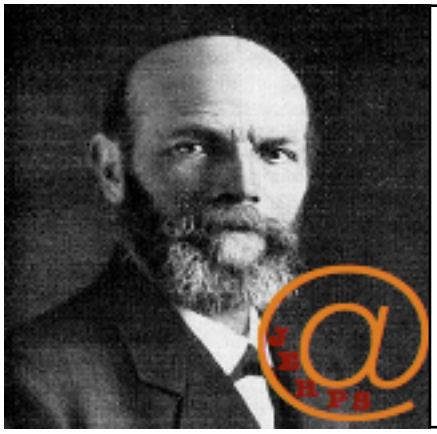


Journ@l Electronique d'Histoire des Probabilités et de la Statistique

Electronic Journ@l for History of Probability and Statistics

Vol 6, n°2; Décembre/December 2010

www.jehps.net

Tales of two Societies – London and Paris 1860-1940

John ALDRICH [1]

Abstract

This paper considers the relationship between the Statistical Society of London (from 1887 the Royal Statistical Society) and the Société de Statistique de Paris and, more generally, that between English and French statisticians in the period 1860-1940. The societies were originally for numerically minded economists, public health experts, demographers or geographers but the modern societies are organised around probability and mathematical statistics. At the beginning of our period the statisticians of each country specialised in that country's facts but at the end statisticians in both countries were starting to contribute to an international project. In the late 1930s Maurice Fréchet, Georges Darmois and Daniel Dugué were interacting with Ronald Fisher in a new way that set a pattern for statistics in the post-war period

Key names : E. Borel, A. L. Bowley, G. Darmois, D. Dugué, F. Y. Edgeworth, R. A. Fisher, M. Fréchet, K. Pearson, L. March, G. U. Yule.

Keywords : History of Statistics, Royal Statistical Society, Société statistique de Paris.

Acknowledgement : I am grateful to Janet Foster for help at the RSS archives and to Cheryl Hoskins for help at the Fisher archives of the University of Adelaide. I also thank Michel Armatte for his comments.

1. Economics Division, School of Social Sciences, University of Southampton, Southampton, SO17 1BJ, UK. e-mail : john.aldrich@soton.ac.uk

1 Introduction

In 1885 the Société de Statistique de Paris celebrated its twenty-fifth anniversary and–one year late–the Statistical Society of London celebrated its fiftieth. At the dinner in London Émile Levasseur (1885, p. 279) described the societies as "of the same family" having been formed with "the same object in view." In Paris Loua (1885, p. 357) referred to the Société and "sa soeur aînée."

The "object" has long since changed. The old societies were for numerically minded economists, public health experts, demographers or geographers, while their descendants are organised around probability and mathematical statistics. Looking back, probability was the foundation for the comprehensive schemes Laplace devised before the London Society was formed; indeed Hald (1998) presents the history of mathematical statistics as a series of footnotes to Laplace. However, there was no Laplace project either in London in 1834 or in Paris in 1860 and the changes in the 20th century were not a return to origins. I have recently–see Aldrich (2010)–traced the transformation in the London Society (the change to Royal Statistical Society in 1887 was a change only in name and dignity) and I want to compare its experience with that of the Société and consider how the transformation was reflected in the relationship between French and English statisticians in the period 1860-1940. Greater changes came later but something of the future was already visible in the years leading up to the Second World War.

Developing the family theme, contacts between Paris and London were originally like those between branches of a large family that comes together only on special occasions–respectful but distant. The occasions were big anniversaries and gatherings of representatives of the entire international family, statistical congresses and–from 1887–meetings of the International Statistical Institute. However, at the very end of our period a few people in London and Paris had experiences like those in a 'real' family with a shared everyday life. The mathematical statisticians of the 1930s–Maurice Fréchet, Georges Darmois, Daniel Dugué in Paris and Ronald Fisher in London–engaged whether they agreed or disagreed.

The tales below offer glimpses of this changing family life. The view is from London for my knowledge of Paris is limited and based largely on secondary sources. The view is also quite narrow for the emphasis is on the change from *then* when there was no mathematical statistics to *now* when it is fundamental. However the history of the societies is part of the history of economics, public health, demography and geography in the two countries–indeed part of the history of public administration for both Society and Société contributed to the development of official statistics of the two countries and to official statistics internationally. Desrosières (1998, ch. 5) explores some of these themes in his comparison of statistics and the state in France and Britain and Schweber (2006) explores others when she compares British vital statistics and French démographie in the period 1830-1885. The societies and the Institute took their history very seriously and celebrated it with anniversary publications as well as with toasts: the centenary pieces by Macrosty (1934) and Depoid (1961)

Journ@l électronique d'Histoire des Probabilités et de la Statistique/ Electronic Journal for History of Probability and Statistics . Vol.6, n°2. Décembre/December 2010

and the semi-centenary piece by Zahn (1934) are especially thorough. I have been sparing with general references on the Society and its people for there are many in Aldrich (2010). In its limited domain this paper treats only a detail of a larger picture presented in works like *The Probabilistic Revolution* (vol. 1, Krüger, Daston and Heidelberger (1987), vol. 2, Krüger, Gigerenzer and Morgan (1987)), Porter (1986) and Stigler (1987).

