Percy E. Ludgate (1883–1922): Skibbereen-born Computer Pioneer

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This article will give a brief history of the development of the computer. It will then state what we know about the life of Percy Ludgate, and give details of his work on his analytical machine, what we would now call a programme-controlled computer. In an article in the *The Irish Times* Mary Mulvihill described him as Skibbereen's early answer to Bill Gates,

Skibbereen-born Computer Pioneer

There is no doubt that the invention of the computer was one of the most important developments of the 20th century. It is difficult for the younger generation to realise what life was like before the advent of computers and scientific calculators. People of a certain age will have memories of doing mental arithmetic at school when they were required to do "long tots," that is add up columns of figures, and the unpleasant consequences if they got the wrong answer. Up until recent times many intelligent young (and not so young) men and women spent a large part of their working lives, in offices all over the world, carrying out this type of 'number crunching'. They were the original 'computers'. The word 'computer' was a job title, i.e. one who computes. However, human beings are often careless, sometimes distracted and consequently make errors in calculations. The results are frequently quite slow even on a good day. Therefore, people have been searching for hundreds of years for a device or machine to do the job more efficiently.

The *abacus*[1] was an early aid for mathematical computations; it aids the memory of the person doing the computation. It was, and is, useful for addition and subtraction but slow for division and

multiplication. It is still used in some countries in Asia. The modern abacus consists of rings that slide over rods. In ancient times they used pebbles for counting; the word 'calculus' comes from the Latin word for *pebble.*

Percy E. Ludgate (1883–1922); this photo taken a few years before be died

Over the centuries there were many mathematical devices invented. The great Renaissance genius, Leonardo da Vinci (1452–1519) made drawings of a gear-driven calculating machines but there is no record of it being built. In 1612 John Napier invented *Logarithms* which are still used to simplify multiplication and division. This led to the invention of the *slide rule*[2] by William Oughtred and others between 1620 and 1630. It was the most widely used calculating tool in science and engineering until circa 1974 when the invention of the electronic scientific calculator made it largely obsolete. During the 1960s it was used by the NASA scientists who were involved in the first moon landings.

In 1642 Blaise Pascal, at the age of nineteen years, invented the *Pascaline*[3] for his father who was a tax collector. This was a gear-driven one function calculator – it could only add. Unfortunately, seventeenth century technology was incapable of fabricating the gears with the required accuracy. Pascal's ideas were very practical and useful. The milometer portion of a car's speedometer used the same mechanism as the Pascaline to increment the next wheel after each full revolution of the previous one. This was used until cars adopted digital technology in recent years.

During the Industrial Revolution many manufacturing processes became mechanised. Some systems remained repetitive, monotonous and dangerous. This applied to weaving in particular. In order to make the intricate patterns with the material it was necessary for a 'Drawboy' to sit inside and lift or move a number of threads according to the directions of the master weaver. In France when Joseph Marie Jacquard (1752–1834) [4] inherited his family weaving business he planned to invent a loom that would work automatically. His work was interrupted by the French Revolution and he did

not complete his invention until 1801. He used a system of interchangeable punch-cards and hooks which controlled the weaving of the cloth so that any desired pattern could be obtained. It also had the effect of reducing the number of workers and the work could be done by relatively cheap and unskilled labour. Redundant weavers rioted and smashed looms in many factories. Jacquard looms spread to England where they caused considerable industrial unrest. The Luddites [5] were a social movement in 19th Century England following a mythical leader 'Gerard Ludd' who protested against the changes brought about by the Industrial Revolution. In Lancashire they targeted the Jacquard wide-framed automatic loom. During the riots of 1811–1812 looms were smashed and some mills were burned down. The British Government had to call out the Army to control the situation.

Jacquard influenced many inventors including Charles Babbage (1791–1871) who is considered 'father of the computer' and is credited with inventing the first mechanical computer that eventually led to more complex designs.

