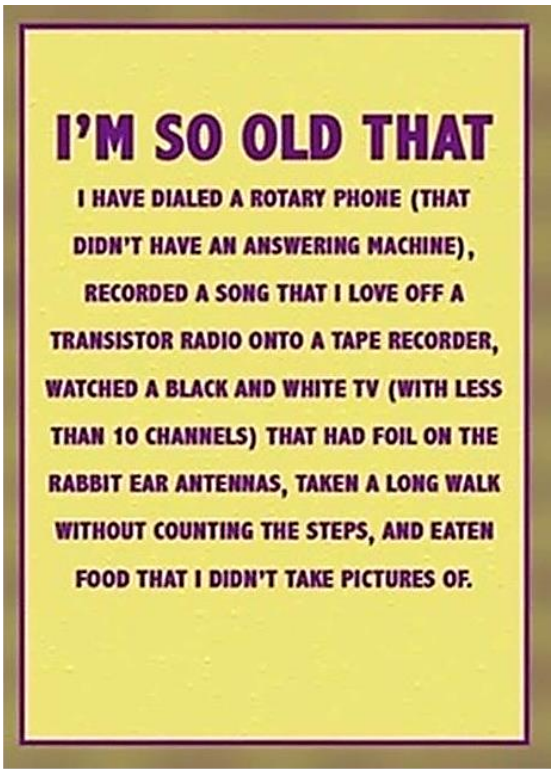
In The Age of Technology 1950 – 2024

Author: Philip McDouall

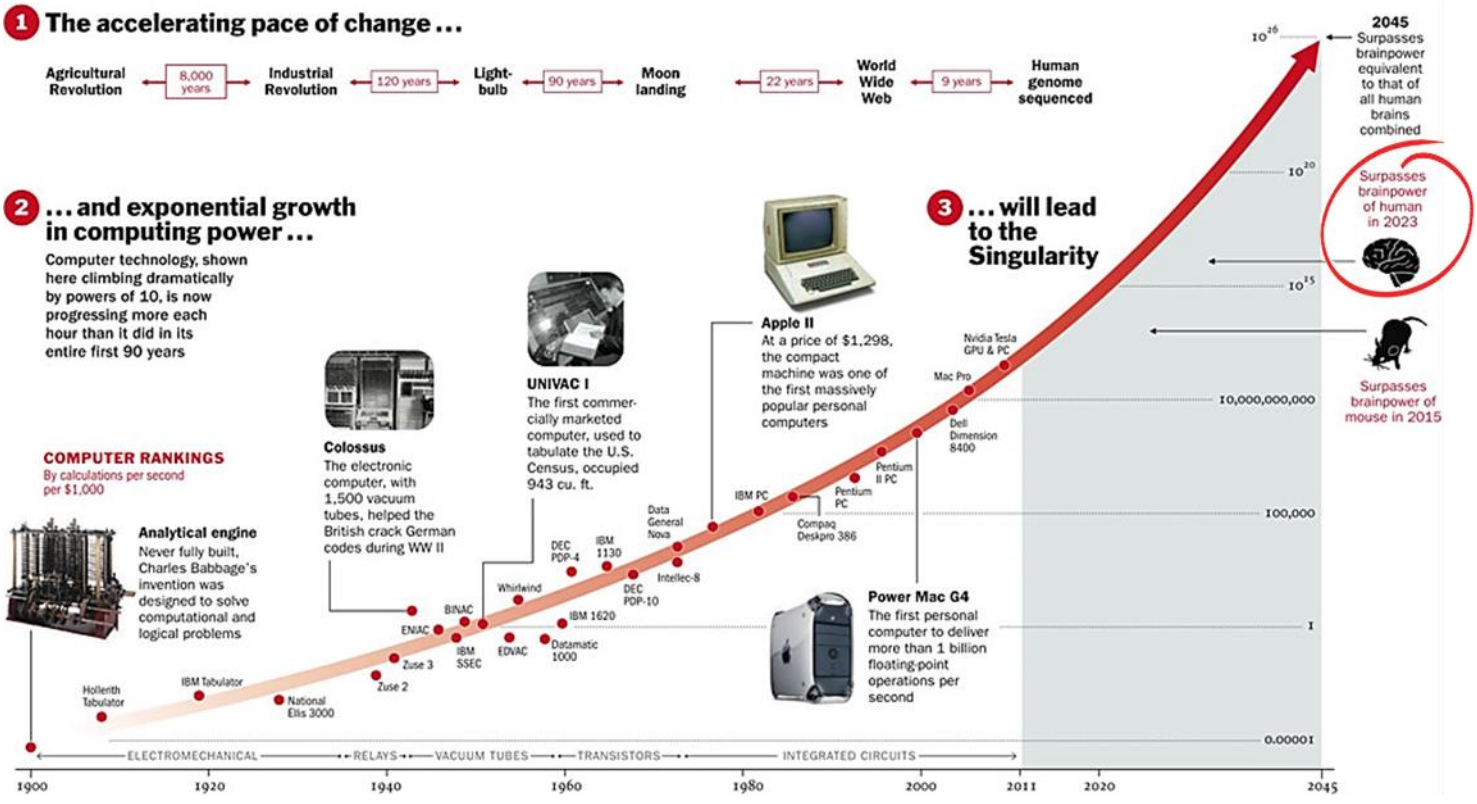


I grew up in an age of incredible technological advancement beginning with the invention of semi-conductors and ICs (integrated circuits) and now well into the era of AI (Artificial Intelligence). This is the story of my life as it revolved around and interacted with technology. Advancements in medical and space sciences have been intentionally omitted as they are areas I did not directly interact with, although the first man on the moon in 1969 was a momentous achievement indeed. Further, the discussion largely focuses on consumer technology rather than commercial or industrial which would infinitely broaden the scope.

As I commenced writing this paper the worldwide web is just turning 25 on March 12, 2014. The motivation to write was partly the satirical poster on the left, but more importantly a futurist's prediction illustrated in the chart below.

As technological advances continue, it is both fascinating and thought-provoking that the human race is reinventing itself. The futurist, Ray Kurzweil, stated in 2010 that a singularity would be reached by 2045, that is the computing power in the entire world, would, for the first time, exceed that of all human brain power combined. As I continue to add to this paper in 2024, I notice that his 2023 predicted milestone of technology surpassing individual human brainpower has been practically achieved with the first use of AI.

So how has technology evolved during this period?



Futurist Ray Kurzweil's 2010 predictions

Media Devices

I was born in 1950 in the UK, the twin brother of Stuart, and one of six siblings. As children, our interaction with electronic technology was primarily radio and then television, all driven by valve and CRT (cathode ray tube) technology and the earliest discrete transistors, some of them each as large as a thimble. As semi-conductors and IC's became more sophisticated, electronic developments continued at a rapid pace.

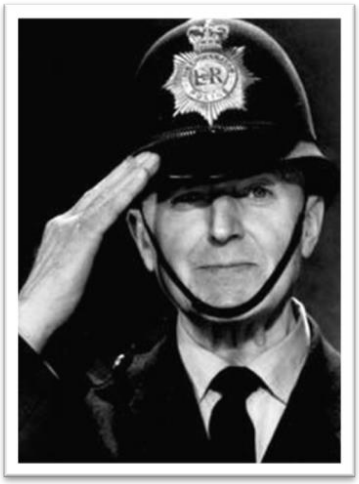
Black and white TV using a CRT

When England was in the finals of the soccer world cup in 1966 the whole country wanted to be in on the action, but not everyone had a TV because over-the-air coverage was not ubiquitous, and cable TV only reached a broader audience in the 1980's. During the world cup the streets in Camberley were deserted. The next day the newspapers had pictures of crowds of onlookers who did not have TVs, peering over garden fences, snooping through house windows and stopping at shop fronts selling TV's. By the way, England won!

When films or movies were released, they were rarely shown on TV. Community cinemas or movie theatres would be packed, another institution that has been largely overtaken by the ability to view practically any film ever made at anytime online.

The radio was listened to occasionally during the week, mostly the news or the Queen's speeches. However, the main source of news was always the print media, i.e. newspapers and magazines, as it had been for a couple of centuries, until more recent times when they have been all but superceded by the online media.