2 "Fellow labourers"

In 1905 there was more partying in London and Yves Guyot, a past-president of the Société, must have pleased his hosts when he referred to the "daughter society" of Paris. However, when Fernand Faure took the genealogy of the Société back to 1799, Yule (1906, p. 445) passed on the correction; Falguerolles (2010) gives a modern account of the predecessors.

The London Society was formed along with other societies in the United Kingdom and abroad in what Westergaard (1934) called the "age of enthusiasm." A French (and probability) connection may be suspected in the Society's origins for some of the founding generation of the Society and its older sibling, the Statistics Section of the British Association for the Advancement of Science, were versed in the writings of Laplace–vide Quetelet, Drinkwater and Lubbock, Whewell and Babbage–and Poisson was still producing social mathematics. However, probability was *not* part of the Society's object which, according to the prospectus of 1834 (reproduced in Macrosty (1934. pp. 22-8)), was "procuring, arranging and publishing 'Facts calculated to illustrate the Condition and Prospects of Society.'" Four main classes of fact were distinguished: economical statistics, political statistics, medical statistics and moral & intellectual statistics. In the first issue of the *Journal* it was explained why the facts would usually be numerical: "The Statist commonly prefers to employ figures and tabular exhibitions, because facts, particularly when they exist in large numbers, are most briefly and clearly stated in such forms." (Anon., 1838, p. 1.) There was no Laplace project in the early decades of the Society and the first person to embrace it, or at least its Quetelet version, was W. S. Jevons (1835-1883) who arrived in the 1860s. Jevons did not really press the cause inside the Society and that was left to his friend Edgeworth as we see Section 4 below.

There are many accounts of the early decades of the Society giving the context for the programme of "procuring, arranging and publishing" and describing how it was to be implemented; see, inter alia, Cullen (1975), Hilts (1977) and Goldman (1983). Some of the founding generation wanted to promote an alternative to deductive Ricardian political economy and originally the Society envisaged collecting data itself. The Society–and political economy–changed and a comfortable accommodation was reached; the Society also gave up trying to mount its own statistical enquiries. Although circumstances and priorities changed, the Society steadily built up an infrastructure that would support its activities throughout our period. From 1838 the Society had a *Journal* to broad-

Journ@l électronique d'Histoire des Probabilités et de la Statistique/ Electronic Journal for History of Probability and Statistics . Vol.6, n°2. Décembre/December 2010

cast the "arranged" facts: as well as reporting the transactions of the meetings, this printed miscellaneous items–statistical returns and articles–that were not linked to the meetings. As an information hub, the Society's chief physical resource was its library (more recently considered redundant and dispersed): by 1855 this had 2500 volumes–see Tooke (1855, p. 98)–and from the 70s additions (including the latest issues of the Paris journal) were reported in the *Journal*. In the 70s the *Journal* began publishing book reviews–any early French title was Block's *Traité Théorique et Pratique de Statistique* which Anon. (1878, p. 151) judged a "thorough and exhaustive treatise on statistics [which] will be of the highest interest to all who study the science." From 1896 the *Journal* listed the contents of recent periodicals and its first selection of French titles included the *JSSP*.

From the beginning, the "condition and prospects of society" were understood to have universal reference: facts about other countries mattered–both intrinsically and for comparisons–and statisticians in those countries were clearly best placed to obtain them. The first volume of the *Journal* (1838) printed the Annual Report of the Statistical Society of Saxony–in translation for the *Journal* published only in English–and named eight Foreign Honorary Fellows. The system of honorary fellows underlined the significance of the Society's project, promoted communication and assisted directly in the procurement of facts for the Honorary Fellows often contributed to the library. France provided two of the eight Fellows of 1838–six other countries contributed one each–and France kept its lead until after the Second World War. The Fellows from France with date of election (where I could find it) were Dupin (1838) Guerry (1838), Le Play (1842), Chevalier (1850), Garnier (1850), Block (1856), Horn (1860), Levasseur (1860), Wolowski (1867), Chervin (1879), Jacques Bertillon (1880), de Foville, Cheysson, Colson, Guyot (1908), March (1911), Barriol (1913), Delatour (1918), Borel (1933), Huber (1936), Darmois (1954), Fréchet (1955), Lévy (1955) and Dugué (1975). The *Journal* recorded the award of these honours and, when the time came, commemorated the lives. The obituary for Maurice Block–Anon. (1901)–is representative: a basic biography, a comment based on personal knowledge–"he was of a modest and retiring disposition though of marked independence of character, and very straightforward"–and a general appraisal–"His loss will be widely felt not only in France but amongst statisticians and economists of all countries."

