Revue d'Histoire des Mathématiques

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Tome 21 Fascicule 1 2015

SOCIÉTÉ MATHÉMATIQUE DE FRANCE

Publiée avec le concours du Centre national de la recherche scientifique

REVUE D'HISTOIRE DES MATHÉMATIQUES

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Périodicité : La *Revue* publie deux fascicules par an, de 150 pages chacun environ.

Tarifs : Prix public Europe : 87 €; prix public hors Europe : 96 €;
prix au numéro : 43 €.
Des conditions spéciales sont accordées aux membres de la SMF.

Diffusion : SMF, Maison de la SMF, Case 916 - Luminy, 13288 Marseille Cedex 9
Hindustan Book Agency, O-131, The Shopping Mall, Arjun Marg, DLF Phase 1, Gurgaon 122002, Haryana, Inde
AMS, P.O. Box 6248, Providence, Rhode Island 02940 USA

 N° ISSN : 1262-022X

Maquette couverture : Armelle Stosskopf

Revue d'histoire des mathématiques
21 (2015), p. 111–150

"ANTI-AIRCRAFT GUNS ALL DAY LONG": KARL PEARSON AND COMPUTING FOR THE MINISTRY OF MUNITIONS

June Barrow-Green

Abstract. — In December 1916 Pearson offered the services of his staff from the Drapers' Biometric Laboratory and the Galton Eugenics Laboratory at University College London, to the Ministry of Munitions. The offer was accepted with alacrity by A.V. Hill, head of the Anti-Aircraft Experimental Section, who was eager to liberate his own men from the labours of computation. From January 1917 until March 1918 Pearson worked tirelessly on the often tedious work of computing of ballistic charts, high-angle range tables and fuze-scales. He also made significant contributions to the mathematical theory behind the tables. Pearson's staff consisted of mathematicians, computers and draughtsmen. Women were an important constituent of his work force, not least because the escalating demands of conscription meant that the men were often at risk from the recruiting sergeants. Things did not always go smoothly—Pearson did not take kindly to the calculations of his staff being questioned by the mathematicians producing the data—and Hill sometimes had to work hard to keep the peace.

Résumé ("Anti-aircraft guns all day long" : Karl Pearson et l'informatique au Ministère des munition)

Au mois de décembre 2016, Karl Pearson offrit au Ministère des munitions les services de son personnel du Drapers' Biometric Laboratory et du Galton Eugenics Laboratory, à University College London. L'offre fut très vite acceptée par le chef de la Section expérimentale antiaérienne, A.V. Hill, pressé de

Texte reçu le 5 août 2014, révisé le 29 novembre 2014, accepté le 11 décembre 2014.

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2000 Mathematics Subject Classification : 01A60.

Key words and phrases : Karl Pearson, first world war, exterior ballistics, anti-aircraft gunnery.

Mots clefs. — Karl Pearson, première guerre mondiale, balistique extérieure, artillerie anti-aérienne.

libérer sa propre équipe du travail de calcul. De janvier 1917 à mars 1918, Pearson travailla infatigablement au calcul souvent ingrat des tableaux balistiques, des tables de tir à angle élevé, et des étalonnages de fusée. Il apporta aussi des contributions significatives à la théorie mathématique sur laquelle les tables se fondaient. L'équipe de Pearson incluait des mathématiciens, des calculateurs et des dessinateurs. Les femmes en formaient un contingent important, en particulier parce que les demandes de plus en plus grandes de la conscription rendaient les hommes vulnérables aux sergents-recruteurs. Les obstacles ne manquèrent pas — Pearson n'appréciant pas que les calculs de son équipe soient remis en question par les mathématiciens produisant les données — et Hill eut parfois du mal à maintenir la paix.