When I joined the Army in 1970, valve radios were still very much in use, affectionately called "steam radio", officially the Larkspur sets. It wasn't till around 1980 that a solid-state digital set, the Clansman series, was introduced.



Jack Warner as "Dixon of Dock Green"

At Chafyn Grove (1958-1963), a preparatory boarding school in Salisbury, England, the highlight of the week was to watch a one-hour TV program, "Dixon of Dock Green", about a London policeman who solved petty crimes, concluding with a lesson about the virtues of honesty and being a law-abiding citizen. Of course, such programs were in black and white only, colour being launched in the UK in 1969. Earlier TV broadcasting delivered grainy pictures compared to the crystal-clear images of today's LED TV's. Infra-red remote controllers came much later and led to the term "couch potato".

A record player with a stack of "45's" or 'singles'. Earlier records were 78 rpm, and later LP's were $33^{1}/_{3}$ rpm.

In the fifties, record players were fairly simple electro-mechanical devices that used steel needles and required winding up with manual play, before diamond needles and semi-automatic devices were introduced. Well-used vinyl records produced a characteristically 'scratchy' sound, but it's all we knew. Dolby noise reduction was introduced in 1965 and quickly became the standard for the improved quality of recorded music.

Audio tape reel-to-reel play deck

Tape recorders were quite large and used open reels of tape that sometimes broke or unravelled, typically resulting in poor quality sound too. Then in the mid-60's the cassette tape was introduced, much more practical and moderately portable, especially the battery driven models. People would have whole cases or boxes of cassettes.

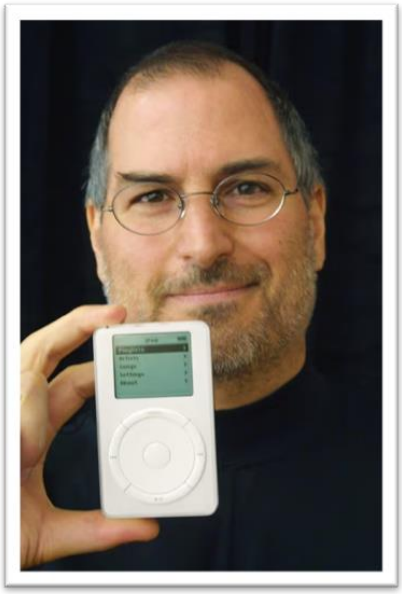
Cassette tape and player

When digital CD's (compact discs) were invented in the 1980's, together with improved noise suppression and surround sound, we thought that was the 'bee's knees' for high quality sound, and many of us invested in large CD libraries, only to find them all but obsolete in the early 21st century, when music could be downloaded or listened to in real-time from the Internet.

The Sony Walkman and Apple iPod

These small plastic devices were invented and released by Philips in 1962, as a more compact and efficient alternative to reel-to-reel audio storage. They were adopted en masse by the mid-1960s and peaked in popularity in the 1980s.

Sony Walkman Cassette Player



Steve Jobs holding the first Apple iPod

In our basement we still had boxes of vinyl records (45's and LP's - 33's), cases of cassette tapes, and in our music room a library of a couple of hundred CD's!

Then along came the Apple iPod, introduced in 2001, which was the first MP3 player to pack a mind-blowing 1,000 songs and a 10-hour battery life into a compact 6.5-ounce package that fitted easily into your pocket. Apple sold over 450 million of them during its 20-year lifespan.

Shooting one's own films in the 1950's and 60's meant owning semi-professional equipment. Our father had a windup film camera with 16mm film, which once developed, was then viewed on a cine projector. Film nights at home were a lot of fun.

Home Cine Projector

Later on, video tapes were all the rage, especially the rental business, one of the largest being the Blockbuster chain. I even owned a Sony video camcorder in the '80's, shooting videos of the children growing up.

Sony Camcorder

Video Tapes VHS and DVD's

When you could subscribe to a digital streaming service for a few dollars each month and gain access to a whole library of movies with crystal-clear picture quality, why would you resort to clunky, old-fashioned VHS? For a small subculture of VHS enthusiasts, there are a number of benefits to this outdated technology. For starters, there's the nostalgia factor, ramped up by VHS collectors displaying their tapes on social media platforms such as Instagram. By the way, the VHS system battled it out with rival Betamax for years although VHS finally won.

Video Cassette Tapes

DVDs (rental services)

In a similar vein, it appears that DVD (Digital Video Discs) rental services are still in use (2010). Netflix, which started life as a mail-order DVD rental service before becoming the streaming behemoth it is today, still makes $200 million (£154m) a year from DVD rentals. Some customers cite the wider choice of titles, with 100,000 movies to choose from as opposed to 6,000 movies and TV shows online, as a reason for sticking with the old-fashioned method.

DVD (Digital Video Disc)

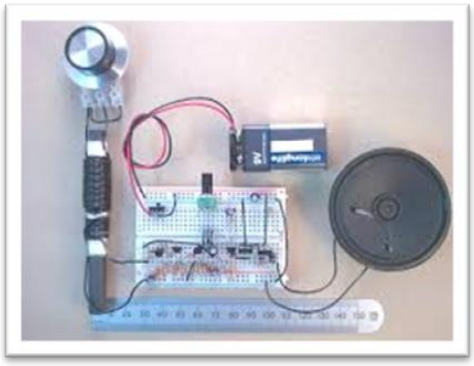
IMAX 3-D Films

However, more recent technological developments in 3D films, both for flat screen TV's and IMAX theatres, have once again displaced earlier systems, and provide a more immersive experience. This is especially true of 3D goggles for generating virtual reality scenarios, and used both for entertainment and specialised training purposes.

Radios

One of the first family radios that I recall was the Grundig, quite a large one and with good quality sound, but all valve driven. My first transistor radio was built from a kit, which I could handily take with me into class and listen to with an earpiece when the teacher or the subject was uninteresting.

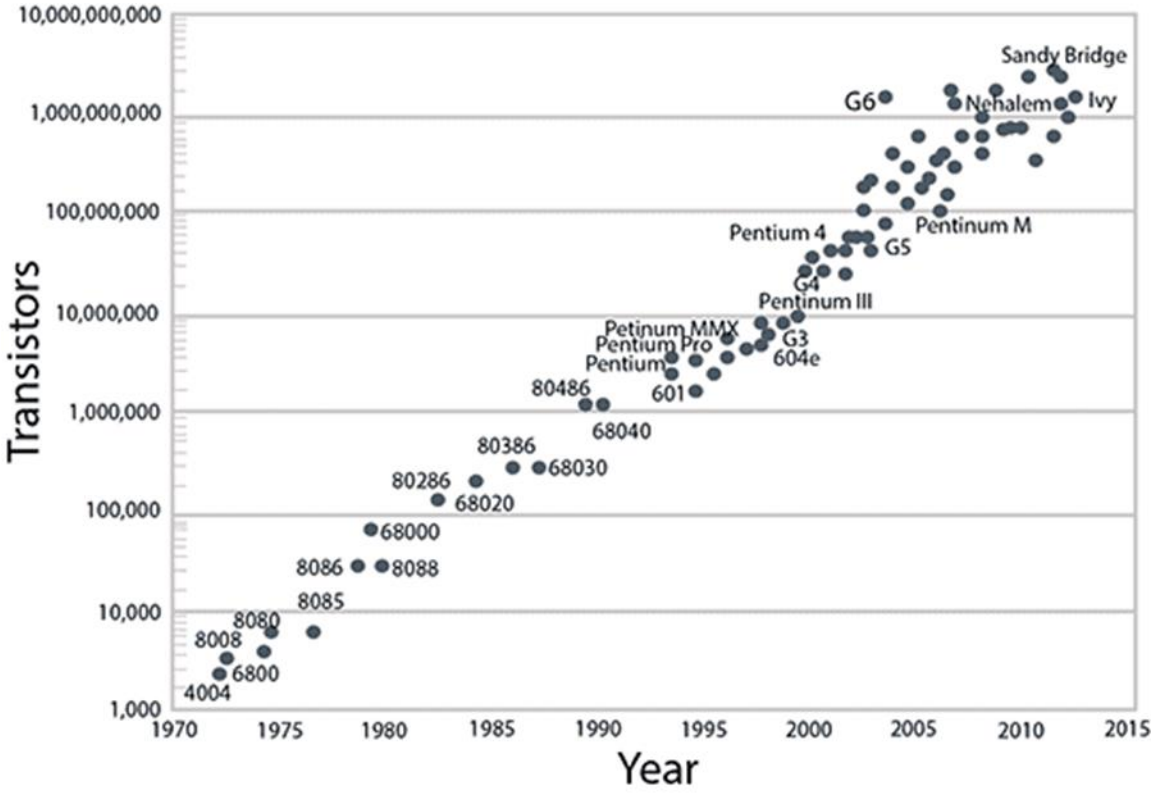
Grundig Valve Radio



Transistor Radio Kit Assembled

Transistor Radio

On the topic of transistors, probably the most significant advance in technological design was the increase in transistor density that has been achieved, starting literally from discrete components in the 1950's, right up to the present day when Apple has produced a chip with 132 million transistors per square millimeter – a staggering number. Microprocessors have undergone similar transformations with powerful computers built onto small chips. It was Gordon Moore, the cofounder of Intel, who, in 1965, published the trend that he observed at the time, that transistor density was doubling every year, revised in 1975 to every two years, a law which has held more or less true to this day.