The circumstances surrounding the founding of the Paris Société and its first decades have been described by Kang (1992) while Depoid (1961), Damiani (1987), Droesbeke (2005) and Armatte (2010) take a longer view. The Société bore a general resemblance to the London Society; their names belied the fact that both societies considered themselves *national* societies–in the United Kingdom the societies of Dublin and Manchester were considered local societies. The objectives of the national societies were similar: in his opening address Michel Chevalier (1860, p. 2) went from the ·maxim, "Connais-toi toi-même" to the need for proper economic, vital and criminal statistics in the course of a paragraph. There was no reference to mathematics and the Dutch perception of French "numbers and equations" versus German "knowledge of state power"–

see Stamhuis (2010)–seemed to belong to an earlier age. The London and Paris societies were unique–in Europe–in having statistics and *only* statistics in their title and perhaps in a family of two a special relationship was inevitable! A perusal of Martin's (1896) survey of the international statistical scene suggests such a conclusion but it would be useful to have a systematic comparison of what the European societies *did*; meanwhile see the observations in Droesbeke (2010), Mespoulet (2010) and Stamhuis (2010).

The London and Paris societies were not societies of professional statisticians for, apart from a few civil servants, there were no professional statisticians: in the German-speaking lands there were academic statisticians but not in England or France. The Société–like the Society–was organised around the regular meeting and a journal though it also published monographs; the library was as important as in London and Depoid (1961, pp. 120-4) tells its story. The journals published a similar mix of papers on economic and vital statistics. On the centenary of the Société Depoid (1961, p. 143) classified the papers from the *JSSP*; an extract from his much larger table will give an idea of the balance of topics and of the slow growth in mathematical statistics:

	1860-85	1886-1910	1911-35	1936-60
Statistique mathématique–Calcul des probabilités	2	3	7	34
Méthode statistique	6	11	10	12
Démographie–Population	65	65	47	28
Questions sociales–Statistiques judiciaires	30	36	21	10
Finance et banque	15	38	37	14
Géographie économique–Monographie	32	13	9	4

The pattern was similar in London–see Macrosty (1934, pp. 56-63, 118-13, 208-223)–but there was more mathematics earlier and in 1934 the Society started a second journal which became the modern *Series B*. The centenary volumes also indicate that the older society was bigger and stayed bigger: 25 years after it was founded the Société had 487 members–Depoid's (1961, p. 184) estimate–against the 860 given by Macrosty (1934, p. 105). The societies had honorary foreign members but I have found no British ordinary member in the Société and only one French ordinary member in the Society–Yves Guyot. He was later made an Honorary Foreign Fellow and when he died the obituarist (Anon. (1928, p. 278)) wrote, "We counted him one of ourselves." The societies were like clubs, debating societies with access to a good library, and not at all like the modern American Statistical Association (founded in 1839) with its 18,000 members from 90 countries. Reviewing the *Société's* Jubilee volume, Anon. (1909, p. 748) noticed "one advantage that does not fall to the lot of its sister on this side of the Channel"–it received public subsidies.

The founding of the Société was not marked in the London *Journal* but it was very likely known for the principals included some familiar figures: Chevalier had been an Honorary Fellow for a decade and had recently negotiated a trade treaty with Britain and Alfred Legoyt, head of the Statistique Générale de la France (SGF) with his access to vital statistics, was the most cited French

statistician in London. Legoyt was also the official delegate to the International Statistical Congress which was held in London a few weeks after the Société's inaugural meeting. The Société appears to have been first mentioned in an article by Tite (1864) comparing mortality in London and Paris where the inevitable reference to Legoyt extended to his role in the Société. A few years later Newmarch's address on the "Progress and present condition of statistical inquiry" contained a long extract from an article in the *JSSP* by Legoyt ("whose name is among the most eminent of our fellow labourers on the Continent") bearing on Newmarch's (1869, p. 368) contention that "the real mischief and incubus of military arguments will never be understood by legislators or subjects until their effects are exhibited in hard facts and naked detail." Military expenditure was no. 6 on Newmarch's list of 18 topics "which in this country require most urgent attention." No. 18 on the list was "Mathematics and logic of Statistics" but here there was no progress to report.

