Charles Babbage's Contributions to Statistics

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1. Introduction

Charles Babbage was born in South London (at Crosby Row, Walworth Road, Southwark) on December 26, 1791, and he died in London (at 1 Dorset Street, Manchester Square) on October 18, 1871. His mathematical researches gained him election as FRS in 1816, but he failed in his many attempts to get employment where his mathematical expertise could be applied. In 1828 his friends arranged for him to be appointed as Lucasian Professor of Mathematics at Cambridge University, and he held that post for 11 years, without giving a single lecture. For 75 years after he died he was remembered largely as an eccentric, with cranky ideas about machines for calculation - but now he is widely honoured as the inventor of the computer (Hyman, 1982).

Babbage did significant work in an astonishing variety of fields other than designing computers; including mathematics, insurance, engineering design, political economy, philosophy, natural theology, geology and cryptology (Franksen, 1984). In the 1830s he pioneered operational research, designing and using multiple-pen recorders to analyse the performance of railway trains. He invented diving equipment, signalling heliographs, flashing lighthouses, tree-ring dating, games-playing machines and coloured lighting for theatres - indeed, he designed a ballet which demonstrated the theatrical potentialities of coloured lighting. His campaign against the nuisance of street musicians gained him even greater notoriety than did his calculating engines (Babbage, 1864, Chapter 26), but he is now regarded as a pioneer campaigner against noise pollution.

From his student period at Cambridge onwards (1810-1814) Babbage played an active part in the formation and operation of many societies, including the Analytical Society of Cambridge (which developed into the Cambridge Philosophical Society), the Astronomical Society (now the Royal Astronomical Society) and the British Association for the Advancement of Science.

2. Babbage and statistics

Babbage was also an important pioneer in statistics. He published mathematical studies of games of chance (Babbage, 1821), and he repeatedly urged the importance of collecting, publishing, studying and utilising statistics on a wide range of topics. In 1824 he served as actuary for a proposed life assurance concern, which did not eventuate. However, the detailed study which he made then of the operation of insurance institutions resulted in his book (Babbage, 1826), in which he examined the practices (*and* malpractices!) of the insurance institutions in Great Britain. That book was written not for actuaries but for educated people generally, and he gave clear accounts of the manner in which annuities and insurance policies are designed on the basis of statistical data on duration of lives. His pioneering study of political economy *On the Economy of Machinery and Manufactures* (Babbage, 1835) had much influence upon Mill and upon Marx. That book contains very much statistical data concerning industry and trade, and those statistics were used for making inferences about efficient operation of various industrial and business concerns.

Before 1828, Babbage examined the very high charges then made for delivery of parcels, and he found that the verifications of cost by each of the many carriers involved in delivering a parcel constituted a considerable part of the total cost. Accordingly, he "suggested that if the Government were to become, through the means of the Post-office, parcel carriers, they would derive a greater profit from it than any private trader, because the whole price of verification would be saved by the public. I therefore recommended the enlargement of the duties of the Post-office by employing it for the conveyance of books and parcels" (Babbage, 1864, Chapter 34). Sir Rowland Hill seems to have been inspired by Babbage's proposals to introduce his revolutionary system for delivery of letters anywhere within Great Britain at a uniform charge of 1 penny (for which purpose postage stamps were invented in 1841) (Hyman, 1982, p.65).

Other topics on which Babbage published statistics include: sex-ratios (Babbage, 1829), linguistics (Babbage, 1831), lighthouses (Babbage, 1853), financial transactions (Babbage, 1856), physical and biological data (Babbage, 1857a), and window-breaking (Babbage, 1857b).

At Paris in 1826, Babbage met Lambert Adolphe Jacques Quételet, the founder of modern statistics, and they became close friends (Hyman, 1982, p.61). In 1833 Quételet was sent by the Belgian Government to Cambridge, to deliver "a budget of statistical facts" to the 3rd meeting of the British Association for the Advancement of Science; but when he arrived he found that there was no place for it in any section of the BAAS. Thereupon, Babbage (with some friends, including Malthus) organised a provisional Statistical Section. The General Meeting thereafter approved the permanent establishment of a Statistical Section (under rather stringent rules to confine its enquiries to collections of facts), and before the end of the 1833 meeting that new Statistical Section had attracted an audience larger than for any other section of the BAAS. Babbage was appointed as Chairman of the permanent committee for the Statistical Section. At a public meeting in London on March 15, 1834, Babbage founded the Statistical Society of London (now the Royal Statistical Society of London) (Babbage, 1860a), and he was active as the Trustee for the rest of his life (Hyman, 1982, p.151).

Quételet continued to develop statistical science, and eventually he organised the First International Statistical Congress which was held at Brussels in September 1853,

with Babbage participating (Babbage, 1853 and 1857a).