Moore's Law – the trend of the doubling of transistor density every 2 years

Communications

Rotary Dial Telephone

While at boarding school the only way of communicating with our parents was via handwritten letter. Each Sunday it was compulsory for the entire school to sit down for an hour and write a letter home. Only the headmaster had a phone in his study, one of the earlier rotary phones that relied upon counting pulses to register a number. Many of those in rural residential neighbourhoods only had access to "party lines", i.e. shared phone lines connected to an exchange, where an operator would connect you to the person you wanted to call. Of course, those on the party line could listen in if they wanted to.

Early rotary dial phone

A visit to the first automatic analog exchanges was incredibly noisy and very hot, because the electro-mechanical 'step-dialers' ratcheted up as each pulse was registered. It wasn't till the 1980's that we got a push-button digital phone.

Telephone operator working a manual exchange

Our phone No. was "Camberley 23081" - we didn't have or know our local dial code because we always went through a manual exchange.

In the Army, field telephone sets were common because they could be interconnected via a pair of wires rolled out across the terrain or strung up on poles and in trees. No other infrastructure was required because they had batteries

Field Telephone Set

for voice transmission and a hand crank generator for ringing. One had to be careful not to be holding the wires when someone turned the generator – it would give you a heck of a shock! Stuart remembers the remote homesteads in the Falkland Islands each having their own ring based upon morse code, so you had to listen carefully for yours.

Public Telephone Booth or Call Box/Pay Phone

Red telephone boxes are up there with the most recognisable features on Britain's streets, along with black taxi cabs and red double-decker buses. At their peak in 1992, there were 92,000 telephone boxes across the UK. There was one on practically every street corner in the cities, whole rows of them in railway stations for example, and always a few even in the smallest villages. But usage has been on the decrease, declining 90% over the past decade as mobile phones have become more widespread. For that reason, in 2017 phone company BT decided to scrap half of the country's remaining 40,000 telephone boxes. Yet they're not set to completely vanish from the streets, as they still handle around 33,000 calls a day and are used by elderly people, young children, and in emergencies when people don't have access to a mobile phone.

Teleconferencing

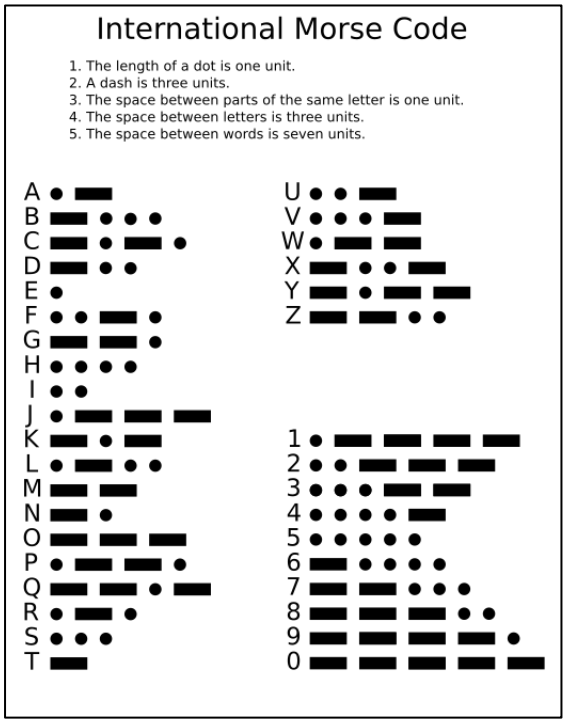
Teleconferencing Phone

The concept of conference calling or teleconferencing was only introduced in the 1960's, and rapidly took over in the business world. Initially, the devices were quite simple, consisting of a loudspeaker attached to a telephone. Trying to connect even a few people on the call could be an exercise in patience, as one dialed each participant in turn before the conference could even start. Later attempts at videoconferencing would be equally frustrating, using a TV connection, when, because of bandwidth constraints, the picture would only update every few seconds, and participants would drop-off unexpectedly due to the unreliability of the link.

In the 1990's British Telecom, Panasonic and Microsoft started introducing more stable videoconferencing devices and services, and when Skype, which will cease to operate in 2025, offered a service for up to 25 participants in the 2000's that was a huge leap forward. Broadband Internet enabled a range of services that we are familiar with today including Facetime, Google Meet, Zoom and WhatsApp, which are so reliable and simple to setup, that it is easy to forget the trials and tribulations of the past.

Telegraph and Telegrams

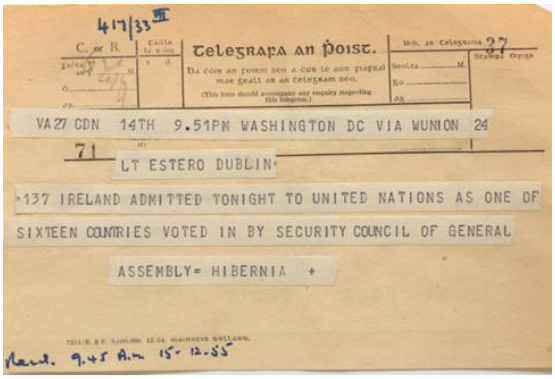
The telegraph was in use from the 1840's to the late 20th century, and was the primary means of 'fast' communication. Morse code was the medium, and was taught to us at the Royal Signals school, although I was never very proficient at it. However, there were many professionals who were exceptional at listening to a rapid stream of dit's and dah's, and interpreting them on the fly, in the same way that others read printed text. The experts could reach 40 words per minute! Our Aunt Marion's nickname was Morse, presumably from her time in the Royal Navy.
Many amateur radio operators communicated across the globe using high power HF radio on the ham radio band with morse code.
Of course, the ubiquitous SOS for "Save our Souls" was the best-known sequence "**. . . - - - . . .**" Morse code was officially deemed obsolete in 1999. Naval communicators also used semaphore, signalling with two flags, and instead of sound for morse code, would transmit visual flashes on an Aldis lamp, both methods avoiding the issue of enemy radio intercept.
[Listen to a morse code stream here.]



Telex

Telex was introduced in 1933 at a speed of 50 baud (bits/sec) and was in use with post offices and corporations into the 1990's until fax machines took over. In the 1960's one of my summer jobs was delivering post office telegrams by bicycle around Camberley.

A Telex machine with ticker tape to send and receive telegrams



Telegram with Ticker Tape

Fax machine

Unlike Telex, Fax machines could transmit text and images, albeit painfully slow by today's high-speed standards. With contracts often needing a real signature rather than electronic authorisation, a few businesses still have a fax machine, with their fax number included in their contact details.

Pagers

Before mobile phones, there weren't many people who could be contacted wherever they were. Invented in 1921, pagers began to be used by firefighters, police officers and medical professionals during the 1950s, before entering the commercial market in 1964 with Motorola's Pageboy I. Our sales force each had one. Doctors and businessmen relied on pagers, until mobile phones and later smartphones came in to replace them.

Dial-up Internet

With seemingly ubiquitous broadband, and the arrival of fibre optic, dial-up internet is a relic of the distant past. The last year that data was recorded was in 2010, when 800,000 people still used the service. Meanwhile, Australia only had 90,000 people using dial-up in 2016, with the figure dropping every year.