In the 19th century France was the foreign country that most interested the British–most dangerous, most attractive and most accessible. Tombs and Tombs (2007) begin their history of Anglo-French relations with the "second hundred years war" which ended in 1815 and 1860 falls in the middle of their chapter on "the war that never was." French was the most widely taught modern language and France the most visited country. France was the most interesting country for the statisticians too and the *Journal* published more news of France–and from France–than of any other country. In its first 60 or so years the *Journal* would reprint material of interest to statisticians from British and foreign sources. Often the topics were newsworthy although two translations from German published in 1883–John (1883) and Mayr (1883)–were more professorial than anything written in England. From 1879 to 1894 the *Journal* published a stream of articles from France: de Foville (1879), Cheysson (1882), Levasseur (1883), Delboy (1884), Bertillon (1884), Liegard (1884), Levasseur (1885b), Fournier de Flaix (1886), Levasseur (1887), Neymarck (1889a, b), Yvernes (1890), Bertillon (1892), Levasseur (1892a, -b), Beaurin (1895). Some of the articles were about France, some about third countries–Spain, Russia and the United States–and some were general. Nearly all came from the *JSSP*–a few were from *l'Economist français*–and the visibility of the Société sustained the sense of a special relationship between London and Paris evident at the Jubilee in 1885. In the later 90s the *Journal* stopped re-printing material and in the period to 1914 there were only two French appearances in the *Journal*: Guyot (1902) presented a paper on the sugar industry on the Continent at a meeting and there was a paper by March (1912a) making some international demographic comparisons.

The Society's interest in France was not quite mirrored in the Société. The Société also collected and disseminated information but, as a smaller body with fewer people to share the work, it did not operate on the same industrial scale. The *JSSP* carried less foreign news in total and Britain was not very prominent, either as subject or source; March (1911) wrote on the death of Galton but only one previous English statistical death was reported, that of Leone Levi, an energetic participant in the ISI. Foreign articles tended to be summarised rather than translated and reproduced in full; the most prominent such 'contributor'

was Ernst Engel of the Prussian Bureau of Statistics although he was only quoted three times. Translations were rare but they included Benini (1904) from Italian and Pearson–in March (1912c)–from English The *JSSP* began publishing book reviews in the 70s but at first only in small numbers. In 1911 it published 20 book reviews while the *JRSS* published three times as many. The works reviewed in the *JSSP* were predominately French with 3 German titles and 1 English; in the *JRSS* set were 14 German titles, 12 French, 2 Dutch, 1 Swedish and 1 Italian. Some of the watching in Paris was done elsewhere: thus Block's obituarist–Anon. (1901, p. 292)–noted how Block produced a resumé of the contents of the *JRSS* for the *Journal des Économistes*. This was actually part of an ambitious regular survey of the "principales publications économiques de l'étranger"–see e.g. Block (1901).

In procuring facts, a natural international division of labour imposed itself but there were projects to which statisticians of all countries could contribute. For international comparisons, standardisation of categories and measures was needed and international organisations were created to facilitate this; see the next Section. The three papers at the Jubilee on the graphical method–by Levasseur, Marshall and Galton–gave a foretaste of the international methodology that mathematical statistics would bring in the 20th century. There were other international methodologies in the 19th century that might have seemed more likely to emerge as *the* methodology common to Society and Société. The core subjects of economic statistics and vital statistics could be treated mathematically and in Britain mathematical economics found its first home in the Society when the *Journal* published Jevons's first effort in 1866; later when he discovered fellow labourers the *Journal* published his very international bibliography (1878). Jevons's main French contact was Léon Walras in Lausanne but, while Jevons was a statistician-economist, Walras was not–see Ménard (1980)–and none of the French mathematical economists seem to have been involved with the Société. The *Statistical Journal* stopped publishing articles on mathematical economics when the *Economic Journal* was established with the leading mathematical economist, Edgeworth as its editor, though reviews of books on mathematical economics continued to appear into the 1930s. The vital statisticians in London and Paris used tools based on mathematics–Levasseur's (1887) article on life-tables was one of the *JSSP* items published in London–but neither Society nor Société made this form of tool-making a major part of its activity.

The next section looks at the Institut International de Statistique, or International Statistical Institute (this name became official in 1947 when English became the organisation's other official language). The significance of the IIS/ISI in the history of relations between London and Paris is two-fold: the founding of the body was the two societies' joint achievement and their members met at congresses of the Institute.

3 International transactions–the IIS/ISI

The statisticians were pioneers of the international congress. The International Statistical Congress, another Quetelet inspiration, held its first meeting in Brussels in 1853 with meetings every few years until 1876 when the system broke down; Westergaard (1932, ch. XIV) and von Neumann-Spallart (1885) describe this congress period. Members of the two societies attended the congresses and wrote reports of the proceedings for the journals; Depoid (1961, pp. 108-9) describes the involvement of the Société. After the Congress system broke down, its purpose was renewed and given more effective and permanent form with the creation of the Institut International de Statistique.