1. INTRODUCTION

On 4 August 1914, the day Britain declared war on Germany, Karl Pearson offered the services of his Laboratory staff at University College London to the Government, and from then on and for the duration of the War he spent much of his time working in support of the war effort.[1] Between August 1914 and July 1917, he produced unemployment charts for the Board of Trade, calculated the torsional strain in the blades of aeroplane propellers for the Royal Aircraft Factory, and calculated bomb trajectories for the Admiralty Air Department. Meanwhile in January 1917 he began working for the Ministry of Munitions on ballistic computations for anti-aircraft guns, as an aid to the Anti-Aircraft Experimental Section (AAES), and it is this work, which occupied him throughout the whole of 1917 and the early months of 1918, that is the subject of this article.[2]

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1 According to Pearson's account, written two years after the event, Pearson offered the services of the Laboratory on the 3 August 1914. K. Pearson to T.G. Foster (Provost of University College London) *Confidential Report on the Work of the Laboratory Staff*, 23 February 1916. [Pearson Papers, 600] But Pearson's son, Egon Pearson, gives the date as the 4 August which is more likely. [Pearson 1938, 85]
That Pearson responded so immediately to the declaration of war may have been to leave no doubt about his patriotism. (During 1879/1880 Pearson had spent a year at university in Germany and had developed a strong attachment to German culture, and it was during this period that he started to spell his first name with a K instead of a C, possibly to reflect this attachment. [Haldane 1957, 304])
For biographical information about Pearson, see [Porter 2004], which largely focuses on Pearson's personal and intellectual development, and [Pearson 1938]. For discussions of Pearson's scientific work, see the many publications of M.E. Magnello, for example [Magnello 2009], [Magnello 1999], [Magnello 1998], [Magnello 1994].

2 For discussions of WW1 ballistic practices outside Britain, see [Aubin & Goldstein 2014] (in particular [Aubin 2014] and [Nastasi & Tazzioli 2014]), [Gluchoff 2005; 2011], [Grier 2001].

2. FORMATION OF THE ANTI-AIRCRAFT EXPERIMENTAL SECTION

On 8 September 1915 Adelaide Davin, one of Karl Pearson's computing assistants at University College London (UCL), saw a Zeppelin for the first time. It was a momentous event and she gave Pearson a vivid description:

> The whole of London is in a state of subdued excitement today as a result of the raid last night. We are all congratulating ourselves that we have seen a Zeppelin at last [...] from all accounts the damage appears to have been greatest just at the back of the College. A bomb fell in the centre of Queen's Square [...]. I was coming home in a tram just before 11 o'clock when the driver called out that there had been a Zep, and that it had been fired at twice—then the tram stopped, and the lights went out, whereupon several women began to shriek. I got out walked home to find all the neighbours in the street gazing heavenwards. Nobody obeyed the instructions to seek shelter. We could see the flashes of the anti-aircraft guns, but they all went very wide of the mark.[3]

The Zeppelin raid was the worst in London during 1915, not only in terms of the number of people killed and injured, but also with regard to the damage to property.[4] But the enemy escaped unscathed. This was not an isolated incident. Zeppelins, despite being large and slow targets, were difficult to bring down. The theory and practice of anti-aircraft gunnery was in the early stages of development—the British, for instance, did not have any anti-aircraft guns until 1914—and anti-aircraft guns were not yet reliable. But as the Germans took to the air in increasing numbers, for reconnaissance and for bombing, in Zeppelins and in aeroplanes, the need to improve air defences became ever more pressing.[5]

In early 1916, in response to this need, the Ministry of Munitions[6] set up the AAES within the Munitions Inventions Department (MID),[7] and appointed as its head A.V. Hill, a physiologist who had graduated as third

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3 A. Davin to K. Pearson, 9 September 1915. [Pearson Papers, 674/9]

4 20 people were reported killed and 86 injured, and the damage to property was estimated at half a million pounds. *The Times* 11 September 1915. The first Zeppelin attack of the war took place over Norfolk on 19 January 1915. [Hogg 1978, 33–37]

5 There was also a problem dealing with Zeppelins from the air. A simple penetration of their fabric was not enough to destroy them and it was only after the development of the incendiary bullet that Zeppelins were brought down on English soil, the first such event occurring only days before the raid witnessed by Miss Davin.

6 Within three years of its formation, the Ministry of Munitions had become the "largest government department the country had ever seen with as many as 1,600,000 men and 800,000 women employed on protected munitions work." [Hazelhurst 1919–1922]

7 The leading figures in the formation of the AAES were Horace Darwin, founder of the Cambridge Scientific Instrument Company, and the electrical engineer Sir Alexander Kennedy. For further details, see [Barrow-Green 2014, 89–92].