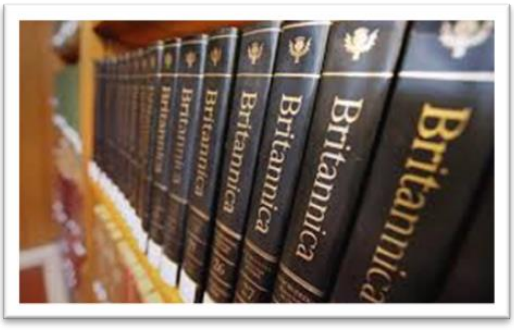
Brother-in-law Jim recalls that the first dial-up acoustic modems around 1970 were used for remote access to timesharing services. The phone handset was placed in a box with sound transducers and the lid closed (this was the subject of my university degree project). The top speed was 150 baud (bits/sec), or 300 if you were lucky. The first modems to access the Internet in the mid 80's were 1,200 baud rising to 2,400 baud.

When I moved to a business in Toronto in 1995, speeds had risen to 9,600 baud, and it was a game changer. And if anything brings back memories of dial-up, it's the sound: Listen here. In due course speeds increased again to 56 kbaud but even the slower rates were thought to be amazing. Now in 2024, speeds over fibre optic cables are attainable up to 1,000 Mbits/sec, and future 6G networks even faster, an unimaginable achievement in the 20th century.

And with the invention of the Internet, came the first search engines, Alta Vista and Lycos being amongst the early popular ones, and Netscape being the dominant web browser starting in 1994-95. Alta Vista was eventually acquired by Yahoo; Google commenced service 3 years later in 1998.

Internet Dial-Up Modem

Early Internet - Alta Vista Home Page



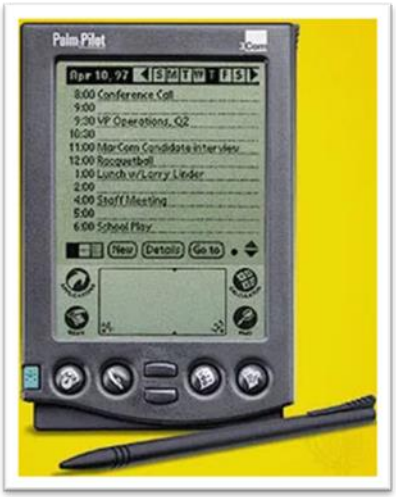
Encyclopaedia Britannica

When we were at school the only method of researching anything was by thumbing through encyclopaedias, sometimes for hours, the most popular one worldwide being the Encyclopaedia Britannica consisting of 32 huge volumes. Many households and libraries had one. It was an enduring publication lasting from 1768 to 2010 when the final print edition was produced. The Internet search engines were of course far easier to access, and their databases were expanding all the time, which meant the end of the print editions. And although the printed word remains moderately popular, many editions of dictionaries, thesauruses and literature gather dust on bookshelves where e-books have taken over.

Mobile or Cellular Phones and PDA's (Personal Digital Assistants)

My first cellular phone in 1990 was a car phone that could be removed, and a large battery clamped underneath. This was not a device that could be put in your pocket, and it was quite heavy, being nicknamed a "brick". Being an early adopter, the first call I received was from the provider while I was on a golf course, asking me if I was satisfied with the service!

Early Nokia Mobile Phone



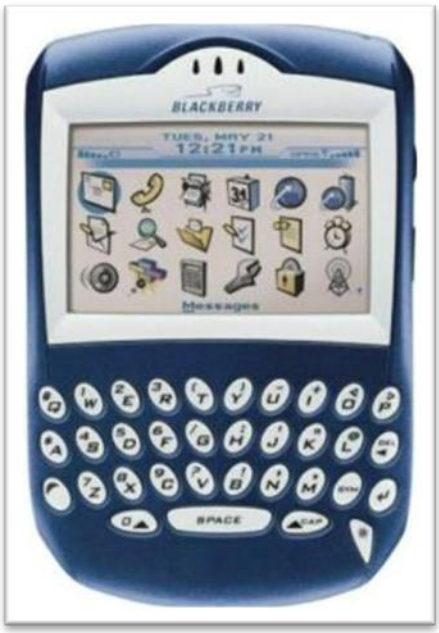
The Palm Pilot, the first popular PDA (personal digital assistant)

For a short while, PDA's became all the rage, although they were limited to one-on-one infra-red local text communication across the room. The most popular by far was the Palm Pilot which had a calculator, a calendar and diary, as well as a few games, amongst other apps. However, compared with today's functionality, it was relatively simple. At least it would fit in your pocket but without a voice capability, its use was limited once cell phones with additional functions were introduced.

An interim technology was the Rabbit mobile telephone which was launched in the UK in 1992 and which my brother Ian used. The system employed telepoint technology, also known as CT2, enabling users to carry their Rabbit phone with them and make outgoing calls from public access points on the Rabbit system, somewhat similar to Wi-Fi hotspots today. Except that incoming calls could not be received, and the rapidly expanding mobile phone networks quickly outstripped all the telepoint providers, leading to the Rabbit system's demise less than two years after its launch. Its use as a home-based cordless phone continued for some years, and one of the few remaining phones is now on display in the London Science Museum!

Rabbit

The distinctive Rabbit telepoint logo



Blackberry Phone
The first PDA plus cell phone

The Blackberry was the first to combine a PDA with a cell phone, and took the business world by storm. It was considered a revolutionary product when it commenced operation in 1999. It had a belt clip holster so was the first easily transportable cell phone, albeit with a keyboard and no touch screen, but we loved them. We could call anyone from anywhere and the voice quality of the networks was very good, although there was minimal coverage outside the towns and cities.

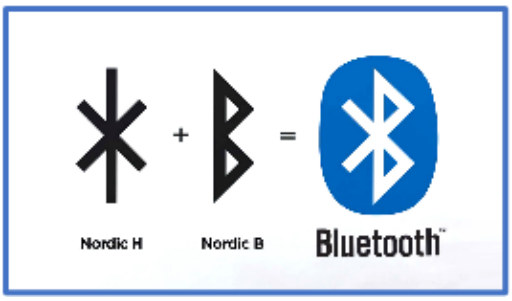
Unfortunately, Blackberry did not adapt to the market quickly enough, and its cell business ceased altogether in 2022.

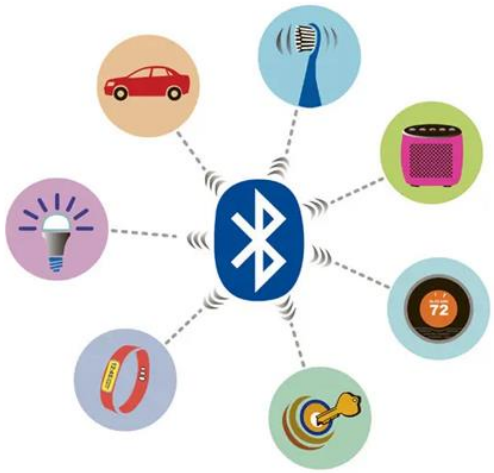
Nokia 3310

Nokia gained the upper hand, most notably with its 3310, a classic mobile phone launched in 2000, and over the next five years sold 126 million handsets. Fast forward to 2020 and 3.5 billion people own smartphones globally.

Bluetooth Wireless Technology

In 1996 Ericsson required a near-field connection for a wireless headset, and invented Bluetooth. Another preliminary use was the wireless mouse which was much more practical. The name was originally intended as a project code name only (after a Viking King nicknamed Bluetooth), however the name stuck, and the symbol was derived from the King's initials H and B in the Nordic language.





Bluetooth Connectivity

Originally intended for near-field, narrowband devices only, on a one-to-one link, the latest release of 5.0 connects gadgets up to 240 metres away and permits broadband transmission with multiple devices at a time. Now practically every device contains Bluetooth.

Barcodes and QR Codes

Barcode Laser Scanning

Invented before Bluetooth, barcodes or UPC (Universal Product Codes) were introduced in 1974, by NCR (National Cash Register) as a way to speedup checkout at grocery stores, and has since spread to every kind of process requiring an instant recognition check, such as at airports for example. Using laser scanning and (later) a direct Bluetooth connection to a computer, the increased processing speed is remarkable, often not even requiring human intervention, such as at self-checkouts. Compared with my childhood days in Camberley of going to a grocery store, being served item-by-item from behind a counter, and being presented with a handwritten receipt, added up by hand in £-s-d (pounds, shillings and pence), the change is staggering.