In the Society the need for new international arrangements came up in connection with the celebrations for the jubilee. It was decided that the celebrations would take the form of a conference and the Council resolved at its meeting of June 12 1884 (Minute book p. 458) that the object of the conference would be

> (1) To review the work of the Statistical Society during its first fifty years.
>
> (2) To consider what has been achieved by the International Statistical Congresses, or by any other means, in the direction of uniformity of statistics, and by what means that object may be further promoted.
>
> (3) To consider the possibility of establishing an International Statistical Association.

The following summer the possibility became reality and the IIS was established. Zahn (1934, pp. 6-11) describes how the Society and Société coordinated their efforts with the meeting in London following closely the anniversary meeting of the Société. The societies coordinated their invitations and the Society's President Rawson W. Rawson attended the meeting in Paris; see Loua (1885). Levasseur and the Austrian professor-bureaucrat F. X. von Neumann-Spallart were present in London and became Vice Presidents of the new body with Rawson President; see in addition to Zahn, Westergaard (1932, ch. XV and pp. 245ff.) and Nixon (1960).

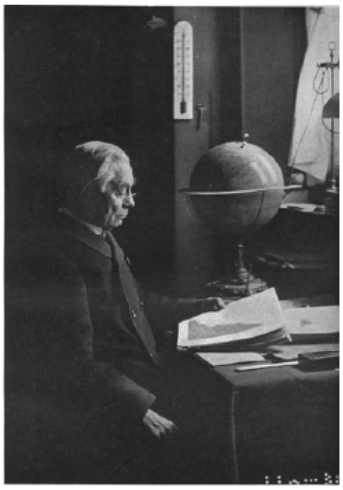
As described by Nixon (1960, p. 123), the Institute's object was

> promoting the progress of administrative and scientific statistics by (1) recommending uniform methods in statistical enquiries in order to increase their comparability (2) calling the attention of governments to questions to be solved by statistics (3) preparing international statistical publications and (4) encouraging an interest in statistical science by governments and others.

The emphasis was on administrative statistics and the Institute looked very much like a society of official statisticians.

Journ@l électronique d'Histoire des Probabilités et de la Statistique/ Electronic Journal for History of Probability and Statistics . Vol.6, n°2. Décembre/December 2010

Exhibit I: Émile Levasseur and the iconography of the geographer



Rawson was President from 1885 to 1899 and Levasseur Vice-President from 1885 to 1911. Rawson (1812-1899) was a figure from the age of enthusiasm: he joined the Society in 1835 and after a career as a colonial administrator gave his time and energy to the Society and the Institute. Rawson was no researcher but his enthusiasm was boundless: thus in 1897 he spoke welcoming Yule's effort to apply the Pearson curves to social data–see Aldrich (2010b, pp. 11-2) for details. Levasseur (1828-1911) *was* a researcher but his work on scientific statistics reflected the conceptions of the times; for biographies see Anon. (1899) and Anon. (1911).

J. B. Martin (1896, p. 605), President of the Society and Treasurer of the Institute, wrote, "The establishment of the Institute has, in my opinion, been of great value to the Society, since we have been brought into more direct relations with many of the most eminent statisticians in all parts of the world." The number of statisticians going abroad for meetings was always small although hosting the meeting would raise larger numbers. The closest of these direct relations were formed between those who ran the Institute and the most eloquent of the *Journal's* obituaries for Honorary Foreign Fellows were written by colleagues, such as that for Alfred de Foville written by Patrick Craigie (1913)–when de Foville was Vice-President Craigie was Secretary-General or Treasurer. The Institute also developed a form of collaboration unknown in either society: the establishment of committees of enquiry into selected topics in which the members tried to come to an agreed position; one on the "representative method" (i.e. sample surveys) is mentioned in Section 6 below and one on correlation figures in Section 7.

The British proved to be both good and bad international citizens. They held important posts in the Institute and worked hard. The group attending

the biennial meeting usually comprised the officers, the Society's Foreign Secretary, an official (governmental) delegate and interested persons. The group was never very large and for Budapest in 1901 it was down to two. It may be that the English had less need of an international forum because there were better opportunities at home–i.e. in the Society–to present their work. A run of poor international showings so disappointed Athelstane Baines, the Society's Honorary Foreign Secretary, that he (1907, p. 449) wrote after Copenhagen, "It was, unfortunately, again the case that the United Kingdom was distinguished by the small proportion present of the members it contributes to the roll of the Institute." Baines could have had Edgeworth in mind: Edgeworth had been elected in 1889 but had never presented a paper and had attended only one meeting, the one in London in 1905. Years later the American W. F. Willcox (1934, p. 311) complained about his countrymen and their notion that membership "is primarily an honor rather than an opportunity." Edgeworth's behaviour is understandable for he was the supreme scientific statistician and had no more than a passing interest in official statistics. After 1907 British attendance improved somewhat; cf. Sections 5-7 below.

