A Short Account of the History of Mathematics

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The Introduction of Analysis into England

The complete isolation of the English school and its devotion to geometrical methods are the most marked features in its history during the latter half of the eighteenth century; and the absence of any considerable contribution to the advancement of mathematical science was a natural consequence. One result of this was that the energy of English men of science was largely devoted to practical physics and practical astronomy, which were in consequence studied in Britain perhaps more than elsewhere.

Ivory

Almost the only English mathematician at the beginning of this century who used analytical methods, and whose work requires mention here, is Ivory, to whom the celebrated theorem in attractions is due. Sir James Ivory was born in Dundee in 1765, and died on September 21, 1842. After graduating at St. Andrews he became the managing partner in a flax-spinning company in Forfarshire, but continued to devote most of his leisure to mathematics. In 1804 he was made professor at the Royal Military College at Marlow, which was subsequently moved to Sandhurst; he was knighted in 1831. He contributed numerous papers to the Philosophical Transactions, the most remarkable being those on attractions. In one of these, in 1809, he shewed how the attraction of a homogeneous ellipsoid on an external point is a multiple of that of another ellipsoid on an internal point: the latter can be easily obtained. He criticized Laplace's solution of the method of least squares with unnecessary bitterness, and in terms which shewed that he had failed to understand it.

The Cambridge Analytical School

Towards the beginning of the last century the more thoughtful members of the Cambridge school of mathematics began to recognize that their isolation from their continental contemporaries was a serious evil. The earliest attempt in England to explain the notation and methods of the calculus as used on the continent was due

to Woodhouse, who stands out as the apostle of the new movement. It is doubtful if he could have brought the analytical methods into vogue by himself; but his views were enthusiastically adopted by three students, Peacock, Babbage and Herschel, who succeeded in carrying out the reforms he had suggested. In a book which will fall into the hands of few but English readers I may be pardoned for making space for a few remarks on these four mathematicians, though otherwise a notice of them would not be required in a work of this kind. The original stimulus came from French sources, and I therefore place these remarks at the close of my account of the French school; but I should add that the English mathematicians of this century at one struck out a line independent of their French contemporaries.

Woodhouse

Robert Woodhouse was born at Norwich on April 28, 1773; was educated at Caius College, Cambridge, of which society he was subsequently a fellow; was Plumian professor in the university; and continued to live at Cambridge till his death on December 23, 1827.

Woodhouse's earliest work, entitled the Principles of Analytical Calculation, was published at Cambridge in 1803. In this he explained the differential notation and strongly pressed the employment of it; but he severely criticized the methods used by continental writers, and their constant assumption of non-evident principles. This was followed in 1809 by a trigonometry (plane and spherical), and in 1810 by a historical treatise on the calculus of variations and isoperimetrical problems. He next produced an astronomy; of which the first book (usually bound in two volumes), on practical and descriptive astronomy, was issued in 1812, and the second book, containing an account of the treatment of physical astronomy by Laplace and other continental writers, was issued in 1818. All these works deal critically with the scientific foundation of the subjects considered — a point which is not infrequently neglected in modern textbooks.

A man like Woodhouse, of scrupulous honour, universally respected, a trained logician, and with a caustic wit, was well fitted to introduce a new system; and the fact that when he first called attention to the continental analysis he exposed the unsoundness of some of the usual methods of establishing it, more like an opponent than a partisan, was as politic as it was honest. Woodhouse did not exercise much influence on the majority of his contemporaries, and the movement might have died away for the time being if it had not been for the advocacy of Peacock, Babbage, and

Herschel, who formed an Analytical Society, with the object of advocating the general use in the university of analytical methods and of the differential notation.

Peacock

George Peacock, who was the most influential of the early members of the new school, was born at Denton on April 9, 1791. He was educated at Trinity College, Cambridge, of which society he was subsequently a fellow and tutor. The establishment of the university observatory was mainly due to his efforts, and in 1836 he was appointed to the Lowndean professorship of astronomy and geometry. In 1839 he was made dean of Ely, and resided there till his death on Nov. 8, 1858. Although Peacock's influence on English mathematicians was considerable, he has left but few memorials of his work; but I may note that his report on progress in analysis, 1833, commenced those valuable summaries of current scientific progress which enrich many of the annual volumes of the Transactions of the British Association.

Babbage

Another important member of the Analytical Society was Charles Babbage, who was born at Totnes on Dec. 26, 1792; he entered at Trinity College, Cambridge, in 1810; subsequently became Lucasian professor in the university; and died in London on Oct. 18, 1871. It was he who gave the name to the Analytical Society, which, he stated, was formed to advocate "the principles of pure d-ism as opposed to the dot-age of the university." In 1820 the Astronomical Society was founded mainly through his efforts, and at a later time, 1830 to 1832, he took a prominent part in the foundation of the British Association. He will be remembered for his mathematical memoirs on the calculus of functions, and his invention of an analytical machine which could not only perform the ordinary processes of arithmetic, but could tabulate the values of any function and print the results.

Herschel

The third of those who helped to bring analytical methods into general use in England was the son of Sir William Hershel (1738-1822), the most illustrious astronomer of the latter half of the eighteenth century and the creator of modern stellar astronomy. Sir John Frederick William Herschel was born on March 7, 1792, educated at St. John's College, Cambridge, and died on May 11, 1871. His earliest original

work was a paper on Cotes's theorem, and it was followed by others on mathematical analysis, but his desire to complete his father's work led ultimately to his taking up astronomy. His papers on light and astronomy contain a clear exposition of the principles which underlie the mathematical treatment of those subjects.

In 1813 the Analytical Society published a volume of memoirs, of which the preface and the first paper (on continued products) are due to Babbage; and three years later they issued a translation of Lacroix's Traité élémentaire du calcul différentiel et du calcul intégral. In 1817, and again in 1819, the differential notation was used in the university examinations, and after 1820 its use was well established. The Analytical Society followed up this rapid victory by the issue in 1820 of two volumes of examples illustrative of the new method; one by Peacock on the differential and integral calculus, and the other by Herschel on the calculus of finite differences. Since then English works on the infinitesimal calculus have abandoned the exclusive use of the fluxional notation. It should be noticed in passing that Lagrange and Laplace, like the majority of other modern writers, employ both the fluxional and the differential notation; it was the exclusive adoption of the former that was so hampering.

Amongst those who materially assisted in extending the use of the new analysis were William Whewell (1794-1866) and George Biddell Airy (1801-1892), both Fellows of Trinity College, Cambridge. The former issued in 1819 a work on mechanics, and the latter, who was a pupil of Peacock, published in 1826 his Tracts, in which the new method was applied with great success to various physical problems. The efforts of the society were supplemented by the rapid publication of good text-books in which analysis was freely used. The employment of analytical methods spread from Cambridge over the rest of Britain, and by 1830 these methods had come into general use there.