Masahiro Hara of Denso Corp, who invented the QR Code.

Barcodes had their limitations, specifically the amount of data they could hold, being only read in the horizontal direction, together with their relatively slow reading speed. Therefore, in the early 2000's the Japanese invented the QR (Quick Response) code, which enabled two-dimensional scanning (with 200 times the data capacity) at far higher speeds. Further, the QR code enabled easy scanning with a digital camera, and is now found on practically all printed materials, primarily to give website links providing more information directly to cell phones.

Scan this one:

Photography

None of these phones had cameras, so photography required another complete set of equipment, and of course was in use long before digital photography was even invented. My older sister Trish had a Brownie Box camera, with the viewfinder on top, one of the most popular amateur cameras of its day. My first camera was of an earlier vintage still, a so-called folding camera inherited from an old aunt. Films were bought in rolls on spools, which had to carefully inserted into the camera in order to avoid light spoiling the film. Pictures were taken very selectively because the film and its subsequent development and printing was expensive. Initially all photos were black and white, and only in the 1960's did colour become more common.

A Kodak Brownie Box Camera from the late 1950's

A Folding Camera

SLR (Single Lens Reflex) cameras eventually took over amateur photography in the 1980's, but the advent of digital point-and-shoot cameras in the 1990s through the 2010s, when LCD viewfinder displays took over, preceded smartphones that became the cameras of choice from the 2010's. At the time it was astonishing that a camera could be packed into such a small flat device.

Camera Film Spool (left) and later 35mm Cartridge

Polaroid Cameras

Polaroid cameras or instant cameras, which allowed you to immediately print your picture, first went on sale in 1948. Created by inventor Edwin Land, the cameras achieved great success, notably in the 1960s. Polaroid cameras came to an end in 2005, with the last film packs being produced up to the end of 2009.

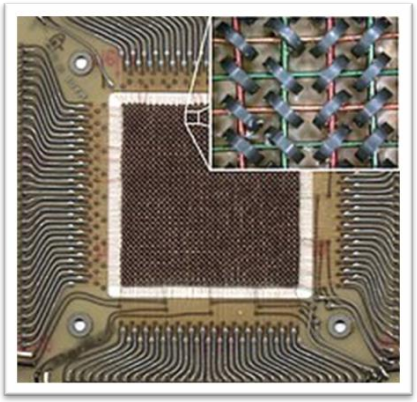
Polaroid Instant Camera

Camera Drone for Aerial Photography

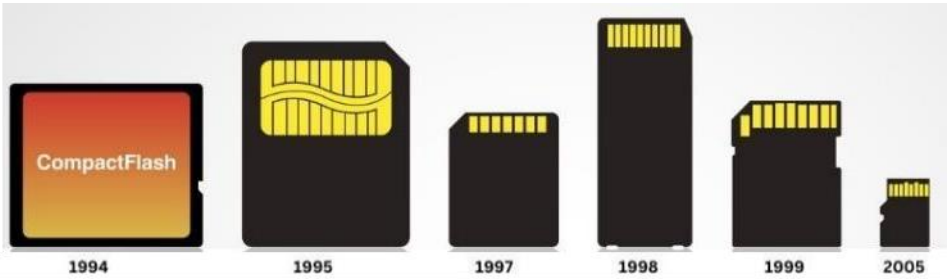
The invention of drones has taken photography to a new level still. From about 2010 consumers could simply purchase a drone, affix a camera, whether video or still, and fly it practically anywhere, so that aerial pictures of landscapes or objects could be snapped, which before was largely only possible from costly helicopters.

Data Storage

The first storage technology I came across was made of magnetic cores, literally thousands of them, each core storing one bit. The design relied on a low current in circuit wires passing through tiny soft iron rings in order to magnetise them in a specific direction thereby being saved as a binary 1 or 0. Each ring retained its magnetic field until such time as it was re-programmed.



Magnetic core memory card of 128 bytes which would be stacked to form a memory module



Evolution of Digital Memory Cards

The first digital cameras relied upon removable storage, digital memory cards, that could be inserted into a card reader for display on a computer or projector screen for example. The memory size was quite small, typically 32 MB, and the cards expensive to buy.

Storage or thumb drives

In parallel, once USB ports were standard on computers, thumb drives became a popular method of storing files and distributing them to others. Initially they were limited to 64MB and cost about $1 per megabyte, but were soon available at much higher capacities for considerably less.

Floppy disks

Floppy disks are no longer in production, but they were the preferred method of storing and transferring data for many. In fact, up until October 2014, the US Department of Defence was still using them as it relied upon a 1970's computing system – the IBM Series/1 Computer – before it finally updated its systems.

Floppy Discs: 8", 5¼" and 3½" sizes

Projectors

In our early school days, all of the teachers relied solely on a chalk board or blackboard to communicate a lesson to the students. The first projector was a light box in which a picture was inserted face up, with a bright light illuminating it, and the reflected light projected via a mirror and a lens onto the screen. However, the room had to be especially dark because the image was hard to see.

Manual Slide Projector

Occasionally we had slides, large 2” size, which were inserted one at a time into a projector, but it was slow and also required a darkened room. A semi-automatic projector with a wired remote control and the slides, the 35mm size, inserted into cassettes, was far superior, and I had one at home to display photos for quite a few years. After digital photography took over, most of my slides were converted to computer files, a rather tedious process.

Semi-automatic Slide Projector with Cassette

In my later school years in the 1960’s, the overhead projector was first introduced, and could be used in a normally lit classroom. However, either the glass top was written on directly using erasable markers, or slide sheets were prepared in advance using coloured pens. Later developments involved graphic artists preparing coloured slides by hand, an arduous and expensive way of showing diagrams and illustrations, before computers and printers made them easy to produce.

Overhead Projector

Typewriter

When was the last time you used a typewriter? Chances are, not recently or not at all. For some these seemingly obsolete items are still a part of daily life, whether for their nostalgic value, a desire to use analogue technology or simply down to personal preference.

The typewriter became quite common in businesses from around the 1880’s and endured for practically 100 years. Women (mostly) could be typists for their entire careers, and some would be termed speed typists achieving upwards of 100 wpm (words per minute). However, speed was largely limited by the mechanics because the print arms would often lock together. Watch this video of a speed typist: Speed typing.

Other issues were changing the ink ribbon or the ribbon itself getting stuck, and of course the paper feed was tricky if the sheet wasn’t inserted absolutely square.

My entire university degree project of some 200 pages had to be typed up, and if any corrections or insertions were to be made, then the whole page invariably needed retyping. The typists themselves were prone to make mistakes as well, and while a letter or word could be corrected using ‘whitener’ to mask the error, and then retyping over the top, it could be messy and time-consuming. Speed typists would keep their eyes on the original text beside them, only occasionally glancing at the typed text, and if their fingers were incorrectly positioned on the keys, the resulting output was gibberish.

Copiers

If a copy of a typed letter was required, a second sheet of paper was positioned behind the first one with a piece of carbon paper in between, in order to make an imprint. Of course, this is the origin of “cc” or carbon copy. This form of duplication meant that the carbon would get onto your hands as you inserted it, leaving unwanted fingerprints on the paper.

If multiple copies were required, then a waxed stencil sheet was typed on so that the letters cut through the wax layer. The stencil would be inserted into a duplexer or duplicating machine, that was often hand operated. Printing ink was spread on the rollers so that as the drum was rotated, the ink would seep through the wax imprint, leaving its impression on the sheets of paper as they were fed through. Similar duplicating machines used methylated spirits leaving a purple print on the paper.

Early Duplicating Machine

One of the first photo copiers was exactly that, i.e. it took a photo and developed prints. Our headmaster at Chafyn Grove school (early 1960's) had one of the first, as large as a washing machine, and hung up the developed copies to dry prior to distribution. When modern photocopiers were widely introduced in the 1970's everything was far easier, cleaner and a lot faster.