The societies and Institute undertook to procure, arrange and publish social facts; this original project made room for a new one, or at least a radical reinterpretation of the original one, and that new project will occupy most of the rest of the paper.

4 The mathematical turn in London

One person in London in 1885 looked beyond the procuring, arranging and publishing of social facts, F. Y. Edgeworth (1845-1926). In his Jubilee paper, "Methods of statistics", Edgeworth (1885, pp. 181-2) contemplated three definitions of "statistics":

> the arithmetical portion of Social Science [...] the science of Means in general (including means of physical observations)..., the science of those Means which relate to social phenomena.

The "arithmetical portion of social science" was Edgeworth's gloss on statistics as it was understood in London–and in Paris–but his interest was in the science, or sciences, of means. His paper was a contribution to the applied science for it showed how significance tests could be applied to social phenomena.

Edgeworth recognised Laplace, Poisson and Cournot as masters but no contemporary French author carried the same weight–Edgeworth (1889) reviewed Bertrand's *Calcul* favorably but he did not get anything from it. (The history of probability in 19th century France is traced in Schneider (1987).) Edgeworth paid more attention to his German contemporaries, treating Wilhelm Lexis (1837-1914) as an authority and Ladislaus von Bortkiewicz (1868-1931) less respectfully; there are sketches of Lexis and Bortkiewicz in Hertz (2001d) and Hertz (2001c) respectively. Edgeworth followed the literature in all the major languages but, as he grew older and as the subject developed in England,

Exhibit II: Karl Pearson and a new iconography

he was less open to foreign influences. His position in the Society was one of isolated eminence: for forty years the *Journal* published his articles on the science(s) of means, in 1912-13 he was President and yet he was hardly read. In 1896, after he had been preaching for more than a decade, a follower appeared, Arthur Bowley (1869-1957). Even so, for Bowley mathematical statistics would always be subordinate to his main interest in economic statistics.

In one of Edgeworth's (1896, p. 534) notes in the *Journal* there is a casual but startling reference to one "who has made the greatest advance in the science of Probabilities which has been made since the era of Poisson." Karl Pearson (1857-1936), the professor of applied mathematics at University College London, was a relative newcomer to probability and Edgeworth liked to be encouraging. Pearson's statistical work, which would reach vast proportions, was part of a new approach to the study of heredity, biometry; Pearson provided the mathematics, W. F. R. Weldon (1860-1906) the professional biology and Francis Galton (1822-1911) the inspiration. Establishing the subject was largely the work of Pearson– he produced the courses, journals, propaganda and encouragement to converts; for a guide to the literature on Pearson see Aldrich (2001/10). After Karl Pearson came Ronald Fisher for in "1'école statistique britannique" the roles of leading biometrician and leading mathematical statistician were combined in one person whose background was in applied mathematics; Fisher appears in Section 6 below.

Biometry was not social enough to concern the Society and Pearson was never a member, nor was he involved with the Institute. In the beginning he published in mathematics/physics journals and from 1901 mainly in *Biometrika*, a journal he founded with Weldon and Galton for "the statistical study of biological problems." *Biometrika* published substantive biological studies and pieces on statistical theory but the latter came to so predominate that by 1940 it

was no longer a biological journal. *Biometrika* took articles in French, German and Italian but biometry was largely an Anglo-American enterprise. There was only one contribution from France before 1940–from the botanist, E. Gain (1904)–and only one other contribution in French–from the Argentinian Carlos Dieulefait (1934). The twelve articles in German included four from Russian authors, though they wrote on mathematical statistics, not on biology; for their contribution see Seneta (2009). The *International Statistical Review*–see Seneta and Stamhuis (2009)–celebrated the sesquicentenary of Pearson's birth with articles showing the extent of his influence; there was not one on Pearson in France although he had influence there–see the next Section.

Stigler (1987) concludes his history of statistics to 1900 with an account of the "English breakthrough." The breakthrough occurred *outside* statistics as the subject was then understood and the Statistical Society appears only at the end of Stigler's account in the person of G. Udny Yule (1871-1951). Yule was Pearson's assistant when he joined the Society in 1895 and his first papers showed how the techniques of Pearson curves and correlation could contribute to the debate on the effectiveness of different forms of poor relief. Like Edgeworth and Bowley, Yule made the Society the focus of his professional activities; Yule was not a narrow technician–thus, when he reviewed Fernand Faure's *Eléments de Statistique,*he (1906, p. 445) wished naturally that the methods had included "measures of dispersion and of correlation" but he also thought that the chapter on the organisation of statistics in France would be of most interest to "the English reader."

