AccessionIndex: TCD-SCSS-V.20210520.001
Accession Date: 20-May-2021
Accession By: Dr.John Walsh
Object name: 20-May-2021 edition of the Irish Times
Vintage: 2021
Synopsis: A printed issue that contains an article on Percy Ludgate by Dr.Chris Horn.

Description:
Dr.Chris Horn has been a regular writer of articles to the Irish Times on technology, especially in the realm of software technologies and the related industry. This article was instead about Ireland's first computer designer, Percy Ludgate (1883-1922), the second person (the first was Charles Babbage) to publish a design for an analytical machine.

Ludgate was born in Skibbereen in 1883. His family moved to Dublin c.1890, where he spent the rest of his life. By the 1901 Census he held a junior post in the Irish Civil Service, while by the 1911 Census he was a clerk to a corn merchant, and by 1916 he was a qualified accountant. He published his paper on what he called his Analytical Machine in the Scientific Proceedings of the Royal Dublin Society (RDS) in 1909, while he was still just a clerk, an amazing achievement. It was reviewed in Nature shortly afterwards. His machine design was very novel, creating several new concepts. Like Babbage's Analytical Engine, it was never built. Unlike Babbage's legacy of hundreds of design drawings, Ludgate's drawings have not yet been found.

A (less than perfect) photograph of this article, see Fig.1, is available online at:
https://www.scss.tcd.ie/SCSSTreasuresCatalog/literature/TCD-SCSS-V.20210520.001/TCD-SCSS-V.20210520.001-Fig01.jpg
A printout of the text of the article is available online at:
https://www.scss.tcd.ie/SCSSTreasuresCatalog/literature/TCD-SCSS-V.20210520.001/Remembering-PercyLudgate-Irelands-first-computer-scientist-IrishTimes-transcript-20210520.pdf

Further detail on the life and contributions of Percy Ludgate can be seen via a mobile-friendly Ludgate page of this Collection, see:
https://www.scss.tcd.ie/SCSSTreasuresCatalog/ludgate/

Dr.Chris Horn did his Ph.D. in the Department of Computer Science, Trinity College Dublin, became a staff member, and then was a founder of Iona Ltd.

Many thanks to John Walsh for donating this item.

The homepage for this catalog is at: https://www.scss.tcd.ie/SCSSTreasuresCatalog/
Click *'Accession Index'* (1st column listed) for related folder, or *'About'* for further guidance. Some of the items below may be more properly part of other categories of this catalog, but are listed here for convenience.

Accession Index	Object with Identification
TCD-SCSS-V.20210520.001	20-May-2021 edition of the Irish Times, A printed issue that contains an article on Percy Ludgate by Dr.Chris Horn, 2021.
TCD-SCSS-V.20121208.873	On a Proposed Analytical Machine, Percy E.Ludgate, offprint of article in Scientific Proceedings of the Royal Dublin Society, 1909.
TCD-SCSS-V.20170124.001	Nature volume that includes review of article on Percy Ludgate's analytical engine, Nature, Vol.81, including: C.V.Boys, 'A new analytical engine', pp.14-15, Jul-1909.
TCD-SCSS-X.20121208.002	Percy E. Ludgate Prize in Computer Science. Prize in memory of Percy Ludgate's novel 1909 design for an Analytical Engine, the next after Babbage's.
TCD-SCSS-V.20210507.001	Technical paper by Coghlan, Randell, Hockie, Gonzalez, McQuillan, O'Regan, 'Investigating the Work and Life of Percy Ludgate', in the *IEEE Annals of the History of Computing*, plus a printed copy of the issue that contains the paper, both courtesy of IEEE, 2021.
TCD-SCSS-V.20210921.001	Historical paper by Coghlan, Randell, Hockie, Gonzalez, McQuillan, O'Regan, 'Percy Ludgate (1883-1922), Ireland's first computer designer', in the *Proceedings of the Royal Irish Academy: Archaeology, Culture, History, Literature*, plus a printed copy of the issue that contains the paper, both courtesy of RIA, 2021.
TCD-SCSS-X.20121208.001	Charles Babbage's Engines, Irish interactions with Charles Babbage regarding his Difference Engines and Analytical Engine, c.1843.
TCD-SCSS-V.20121208.870	Ada Lovelace's famous translation with an 'Addition', Prof.J.G.Byrne's offprint of Ada Lovelace's translation of L.Menabrea's 'Sketch' of the Analytical Engine, incorporating an offprint of Charles Babbage's 'Addition', c.1843.
TCD-SCSS-V.20171231.001	Ed: Chris Horn, Professor John Byrne: Reminiscences: Father of Computing in Ireland, ISBN-10: 1520696841, ISBN-13: 978 1520696843, 2017.

References:

1. Chris Horn*, Remembering Percy Ludgate, Ireland's first computer scientist*, p.16, Irish Times, 20th May, 2021.

2. Ed. Chris Horn, *Professor John Byrne: Reminiscences: Father of Computing in Ireland*, ISBN-10: 1520696841, ISBN-13: 978-1520696843, 2017, see elsewhere in this catalog.

3. Coghlan, Randell, Hockie, Gonzalez, McQuillan, O'Regan, 'Investigating the Work and Life of Percy Ludgate', *IEEE Annals of the History of Computing,* Vol. 43, No.1, pp. 19-37, DOI: 10.1109/MAHC.2020.3038431, January-March, 2021.