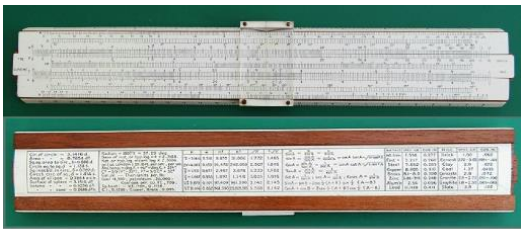
Olivetti Mechanical Calculator

Calculators

At school there were no calculators. The best we had were log or logarithmic tables together with conversion charts, and everything else was either memorised by heart, such as the times tables, or practiced until you knew conversion factors and geometric angles without having to look them up.

At home, my father had a mechanical calculator to assist him with his work as an Army Paymaster. It was a hand-cranked device that included a print out. And later on in retirement he was one of the first of his generation to use an early computer which he was quite proficient at.

My first "calculator" was my father's slide rule which was handy while studying engineering at university in the mid-1970's. When the first digital calculators were introduced by Hewlett Packard, we were permitted to use them in class but not in exams, as it was considered too easy, and therefore akin to cheating.



My father's slide rule with useful formulas underneath

My first electronic calculator at university in 1976, replacing the slide rule

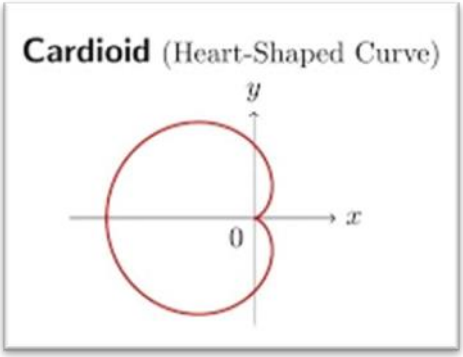
The next development was the scientific calculator with many more mathematical functions, and especially useful at work.

Early Scientific Calculator

Computers

My first experience with a computer was during a school outing in 1967 to the local technical college in Hatfield which had an Elliot 803 computer that seemed to fill half the room. I joined the school computing club, and wrote a program in 'Autocode' to plot a cardioid, which at the time was considered very cool.

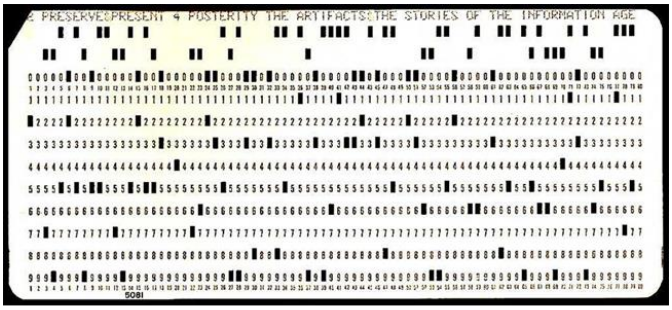
Elliot 803 Computer and Peripherals



The program was prepared on 5-hole punched tape in order to feed it into the computer. Later input methods included 8-hole tape and computer cards.

A 5-hole punched tape machine

Computer punched tapes, 5- and 8-hole.



Computer punched card. An entire stack of them would form a program.

My first desktop office computer was a Commodore 64, so-called because it had 32 kB of core memory and 32 kB of graphics memory which at that time we thought was huge. Plus it could be connected to a floppy disk drive for storage. Programming was done in the 'Basic' language which was laborious but simple to use.

Commodore 64

For example, take a mathematical equation of 1 + 2 = 3 which was programmed as follows: A = 1; B = 2; C = A + B; PRINT C.

The graphics card enabled us to plot curves and draw diagrams, which simplified much of the earlier manual work of plotting by hand on graph paper. My children enjoyed it too, as one of the very first computer games was "space invaders". A drawback compared with modern PC's, was the long boot up time. On

arrival at work, you would switch on your computer, and have time for a cup of coffee and a chat with colleagues, before it was ready to use. And if your computer froze or locked up, one had no alternative but to initiate a reboot with the infamous key combination of “CTRL+ALT+DEL” followed by another coffee break!

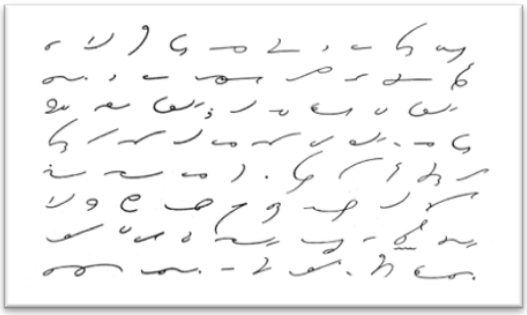
For more complicated work, including the control of electronic instrumentation via the IEEE 488 and IEC-Bus 625, some of the programs had to be written in machine code using DOS (Disk Operating System), later to become MS-DOS, which itself was superceded by the Windows operating system.

Nintendo Game Boy

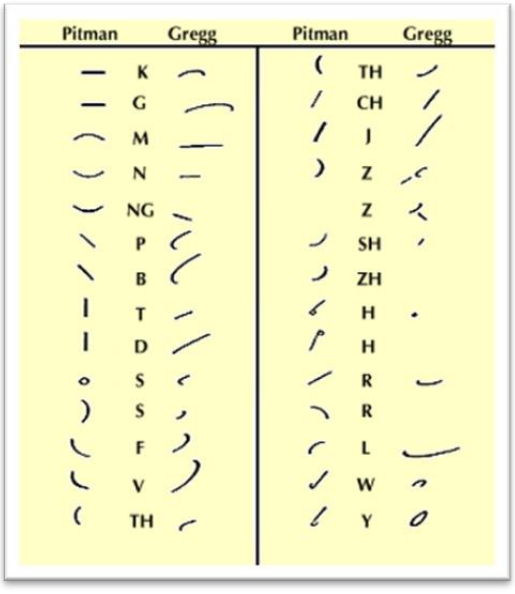
Gaming became popular with the advent of the Nintendo Game Boy in 1989. Despite mixed reviews criticizing its monochrome graphics, an estimated 118.69 million units of the Game Boy and its successor, the Game Boy Color (1998), were sold worldwide, making them one of the all-time best sellers and a cultural icon. Video games today are incredibly realistic and have ballooned into a huge industry.

In the 1980’s the first word processing software from Siemens meant the end of the typewriter. Our secretary demonstrated how she could type a sentence and go back and amend it. Wow! In only a few years, with the introduction of the PC (personal computer), it was also the end of the “secretary” as a career because, with the exception of the most senior executives, employees were expected to type their own letters and documents. Those that did remain became “office assistants” or “office managers” for an entire group or department.

Before portable recording devices were available, another key role of the secretary, was taking notes in real-time, for example the minutes of a meeting or their boss dictating a letter, and typing them up afterwards. I recall my sister Jeanie describing it to me as part of her work at the Council of Europe in Strasbourg. For this purpose she had to be very good at ‘shorthand’, also known as stenography, which has been in use in various forms for hundreds of years. It is a method of writing notes in an abbreviated rapid form, but which can later be deciphered by the writer. Although there were nationally recognised symbols, such as Pitman and Gregg, every secretary added their own unique ‘hieroglyphs’ to represent commonly used words or phrases. News reporters had to be especially good at it when taking down notes, as were law court stenographers.



Shorthand Notes



Shorthand Symbols

When battery-powered portable or handheld recording devices were introduced in the 1970’s, shorthand expertise became less of a requirement. Fast forward to today, and not only does your average cell phone record audio, but speech to text conversion software transcribes it instantly. Similar advances have been made in language translation. Jeanie was fluent in English and French, and not only did simultaneous verbal translation, but also had to record it by hand for later typing. Now translation

Handheld Recording Device or Dictaphone with micro cassette tapes

software does the same job in real-time making life a lot easier.

Early Laptop Computer

With the advent of laptop computers and USB (Universal Serial Bus) connections, life became easier still, although the first laptops were very heavy by today's standards, also "bricks". And later still, once electronic miniaturisation and battery technology had advanced sufficiently, tablets became all the rage, and to some extent still are, with some very successful products like the Amazon Kindle electronic book reader.