By the end of the century the cause of mathematical statistics had three supporters in the Society and over the years the number grew slowly. Before 1914–indeed before 1940–nearly all of the mathematically inclined statisticians came from Pearson's University College: Oxford (where from 1891 Edgeworth was professor of political economy) and Cambridge (where from 1912 Yule lectured in the School of Agriculture) provided none and the London School of Economics (where Bowley was only full-time from 1915), only a few; details of who they were are given in Aldrich (2010b).

5 Developments in Paris

The 90s saw the beginning of a mathematical turn in Paris in the work of Lucien March (1859-1933) who headed the SGF from 1890 to 1922 and was active in the Société from 1897. Combining a scientific and an administrative career seems to have been more common than in Britain although 50 years earlier William Farr (1807-1883) had done so very successfully and some less prominent civil servants contributed to mathematical statistics, notably W. F. Sheppard and R. H. Hooker. Of course, official statisticians were always prominent in the Society but not as contributors on the mathematical side.

The first mathematical paper to be presented to the Société was by Vilfredo Pareto (1848-1923). Like Edgeworth's Jubilee paper of a decade earlier, Pareto's paper of 1897 aimed to show how a standard mathematical techniques could be

Journ@l électronique d'Histoire des Probabilités et de la Statistique/ Electronic Journal for History of Probability and Statistics . Vol.6, n°2. Décembre/December 2010

applied to demographic and economic data. In the present case the technique was interpolation and, for piquancy, its creators were the French mathematicians, Cauchy and Bertrand: French statistical writers had not used the techniques and French mathematicians were not publishing on statistics. Pareto was an Italian writing from Lausanne and so some remarks on international careers may be appropriate. The typical contributor to the journals in London and Paris of our period–particularly in the half-century before the Great War–was a home scholar writing in his home language; the journals may have published material from abroad but this only echoed primary work published at home. Edgeworth was the most linguistically accomplished of the English writers and, like Pareto, published in Italian, French, English and German, but, while Pareto published major works in French, Edgeworth's foreign language publications were minor works, usually replies to comments on his work; there is a hilariously abusive exchange between them in the pages of the *Giornale degli Economisti* in 1896. For English would-be analysts around the turn of the century exposure to a *Cours d'analyse* was a rite of passage but that was not so in statistics: the text-books by Bowley (1901) and Yule (1911) refer to foreign works but give no sense that the subject was more advanced abroad. Pearson and Yule had studied in Germany but that was before they became statisticians. Statisticians in London and Paris thought they were at the centre of things, unlike the Italians, Russians, Scandinavians and Poles who felt rather peripheral. Slutsky's paper on the goodness of fit of regression lines (1913) might be taken as a tribute to the centrality of London. A decade later Chuprov (1925) was still looking to London but as one of those displaced by the Russian Revolution; the Nazi persecutions would create many more.

Pareto was responsible for the most discussed piece of statistical economics of the era. His "remarkable formula for the frequency of incomes" was noticed in London by Edgeworth (1896, p. 533) who commented, "This law is of considerable economic interest, as M. de Foville has lately pointed out in the *Journal des Economistes*. The approximate identity of the law as ascertained for different countries, points to the dependence of the distribution of income upon constant causes not to be easily set aside by hasty reformers." Edgeworth discussed Pareto's formula (1896) as a footnote to his own work on asymmetrical frequency curves and he also made some comparisons with Pearson's work. Some of the economic work in Britain is reviewed by Bresciani-Turroni (1937).

The fitting of the Pareto distribution was the subject of March's first paper in the *JSSP* (1898); this considers, along with other methods, Pearson's method of moments. March's thought and career have recently received attention from Jovanovic and Le Gall (2001), Armatte (2005) and Le Gall (2007) and these studies emphasise the influence of Pearson on March. This was profound and went beyond the method of moments and correlation–the technique of statistics–for March translated Pearson's book on the philosophy of science, the *Grammar of Science*, and followed his views on causality. March also promoted Pearson's

Exhibit III: Lucien March as polytechnicien

ideas on eugenics, helping to establish the Société française d'eugénique. He did not, however, contribute to Pearson's biometric project and his natural colleagues across the Channel were the statisticians of the Society, Edgeworth, Bowley and Yule. Over the years March would interact most with Bowley, the most part-time of the London mathematical statisticians.