In the post-Napoleonic War era the British Navy became the greatest in the world. To keep it functioning required an intense amount of data. At the time the Government was publishing a seven-volume set of navigation tables which came with a companion volume of corrections which showed that the set had a thousand numerical errors. Hardly a satisfactory situation! A brilliant mathematician from Cambridge, Charles Babbage,[6] was working on a steam-driven calculating machine which he called the ***Difference Engine***. He obtained Government funding but after ten years the project was nowhere near completion and funding dried up. The completed part is now in the Museum of Science in London. It is estimated that if it was completed it would weigh fifteen tons, have 25,000 parts and would have been eight feet high.

Babbage then turned his attention to what he called the **Analytic Engine.**[7] It was powered by six steam engines and was as large as a house. He spent the rest of his life until he died in 1871 working on it. He adopted the punched card technology of Jacquard and the machine had many of the functions of a twentieth-century computer. Babbage realised that punched paper could be used as a storage mechanism holding computed numbers for future reference. He called the two main parts of his analytic engine the *store* and the *mill* as both

terms are used in the weaving industry. They are now known as the *memory unit* and the *central processing unit*. Government funding was refused and the machine was not built. It is now apparent that this analytic machine was far ahead of its time. In fact it was not until 1991 that the first Babbage Engine was made. One of his assistants was Ada Byron, Lord Byron's daughter, who took a great interest in Babbage's work. At the age of 19 years she had learned enough to begin writing programmes for the unfinished machine. Ada would later become the Countess Lady Lovelace by marriage and is regarded as the first computer programmer.[8]

Babbage refused to publish his findings for many years. The 'Father of the Computer'. was a great inventor but he was also rather eccentric. He died in 1871.

Twelve years later, a man from a completely different background, Percy Ludgate was born in Townshend Street, Skibbereen, Co. Cork who in adult life worked along similar lines to Babbage. Percy Ludgate's father, Micheal, was born in Kilshaingh, Mallow, Co. Cork c 1840. As a young man he went to England and joined the Army in Hythe in Kent on October 1st 1861. At that stage he gave his trade as 'clerk'. In 1863 he married Mary McMahon at Winchester in Hampshire. They had five children in England, namely Arthur (1864), Thomas Edward (1865), Walter Samuel (1868) and Robert William (1869). Another son, Fredrick, was born in Windchester in 1879 [9]

We have been unable to find Fredrick's birth records.

Shortly after this Micheal Ludgate, with his young family, was transferred to Bellary, Madras, in India. Their youngest child Albert died there on August 24th, 1870. A daughter, Augusta, was born in Madras on May 3rd, 1870.

Military records show that Micheal Ludgate was discharged on medical grounds from the army at Winchester as 'Sergeant Second Class Instructor from the Third Battalion Reg. of 60th Roy. Rifles, after 15 years and 80 days service. In his discharge papers his conduct is described as 'very good'.[10]

The next record I can find of the Ludgate family is Percy's birth certificate which shows that he was born in Townshend Street, Skibbereen, Co. Cork on August 2nd 1883. His parents, Micheal and Mary, are described as 'pensioners'.[11]

The Ludgates are not in the 1901 census for Skibbereen but they are in the Dublin one. The family seems to have split up before this

date. The census shows Micheal Ludgate living in a house in Quay St. Balbriggan, and Mrs Ludgate with Alfred and Percy living in Dargle Road, Drumcondra. Percy was described as a 'Civil servant National Educational Officer (Boy Copyist)' Professor Brian Randell of Newcastle University who has carried out an immense amount of research on Percy Ludgate states in an article in the '*Computer Journal*' that he obtained his information from Miss Violet Ludgate, a niece of Percy's, who was living in Dublin at that time (1971) by following up leads that she had furnished.[12] Much of my material is based on his work.