While computers have enabled enormous leaps and bounds in technological advancement, they come with associated risks. I recall my first discussion with government clients in the 1990's on emerging virus threats, when I thought viruses were just the stuff of medical science. How the world has changed since! In consequence, users have had to adopt increasing security measures simply to combat the hackers. We have escalated from completely open systems, to simple 4-digit passcodes for access to everything, to 8-character passwords, to unique passwords for every system or website, to memorable names or words, to two-step verification, and now to personal calling, as well as face or fingerprint recognition. Whatever next!

Advances in computing and the Internet have enabled the widespread use of artificial intelligence (AI). While it is still in its early stages (2024), it has been used to great effect in all kinds of applications including in medical research, manufacturing, automatic chatbots, weather forecasting and much more. At the consumer level, simply posing a question and receiving a comprehensive answer in seconds, can save hours or even days of work. Unfortunately, AI can also be used and abused in nefarious ways, but these tend to be in the minority, so it will doubtless continue to grow with its reach extending into all areas of our lives.

Analogue Clock

Clocks and Watches

Many of our younger generation have difficulty telling the time from an analogue clock, but that's all we had in our younger years. I recall getting my first wind-up wristwatch, a Kienzle[1], at the age of 10 and felt so incredibly proud of it. It was quite basic, just minute and hour hands. Only later did I get one with a second hand and the date, and that was even self-winding using an internal rotating mass!

Later still came battery driven watches vibrating a tiny tuning fork at the upper end of the hearing range, which improved accuracy further still, although the battery needed changing at least yearly. Then came the "quartz crystal" watches with a frequency of 32.768 kHz with unparalleled precision, together with the first digital displays with tiny numbers in red LED's (Light Emitting Diodes) that had to be switched on every time you wanted to read them, because otherwise the battery would drain too quickly.

First Digital Wristwatch

When LCD (Liquid Crystal Displays) were invented, power consumption was reduced further still, permitting displays to be on continuously, with "button" batteries lasting for up to 10 years.

[1] Amazingly, over 50 years later, my son Andrew has an office in the former Kienzle factory which operated from 1822 - 2002!

Lighting

When Thomas Edison demonstrated his first light bulb in 1879, he started an era that would practically end the use of candles and gas lamps. His immediate concern was developing a bulb that would last more than 1,000 hours. By 1950 a bulb would last on average one year, but still consumed considerable power, while generating a fair amount of heat.

Progression from the Candle to LED Lighting

Fluorescent strip lighting dominated office spaces from the 1960's with the associated flickering and some people complaining of headaches. However tube lighting emerged with the spiral CFL (compact fluorescent lamp) which reduced the power consumed by an earlier 60W filament or incandescent bulb to about 13W, only to be shortly superceded by the LED (light emitting diode) bulbs, reducing consumption to around 7W and increasing the life span to several years or more.

The big change came with the durability of LED lights. Previously, if a lamp was toppled for example, the filament would invariably break, necessitating the replacement of the bulb. The other major change was in the use of torches or flashlights and headlamps. Not only would the bulbs regularly burn out or break, but the batteries needed constantly replacing. And if the battery was depleted, the acid gel inside would leak thus damaging the torch.

Batteries

All kinds of batteries were invented in the late 19th and early 20th centuries but the most enduring were the lead-acid battery used in vehicles, and the zinc-carbon cell, or dry cell used in portable equipment for example. Leaking sulphuric acid was hazardous to say the least. If it splashed onto your clothes they would quite literally fall apart within a matter of days. Newer rechargeable Li-Ion or solid-state batteries have overcome all of these issues, and permitted the invention of the e-bike and EV or electric vehicle.

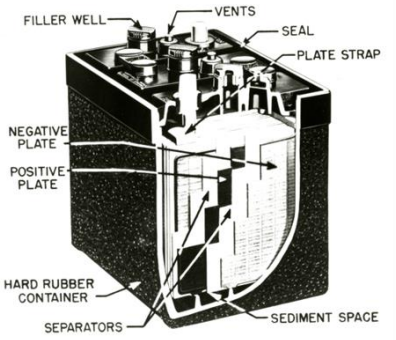


Diagram of a 1953 Lead-Acid Battery

For smaller battery-driven or handheld equipment the 1.5 volt batteries were used, but if they were left in for any length of time, once flat or run down they leaked acid gel. The Ever Ready batteries had a virtual monopoly in the market. The 4.5 volt batteries were better but could still leak.

Common 1.5 volt batteries notorious for leaking acid gel

Torch or Flashlight with 4.5 volt battery

Button cells or coin batteries

Only in the early 2000's were lithium-ion batteries manufactured that could be simply recharged.

Button cells or coin batteries using lithium were made from the 1970's and enabled a wide range of applications, especially the first battery powered watches, but also non-volatile (data retention) memories used in electronic instrumentation. Their high energy density and 10-year shelf life were a big advantage.

Home Solar System

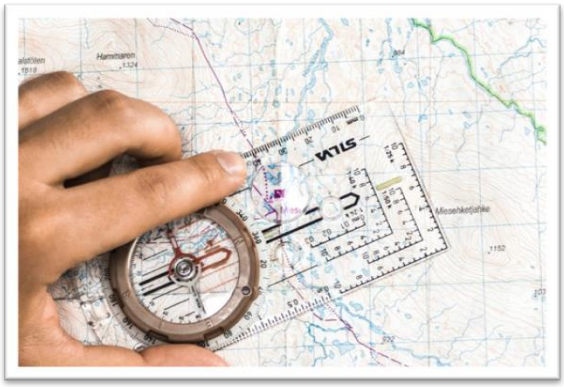
In the early 2000's home solar systems started to takeoff, although relatively expensive. Since then, prices have come down in leaps and bounds, and I installed my first system in 2020. According to my solar software app, over the 4 years it has saved 864 trees! In parallel, battery systems for solar storage have been developed with increasing power density, and municipalities have installed battery arrays filling entire shipping containers which enable them to bridge short power outages for an entire town.

British Army Compass

Navigation

Growing up, all navigation was done on a paper map, and one occasionally got lost. In the Army, much time was spent preparing route cards for the drivers, which often meant driving the route oneself first in order to ensure accuracy, otherwise one ran the risk of losing an entire convoy! Marching on foot across the countryside necessitated even more detailed work using map and compass, and when required, counting paces to judge the distances walked.

The first prismatic compasses were heavy, although very accurate, with mother of pearl cards carefully engraved with every degree marked.



Silva Compass

Once the plastic Silva compass became available in the 1970's, cross country navigation was much more practical, and I used to do a lot of orienteering with one.

However the real skill was combining compass work with map reading, as well as fitness, and interpreting the symbols and contours on the fly.

Orienteering

Only in the late 1990's did the first civilian use of GPS (global positioning system) become generally available, although at that time the United States overlaid what was termed "dithering", deliberately reducing its accuracy from ±1m to ±10m so that enemy forces in battle could not take full advantage of it. Some time later it was integrated into mobile phones with a mapping capability.

Hertz NeverLost GPS System

I recall my first business trip in a rental car with a GPS, the Hertz "NeverLost" in California. My wife was on the speaker phone with me, and the female GPS voice said "turn left here". Being unfamiliar with GPS systems at the time, she wondered who on earth the woman was sitting next to me in the car!

Transportation

Such a paper would be incomplete without mentioning the developments in transportation during my lifetime.

Bicycles

Derailleur Bike Gears

I only learned to ride a bike when I was 11 years old, so I was very proud of my first one. It had no gears, and no suspension but it did have a bell!

My next bike was a big upgrade as it had three gears of the Sturmey Archer type, embedded in the rear wheel hub. Only later could I afford the derailleur gears of today, which became popular after 1964 when the "slant-parallelogram" technology was introduced.

Sturmey Archer 3-Speed Bike Gear Shift

I rode my first bike with front fork suspension in 2020, and what a difference it made from the previous "boneshakers" especially when riding on country trails. At that time I converted to an e-bike with semi-automatic gears and lots of power, which, living in a hilly area, put the fun back in biking. Bike rides of 70km were enjoyable and moderately easy.

My e-Bike with 625Wh Battery and Semi-Automatic gears

Cars

While cars have been widely used since the beginning of the 20th century, they tended to be large, and consequently heavy, quite noisy and, if not perfectly tuned, the exhaust fumes could be obnoxious. A noticeable shift to smaller cars was the invention of the Mini in 1959 which caused quite a stir, and very quickly became popular because it was much easier to park and quite zippy to drive. The transverse engine design, together with front-wheel drive was considered revolutionary. And when the Mini Cooper sports model came two years after that, it really took off.