3. Charles Babbage and New Zealand

Babbage's elder sons Dugald Bromhead Babbage (1823 - after 1881) and Benjamin Herschel Babbage (1815-1878) migrated to South Australia in 1849 and 1851. Benjamin Herschel became a prominent explorer and engineer, and Dugald Bromhead introduced currant farming into South Australia. Very many relics of Charles Babbage are now preserved in New Zealand and in Australia, some with his descendants and some in various museums and libraries. The Wanganui Regional Museum has a large collection of Babbage family papers from the 16th century onwards, including the manuscript of Charles Babbage's extraordinary memoir *Passages from the Life of a Philosopher* (Babbage, 1864). The Babbage family in Auckland have the first Gold Medal of the Royal Astronomical Society, which was awarded to Charles Babbage on February 13, 1824, for his invention of the Difference Engine - the first of his calculating engines, none of which was completed. They hold a fragment of the Difference Engine - one of the six fragments assembled in 1879 by Charles Babbage's youngest son, from parts made before 1834. They have inscribed books and many letters to Charles Babbage, including two from his remarkable young disciple Augusta Ada, Countess of Lovelace (1815-1852), the daughter of Byron (Tee, 1983).

Dr Stuart Barton Babbage, a great-great-grandson of Charles Babbage, was born at Auckland in 1916, he studied history at Auckland University College (graduating MA in 1935 (Babbage, 1937)), and he became Anglican Dean of Sydney and then of Melbourne. His large collection of family relics includes a huge album with diplomas from about 40 scientific societies in Great Britain, Europe, Russia, Canada and the USA, which elected Charles Babbage as an Honorary Fellow or as a member (Tee, 1983). One of those diplomas, nominating Babbage as a Corresponding Member of the Belgian Commission Centrale de Statistique, was signed on May 19, 1854, by Quételet, as President of that Commission.

In Dunedin Public Library, the Alfred and Isabella Reed Collection contains many manuscript letters from eminent people in Great Britain. There are 10 letters from Babbage in that collection: to William John Broderip, to Sir John and Lady Lubbock, to "Dear Madam", to the Professors of University College London, to Miss Angela Burdett-Coutts, to Sir Benjamin and Lady Brodie, to Professor Richard Owen, to "My dear Sir", to Mrs Hodgson Cadogan and to "My dear Madam". Most of those are brief social notes - none of them deals with statistics, and only the note to Owen mentions any scientific matters.

4. The Governor, the gaoler and the genius

Sir George Grey (1812-1898) was born at Lisbon in 1812, and he became an engineer Captain in the British Army in Ireland. In 1836 his friend Charles Darwin returned to England after five years travelling around the world on HMB *Beagle*, and Darwin's enthusiastic account of his experiences inspired Grey to go exploring in Western Australia. Babbage assisted Grey, by arranging for the Royal Geographical

Society to sponsor Grey's expedition; and Grey named after Babbage the low and sandy island off the current site of Carnarvon. Grey became Governor of South Australia, Governor of New Zealand (twice), Governor of Cape Colony (twice) and Premier of New Zealand. He maintained a very strong interest in science, and he corresponded with many scientists, including Babbage (Tee, 1983).

In the 1840s the British economy was devastated by the Irish Famine, and in 1847 Babbage's neighbour, the builder Henry Monson (1793-1866), was utterly ruined. Emigration to New Zealand offered Monson the only chance of avoiding starvation. Babbage offered his assistance, and he went to considerable trouble to arrange for Monson and his sons to sail on the *John Wickliffe* in 1847, with the founders of the Otago Settlement. Babbage presented Monson with a lathe, and with multiple copies of some of his books; some for Monson and his sons, some for Governor Grey personally, and some for Grey to pass on to a library in New Zealand. Babbage wrote to Grey commending the Monson family to him, and Grey reported to Babbage that, after Henry Monson's tiny cottage at Leith had burned down, he had given Monson the post of Dunedin's gaoler (Tee, 1984).

Monson worked as the gaoler from 1851 to 1861, during which period he proved himself to be an exceptionally humane and compassionate man. He became very popular with his inmates - but less so with the respectable citizens of Otago, who were scandalised (in 1856) to learn that the crowd at a racecourse meeting had included the inmates of Dunedin gaol. Monson had let them out with instructions to be back by half-past 5 o'clock - and they did all return close to that time! (Locke, 1978).

Nine years after Babbage had assisted the Monson family to sail to Otago a letter arrived for Henry Monson in London, and Babbage forwarded that letter (at his own expense) to Dunedin. Henry Monson's second son John wrote to Babbage, thanking him warmly for his continuing assistance, and telling how "my respected father" and himself were progressing in Otago (Tee, 1984).

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