Percy attended North Strand Parish School and then entered the Civil Service but he left it after a few years. Why did he do so? After extensive internet research I found the answer in a House of Commons Parliamentary reply to a question by Mr. T. Harrington. The Financial Secretary to the Treasury (Mr. Victor Cavendish) stated that Mr. Ludgate had a medical examination in February, 1903, for a second-division clerkship and "the result of this examination proved unsatisfactory"[13]. Percy failed his medical, didn't get the job and went back to school to study accountancy in the Rathmines College of Commerce. He was awarded a Gold Medal by the Corporation of Accountants on the occasion of his final examination. In the 1911 Census he is described as a 'Commercial Clerk (Corn Merchant)'. He had got a job with Kevans and Sons, 31 Dame Street, Dublin which later transferred to Westmoreland St and became part of Cooper Brothers. He worked there as an auditor for the rest of his life.

He never married. Miss Ludgate said that 'he liked walking; took long solitary walks. I do not think that he had many other interests. He attended his parish church (St. George's, Temple St, Dublin) regularly. He was a gentle, modest, simple man. I never heard him make a condemning remark about anyone. I would say he was a really good man. He always appeared to be thinking deeply'.

A Mr. E. Dunne who joined the firm of Kevans and Sons in early 1921 confirmed this and said 'that my associations with Mr. Ludgate were quite brief. He was humble, courteous and popular. As a person he possessed the characteristics one usually associates with geniuses, and he was so regarded by his colleagues on the staff'. During the Great War (1914–18) he worked on a committee, set up by the War Office, headed by M.T. Condren-Flinn, senior partner of Kevans and Sons. The task of this committee was to control the production and sale of

oats country-wide in order to maintain a supply for the cavalry divisions of the Army. This involved planning and organisation on a vast scale and Ludgate was much praised for the major role he played.

It is almost certain that it was while he was working for Kevans & Sons that he started work on his analytical machine. It was a private hobby without financial support from any source and according to his niece 'he worked on it nightly'.[14]

From the turn of the century technology had improved and the time was more propitious for the development of an analytical engine or as we would now term it a programme-controlled computer. Ludgate did not attempt to finish Babbage's work. Rather, he claims that until the later stages of his efforts, he had been in ignorance of Babbage's work. Randell states that his designs are sufficiently novel for this to be accepted. Indeed all three main components of the analytical machine, the store, the arithmetic unit and the sequencing mechanism show evidence of considerable ingenuity and originality. His work was encouraged by Professor A.W. Conway of University College Dublin. Also in his paper published by the Royal Dublin Society in *Scientific proceedings of the Royal Dublin Society* [15] he writes 'In the first place I deserve to record my indebtedness to Professor C.V. Boys FRS for the assistance which I owe to his kindness in entering into correspondence with me on the matter to which this paper is devoted.' This paper is available on the Internet but is rather long and technical. The following brief account is taken from Mary Mulvihill's book *Ingenious Ireland* :

> Percy Ludgate's design was also based on the Jacquard loom, but in all other respects differed from Babbage's machine. Where Babbage used columns of toothed discs to store numbers Ludgate opted for a simpler shuttle mechanism. Significantly, Ludgate's design had all the elements of a modern computer: a mechanism for storing data, ways to input data and to program the machine (using pre-punched formula tape and/or keyboards), a printer and even an "operating systems" Ludgate introduced two other features not seen before: his machine could be stopped at any stage mid-calculation to add new variables, and it could do subroutines.
>
> Ludgate's approach to calculations was also unusual. For multiplication he developed a technique using partial products. For division he used a table of reciprocals and a rapidly

converging series using subroutines. In theory, Ludgate's engine would multiply two 20-digit in under ten seconds, and take two minutes to determine the logarithm of a number. It would also solve algebraic equations and geometric problems.

Ludgate envisaged that it would be powered by an electric motor, and the calculations automated, and the complete device – a cube measuring about 60cm. on a side – would be portable. This machine was never made.[16]

That paper attracted international attention and Ludgate was invited to address the Royal Society of Edinburgh in 1914. In this lecture he states that he had:

> designed a second machine in which the best principles of both the analytical and difference types [are incorporated], and from which is excluded the more expensive characteristics.[17]

As far as I can ascertain, this was Ludgate's last publication. From 1914–1918 he had the rather more prosaic job of getting oats for the horses. 1918 to 1922 was the period of the Irish War of Independence and the Civil War, a time of great political and social unrest and much violence. It was not a good time for fundamental research.