4. Coghlan, Randell, Hockie, Gonzalez, McQuillan, O'Regan, 'Percy Ludgate (1883-1922), Ireland's First Computer Designer', *Proceedings of the Royal Irish Academy: Archaeology, Culture, History, Literature,* Vol. 121C, pp. 1-30, DOI: 10.3318/PRIAC.2021.121.09, 2021.

5. Percy E. Ludgate, 'On a proposed analytical machine', *Scientific Proceedings of the Royal Dublin Society*, Vol. 12, No. 9, pp. 77–91, April, 1909. Available at: https://www.scss.tcd.ie/SCSSTreasuresCatalog/literature/TCD-SCSS-V.20121208.873/TCD-SCSS-V.20121208.873.pdf
Last viewed 20-May-2021.

Innovation Talk

Chris Horn

Remembering Percy Ludgate, our first computer scientist

At an international maths conference in Edinburgh in July 1914, a remarkable Irishman made an astonishing claim. Percy Ludgate, born in Skibbereen and then living in Drumcondra in Dublin, described a completely novel mechanical computer.

His design was entirely original and could solve any computation problem (like today's computers). He had published in the Royal Dublin Society in 1909, and some of his designs were also published in an English magazine of mechanics and science. The day after the conference, July 28th, Austria-Hungary declared war on Serbia and the first World War began.

Charles Babbage is renowned as the designer of the first mechanical computer in the 1820s. At the time, mathematical tables were critical for marine navigation but were manually calculated and often wrong. With support from the British admiralty, the English mathematician devised a machine that could compute trigonometrical values to remarkable accuracy simply by cranking a handle to turn its cog wheels.

Each wheel had 10 teeth, representing the digits 0-9. His "difference engine" could work with 20 digit numbers (20 cog wheels per number) and compute using algebraic functions up to the sixth power (a number multiplied by itself six times).

> **Ireland should rightly celebrate and honour his memory as an extraordinary genius**

Initially given £1,700 (about €162,000 today) by the British government, by the 1830s Babbage had then spent 10 times that amount from the government along with a further £6,000 of his own money. He never managed to construct his machine, chiefly because the metal working available then was insufficiently precise to make the intricate parts. In 1991, a scale model of Babbage's machine with about 2,000 metal parts verified the viability of his design at the London Science Museum. A complete working model, with 11,000 parts, is today exhibited at the entrance to the Computer History Museum in Silicon Valley in the US.

In 1834, Babbage proposed a more complex machine, his "analytical engine". It used 50 digit numbers (50 cog wheels per number) on 2.5m diameter ring gears. Unlike his earlier designs it also had a memory system that hich could hold up to 1,000 numbers and, if constructed, would have been 150m long. Unlike his more limited "difference engine", it could solve any computation problem.

Inspired by the patterns programmable by punched cards in Jacquard's fabric loom of 1801, Babbage used punched cards to direct his machine. Ada Lovelace, now recognised as the world's first computer programmer, wrote of Babbage's machine: "We may say most aptly that the analytical engine weaves algebraical patterns just as the Jacquard loom weaves flowers and leaves." He spent the rest of his life trying to raise funds for his invention, building a number of partial prototypes.

Almost a century later, Ludgate strongly asserted that he was unaware of Babbage's work. Certainly, the Corkman's designs are completely different from anything Babbage invented. Rather than cog wheels to represent each digit, Ludgate proposed rods with 10 stepped notches, representing the digits 0-9. Twenty-one such rods were held together in a shuttle, with the first rod indicating whether a number was positive or negative, and the remaining 20 rods representing 20 digits of the number.

His storage system had two concentric independent rings. The outer held 128 shuttles (signed 20-digit numbers), and the inner 64. By rotating the rings, two 20-digit numbers could be presented by the storage system to the arithmetic unit, which mechanically sensed how far each set of rods protruded from their shuttle.

While the Babbage arithmetic unit could only add (with multiplication requiring the requisite number of consecutive additions), the Ludgate arithmetic unit had at its core both addition and multiplication. Both designs had the ability to make decisions on whether an arithmetic outcome was positive, negative or zero. Ludgate, however, also proposed to re-use previously programmed algorithms as stepping stones to more complex computations. Today's computers use "subroutines" to the same purpose.

Most impressively of all, the Ludgate design was small and compact - the entire design fitted into a quarter of a cubic metre, about the size of a small fridge. Unfortunately, his design has yet to be constructed and verified.

First computers

The first fully operational computers were built in extreme secrecy during the second World War. An electro-mechanical computer was constructed by Konrad Zuse in Berlin in 1941 to design guided missiles, and then a fully electronic computer was built in 1943 by Tommy Flowers and Alan Turing at Bletchley Park outside London for breaking encrypted codes.

Dr Brian Coghlan at Trinity College Dublin has conducted extensive research on the life and work of Ludgate, and much of it is available online at scss.tcd.ie/SCSSTreasuresCatalog/ludgate). Prof Brian Randell at Newcastle University has also joined the discovery of Ludgate's foundational and highly creative work, and co-authored a number of international journal papers and talks, most recently at Bletchley Park.

Next year, will be the centenary of the passing of Ireland's first computer scientist, Percy Ludgate. Ireland should rightly celebrate and honour his memory as an extraordinary genius.

Figure 1: "Remembering Percy Ludgate, Ireland's first computer scientist", by Chris Horn, page 16, Irish Times, 20th May, 2021.