 1952, The Imitation Game ends with the poignant scene of Turing's alleged suicide after receiving chemical castration treatment. He was given a royal pardon in 2013, but the production of the film fuelled a petition for the pardon of around 49,000 additional men, who were also convicted of "gross indecency". The petition, signed by thousands including Cumberbatch and Knightley, was honoured and all those convicted were posthumously pardoned in 2017.

Alan Turing's legacy lives on through our modern-day technology. Having inspired many through his own work, and the contributions of many others at Bletchley Park during the 1940s, many scientists have followed in Turing's footsteps to develop our computer: the machine that can think for itself.



A Colossus Mark 2 codebreaking computer being operated by Dorothy Du Boisson (left) and Elsie Booker (right), 1943

https://en.wikipedia.org/wiki/Women_in_Bletchley_Park#/media/File:Colossus.jpg

CHERNOBYL: TECHNOLOGY, MEDIA AND THE PERCEPTION OF DISASTER

Phoebe Kirkland

I first heard of Chernobyl when I was around nine years old and asked my father why we didn't have nuclear power in England like The Simpsons did. My father, born in 1964, explained that we did have nuclear energy, but since the 'Chernobyl Disaster' people didn't trust it very much.

On 26th April 1986, the Chernobyl Nuclear Power Plant in Pripyat, Ukraine, then part of the USSR, had a meltdown as a safety test on Reactor Four failed, leading to an explosion and a fire that lasted nine days. It killed 42 people within the weeks that followed but lead to hundreds of deaths over the decades from the nuclear fallout effects. Many of those who perished from Chernobyl knew they were not going to make it as they died from the fires or direct exposure to the nuclear waste. However, many others did not realise the true nature of the incident they were entering as this information was withheld from them by the authorities and thus died slow and painful deaths in hospital months after the fires had been extinguished.

Initially after Chernobyl, secrecy and confidentiality was of the highest priority. The situation was contained so the USSR's enemies could not use it against them. Despite Gorbachev's principle of Glasnost – openness and transparency in government workings – the USSR attempted to keep as tight a grasp as possible on information surrounding the disaster. When raised radiation levels were measured in Sweden, Western powers were alerted to the potential catastrophe in the USSR. There was already a moderate amount of anti-nuclear sentiment alive in the West after the Three Mile Island nuclear disaster just seven years prior and nuclear disarmament was a popular interest in response to Cold War relations; Chernobyl worsened these attitudes.

I asked my father, who was 22 at the time of the incident, what he knew and thought of the Chernobyl disaster when it occurred. He told me that there was "worry and fearmongering amongst U.K. residents, but there was no concern for the Ukrainians who were affected directly by the disaster. We didn't know enough about the incident to realise people had died. The Russians reported they had it all under control and that was it." The BBC cover story on the incident stated that according to a Soviet report, "measures were being taken to eliminate the consequences of the accident" but limited information was available even to the press at this time.

This response to Chernobyl, which ultimately led to further distrust in nuclear energy, is very different to our ideas around it today. This is due in large part to the technological advances of the internet. There is much more openness and connectivity due to the rise of social media, especially as a news form leading to many more sources from which to draw conclusions than there were in 1986. Since the collapse of the USSR and the opening of the Soviet Archives in 1991, we have had access to once confidential documents that described the true events of Chernobyl rather than the story the Soviet officials wanted us to believe, or the narrative its Western enemies wanted to portray.

A much less subjective depiction of Chernobyl can be drawn from these documents, but with this openness and ease of information also comes conspiracy theories around the disaster. TV shows such as the recent, very popular miniseries Chernobyl by HBO and other short films such as The Russian Woodpecker disseminate these theories amongst the population, which can sometimes limit the scope of information people choose to look at to gather their own conclusions. Thanks to the free information era, we have access to a lot more facts that helps us make an informed decision but that also can create further confusion as to what information is factual and which is 'fake news'. Researching to decide your own opinion on the system can now be done unlike in 1986, when often you received your information from one news source.

It can only be a good thing that we have more access to information about the incident. We now have more sympathy for those who suffered to control the disaster and disdain for the officials who attempted to cover it up; our perception of Chernobyl has certainly shifted from outright anger to a retrospective consideration of the disaster. We now have information about what actually caused the devastation: the failures of the officials in charge and the lack of competence of the superiors in the power plant. This is helping to display Chernobyl and therefore, nuclear power as a whole, in a new light.

The development of one aspect of technology – the internet – has allowed another technology – nuclear energy – to be seen in a different perspective but the access to the knowledge of the Chernobyl crisis is invaluable, and I hope we can use it to prevent further disasters of this magnitude in the future.

The Chernobyl Reactor 4 building as of 2006, including the later-built sarcophagus and elements of the maximum-security perimeter.

HELLO FROM HISTSOC

Hello historians!

We hope that you're all settling well into the new academic year!

Firstly, thanks to everyone that came to our 'Roaring Twenties' themed Otley Run and well done to those that made it to Donuts at the end of the night! We loved seeing your costumes as you all put such great effort into looking the part. Pictures from the night are up on our Facebook page so take a look if you haven't already!

We also hope you enjoyed the annual Careers Networking Event. Thanks so much if you came, we hope you found the night interesting and got some useful tips from the employers. Myself and Tash (Sponsorship Sec) changed this year's dinner to a drinks-only evening, so any feedback you may have on how you thought the event could be improved next year would be great.

We also had our GIAG pub quiz last Monday. Thanks for all that came, we apologise for the lack of chairs – the turnout was more than what we were expecting! Also congrats to the winners, we hope you enjoy the prizes!

Everything else to come

We have so much more planned for the rest of the academic year. Next up is our annual Christmas Ball on 10th December. Have a look at the Facebook event for more information and if you weren't lucky enough to get a ticket then make sure to join the waiting list!

Also keep your eyes peeled for details about our trip, we will be announcing the destination soon so make sure to keep checking the Facebook event.

Enjoy the rest of first semester!

Emily Wiffin (Academic Sec)

A THANK YOU TO THE 2019/20 ISSUE 1 HISTORY STUDENT TIMES TEAM

Thank you to all those writers and assistant editors who contributed time and effort to providing articles and meticulous help editing them.

Assistant editing team:

Aamina-Noor Shah, Alice Harrison, Annabel Cook, Bretia Coxon-Owens, Briony White, Caitlin Martin, Chloe Harrison-Kirkwood, Chloe Vialou-Clark, Eliza Broadbent, Elizabeth Riddoch, Hannah Cocker, Imogen Bird, Jenny Speakman, Jessica Julienne, Jessica Pitcher, Joana Ribeiro, Meghan Takwani, Millie Scott, Miri Hodnett, Natasha Austen, Nela Spurna, Philippa Luck, Phoebe Watkins and Zoe Glasspool.

HISTORY STUDENT TIMES