In 1922 Percy Ludgate went on holidays to Lucerne in Switzerland. On his return he had developed pneumonia. He was nursed at home by his sister-in-law, his brother Frederick's widow, at 20 Dargle Road, Dromcondra. He died on October 16th and was buried in Mount Jerome Cemetery. His bother Alfred, was his executor and Percy left the remains of his estate to his mother. His assets amounted to £800 including £10 for his personal effects. There is no record of his drawings or manuscripts. All that is left is his published work.

Brian Randell ends his account of Percy Ludgate by saying "One must wonder just how much more he might have achieved if had but a modest fraction of the resources available to Babbage (to say nothing of Aiken)* and had not succumbed to pneumonia at such a tragically young age." Recent plans to make tiny mechanical computational engines using molecular rods make Ludgate and Fowler's work relevant again.[18]

One hundred years ago Percy Ludgate realised the importance of computers. The last paragraph in his 1914 paper states:

> In conclusion, I would observe that of the very numerous branches of pure and applied science which are dependent for their development, record or application on the dominant science of mathematics, there is not one of which the progress would not be accelerated, and the pursuit would not be facilitated, by the complete command over the numerical interpretation of abstract mathematical expressions, and the relief from the time-consuming drudgery of computation, which the scientist would secure through the existence of machinery capable of performing the most tedious and complex calculation with expedition, automatism, and precision.

These are the last recorded words of a long-forgotten son of Skibbereen. He is not completely ignored by the computer community. The Faculty of Engineering, Mathematics and Science in Trinity College, Dublin, award the Ludgate Prize annually. The citation reads as follows: "This prize was instituted in 1991 in memory of Percy E. Ludgate, an Irish designer of an analytical engine. It is awarded to the student who submits the best project in the Senior Sophister year of the moderatorship in computer science. The prize is €127."

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* Howard Aiken was the principal designer of the Harvard Mark 1 Computer which was built as partnership between Harvard and IBM in 1944.

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As readers will no doubt realise, there are a number of gaps in Percy Ludgate's life story. Despite my best endeavours, I have been unable to find out why the Ludgate family came to Skibbereen or how long they spent here. If anyone has any information, please contact me at: jimfbyrne@eircom.net.

Shipwrecks off the West Cork Coast: *L'Impatiente* – a ship of the French Fleet Wrecked at the Mizen, 1797

Edward J. Bourke

French fleet activity off the Irish coast during the Napoleonic period was much less than might have been expected. This must be attributed to the British having relative mastery of the coastal waters. After 1800 there was a very effective observation and communication system consisting of signal towers and a telegraph system. This allowed a rapid response by land troops and intercepting action by the Royal Navy. The Channel Fleet blockade of the French ports meant that if the French ships exited their main base at Brest, the British ships were not far behind.

When Admiral Morad de Galles sailed on December 16th, 1796, he had 17 ships of the line, 13 frigates, 6 corvettes, 7 transports and a powder ship. In addition to the sailors, each ship of the line carried 600 troops and the frigates 250. In all there were 14,000 troops commanded by General Hoche. Bad weather, which had allowed the French to slip out, was also their downfall. The first loss was the *Seduisant,* a 74 gun ship. She ran onto rocks at the Iroise Channel at Brest. Most of the 1,200 aboard perished. The fleet became scattered at sea; it arrived in sections at Bantry. An easterly wind made the approach to Bantry difficult and only eight ships entered the bay. Since they had been in the area for four days, Admiral Kingsmill at Cork was aware of their presence and a dispatch was sent to Bristol. Meantime, the later Earl of Bantry, Mr. White, had assembled militia men and displayed their force on shore so that the French were unsure of the reception they might receive. The French longboat was captured when they landed to reconnoitre.

The storm made landing difficult and the delay might allow their