Mini Cooper

Back then there were none of the features that are standard in any car today. The windows were wound up and down manually, the boot or trunk could only be opened by hand and so on. Even the indicators on many cars were the electro-mechanical illuminated arrows that popped up on the side of the car. Consequently, driving tests included hand signals in case the indicators malfunctioned.

Electro-mechanical indicator or trafficator

In cold weather the heating was negligible until the car had fully warmed up, quite some time after the start of the journey, and in hot weather there was no such luxury as cooling or air conditioning.

Although automatics were widely available in North America in the 1950's, Europeans mostly drove manual cars, making driver training a lot more difficult with the inevitable crunching of gears until one had got the hang of double declutching. Of course, synchromesh later resolved the issue.

My Triumph Spitfire ran beautifully for a year while I was at university, so I bought one 45 years later to restore in retirement, which was a lot more work than I had imagined, but now in 2024 it's complete. However, the next generation of self-driving or autonomous vehicles are already undergoing trials, although commercial production appears to be some way off, before we can solely rely on a robot to drive us around safely.

My first car an Austin 1100

My favourite car a Triumph Spitfire Mk3 1970

Trains

The Age of Steam

Along the grounds of our school in Salisbury, ran a branch railway line, and when we first went there in 1958, there were only coal-fired steam engines running on it. The cricket master reminded us before every match that if we could hit a cricket ball into the funnel of a passing engine he would give us £100! On our Sunday walks we would go to a small footbridge going over one of the lines, and wait till an engine passed underneath so that we could be enveloped in a huge cloud of smoke and steam. Whenever we travelled by train to London and back, Mum would make us take a bath because the soot was everywhere. Only in the early 1960's did diesel engines become more commonplace, ultimately leading to the end of the age of steam. If there is one thing that brings back the nostalgia, it's the classic sound of a steam engine. Listen here.

My first high-speed train journey was in Japan in the late 1990's travelling in the bullet train at speeds of up to 250 kph, considered then to be a marvel of modern engineering. As I add this to the paper in 2024, the bullet train is celebrating its 60th anniversary! It was followed by another amazing feat of railway engineering, the chunnel with both road and rail links. The idea of a tunnel under the English Channel was first proposed in 1802 but construction wasn't started until 1988. It was completed in 1993, and Eurostar train services commenced in November 1994.

The Bullet Train

BEA Vickers Viscount

Air Travel

Whenever we crossed the English Channel to the continent, travel was by ferry, which took sometime to reach the more distant ports like Ostend. But once we started attending boarding school in England and were living in Germany, the only practical option was by air.

The first planes we flew in were the BEA (British European Airways) Vickers Viscount, an exceptionally noisy propeller aircraft.

I well remember that after the hour and a half flight, Stuart and I were DOA (deaf on arrival) as we couldn't hear a thing for quite some time afterwards except for a high-pitched whine in our ears. No one thought of hearing protection for passengers. Then jet travel started and the level of comfort increased significantly.

When I was studying at university in the west of England near Swindon (1973-1976), we would often see the first prototype Concorde supersonic aircraft flying overhead from the plant in Bristol, and we would stop and stare at yet another incredible machine that was a technological masterpiece of its time. Unfortunately the Concorde only flew commercially from 1976 to 2003 as its operating costs were too high, and when one flight ended in catastrophe, it spelled the beginning of the end. However, the concept of flying from London to New York in just three hours at Mach 2 was a mind-boggling achievement and still is.

Supersonic Jet Concorde

Royal Air Force Harrier Jet

While not part of commercial air travel, it is worth mentioning another marvel of technological development which has since become an object of aviation museums. In the Army, I had the opportunity to fly in a Harrier Jet or STOVL (short takeoff, vertical landing) aircraft. The experience was incredible because of the G-forces upon takeoff, with the pilot instructing me to be ready to eject at any moment should he say it three times in rapid succession. Fortunately, it was a safe exhilarating flight. Incredibly, because it was designed as a day fighter only, the pilot had to fly the jet by sight, reading a map on his lap to navigate. It entered service in the 1970's and continued for some 30 years before it was phased out.

Conclusion

The end of the 20th century and the beginning of the 21st, was an exciting period to have grown up, and as an Electronic Engineer, to have been at the forefront of technology. That brings us back to Ray Kurzweil and his future predictions, particularly his foretelling of a singularity. An ensuing discussion examined the consequences of reaching such a technological milestone. Incredibly, one conclusion was that humans would render themselves obsolete. The ability for computers, processors and intelligent systems to reinvent and develop themselves without human assistance or intervention, means that humans quickly become inferior to their "robotic" cousins, and thereby slowly become extinct. Humans 2.0 takeover. They do not require medication nor hospitals nor schools nor even emotional support. They don't even need food, just recharging from time to time from a source of continuous power yet to be invented. There will be no requirement to travel, except to distant planets, which they will be well suited to doing.

While humans have all but destroyed their global environment through carbon emissions, chemical pollutants and rampant development, the world might actually have a chance to recover. Perhaps a small core of humankind 1.0

will be kept by our future cousins, much like animals are kept in zoos today. We will be observed and analyzed only because of a scientific need to ensure their survival should an unforeseen event occur that puts robotic technology at risk, whatever that might be.

Potential risks have already become apparent. During the runup to the millennium celebrations, there was much heated discussion about the reliability of the world's computer networks. What became known as "Y2K" or the "Millenium Bug" referred to potential computer errors related to the formatting and storage of calendar data for dates on and after the year 2000. Many programs represented four-digit years with only the final two digits, making the year 2000 indistinguishable from 1900. Computer systems' inability to read dates correctly had the potential to bring down worldwide infrastructures for computer reliant industries, or so people thought. There were dire warnings about a pending stock market crash, and even airplanes falling from the sky! Nothing happened but there was widespread panic regarding a possible Doomsday scenario.

Another real risk is the possibility of a massive solar flare which would interfere with communications and high voltage systems around the globe causing a huge power surge and ultimately widespread failures and disruptions. An example of such an occurrence was a wide area power outage in the American northeast and Canadian southeast in 2003 when several interconnected power grids all collapsed at once. The root cause was a problem with the design of the grid itself, but it nevertheless exemplified the vulnerability of what could happen on an even larger scale.

And when such an outage occurs, only then do we realise the extent to which we humans have become almost solely reliant on electric power. The havoc caused by a prolonged blackout brings us practically to our knees. However, the advantages of technology clearly outweigh the risks. We can hopefully save our planet in the process.

Postscriptum

In retrospect, I could have asked the AI software, ChatGPT, to write this entire article for me in a fraction of the time but it would have lacked the personal touch, and anyway it wasn't available when I started writing.
However, I did 'consult' it after completion, and it added to my conclusion:

A Connected, Digital Future

The technological advances from 1950 to 2024 have been nothing short of transformative. The evolution from simple household electronics to interconnected smart devices and AI-driven products shows how far technology has come in shaping the consumer experience. As we move into the future, it's likely that these innovations will continue to evolve, making our lives even more connected, convenient, and digitally driven.

Pretty good!

PPS: As 2024 draws to a close, I received a Christmas card from my twin brother Stuart, which sums up the extent to which technology now dominates our lives:

'Twas the night before Christmas,
and all through the home,
Not a person looked up
From TV, tablet or phone!

And in a look to the future, a Toronto Star newspaper article from January 1st 2025 states:

Generation Beta starts today. What will the world look like for babies born in 2025 and after?

Generation Beta

Anyone born between 2025 and 2039 will be part of Generation Beta, and, there's already some things we do know, from growing up in a post-pandemic world to having social media play a big role in their development. They'll use AI for everyday tasks without a second thought.

Gen Alpha includes people born between 2010 and 2024, while Gen Z'ers were born between 1996 and 2010. Sean Lyons, a professor of social studies, cautioned that it's still too early to know what they'll be like — especially since the oldest of Gen Alpha and Gen Z are still only just starting high school or entering the workforce, respectively. "Things change at a frenetic pace these days," he wrote.

That is an understatement!