In December 1907 the Paris Société had a new member sponsored by March. Émile Borel (1871-1956) was a rising mathematician and specialist in function theory (complex analysis)–"by 1899 the name of Borel was probably known to nearly every serious analyst in the world" writes Collingwood (1959, p. 490)– but his interests were turning towards probability; Catellier and Mazliak (2009) describe his contribution to stochastics and Collingwood (1959) gives an English view of his life and achievements. As well as writing on probability, Borel pushed the subject along by creating institutions and by encouraging others although the ISUP and IHP and his great publishing project, the encyclopedic *Traité du Calcul des Probabilités et ses Applications* came after the War. One of his earliest publishing projects was *La Revue du Mois*, a periodical he started in 1906. Volterra wrote the opening article on the mathematics of the biological and social sciences and referred to Pearson's work. Durand and Mazliak (2010) argue that Volterra was behind Borel's conversion to probability: in 1908 Borel published a note in the *Comptes Rendus* on Pearson's problem of estimating mixtures of normal distributions, proposing a less cumbersome technique than the method of moments; empirical work was promised but Borel moved on to other things. It seems that Borel took part in a few meetings of the Société but presented no papers to it. The breadth of his interest in probability was

reflected in his popular book *Le Hasard* (1914).

In 1909 the celebration of the Société's Jubilee (one year early) was combined with a meeting of the Institute and something extraordinary happened. There was the expected fun, including the banquet when Baines, speaking for the Society, likened himself to "a good old uncle addressing his favourite nephews" but Rew (1909) also described the business and the novelty of a section on methods and mathematical statistics which had been set up on March's initiative to accompany the more traditional sections on demography, economic statistics and social statistics. The Institute did not follow up the scheme until after the Second World War.

Edgeworth, Yule and Bowley attended, presented papers and talked to their foreign colleagues. Edgeworth (1909) spoke on the application of the calculus of probabilities to statistics and, besides describing his own research, updated his French references by including Poincaré. Yule surveyed work on correlation and included an account of March (1905) which proposed a method of time series correlation analysis similar to that of Yule's collaborator, Hooker. Bowley's piece was not a survey but a "suggestion for the international comparison of wages by use of the median": after describing the method and illustrating it on British data he asked members of the Institute, "whether it is not possible ... to make similar estimates ... for international comparison." March (1909) presented a paper in the same section. In another section Lexis–who was a founding member and Vice-President from 1889 to 1911–tabled a report on the statistics of tuberculosis and Borel presented a paper on estimating demographic trends (1909a) a topic he treated mathematically in a note in the *Comptes Rendus* (1909b). Borel, Bowley, Edgeworth, Lexis, March and the Australian G. H. Knibbs (1858-1929) came together to discuss the law of error. The subject and the participants belonged to the world of scientific statistics; admittedly March and Knibbs–see Heyde (2001)–were official statisticians but they were unusually professorial in their interests.

After 1909 the Institute returned to business as usual. The next meeting of the Institute was held in The Hague in 1911 and Rew (1911, p. 51) described how proceedings the Prince of the Netherlands opened the proceedings and "concluded by hanging a laurel wreath on a portrait of M. Levasseur which had been placed on the dais." Rew (p. 61) also recalled de Foville's address on "Napoléon, Statisticien": "M. de Foville's mordant and epigrammatic style adorns every theme, and almost every sentence of his discourse was punctuated by the appreciation of his audience." In the sessions statistical method was combined with demography and March (1912b) reported on the best means of establishing the comparability of statistical curves, the outcome of a committee that had been established at the Budapest Congress of 1901; Bowley, the sole English mathematical, took part in the discussion. March was willing and able to draw on the resources of the SGF and he become an important figure in the Institute: he was involved in creating a Permanent Office for the Institute, the plans for which were unveiled in Vienna in 1913. That meeting was attended by Yule but did not present a paper. The mathematical highlight was a "very interesting" memoir by von Bortkiewicz that considered the frequency-distribution

of time-intervals between events occurring at random during a given period illustrated by the intervals between deaths of the Members of the Institute–see the account of Flux, Rew and Yule (1913). Brussels was chosen as the city for the next meeting.

It was business as usual too for the Society and Société: French books were reviewed in London and, less often, English books in Paris. Borel's *Éléments de la Théorie des Probabilités* was taken by John Maynard Keynes (1883-1946), the Society's probability specialist. Just as Borel, the pure mathematician interested in probability and statistics, had no counterpart in England so Keynes, the logician-economist, had no counterpart in France. Keynes started working on probability in 1905 to produce, after many years and many diversions, *A Treatise on Probability* in 1921; Keynes's singular statistical career is recounted in Aldrich (2008) and the British probability scene is sketched in Aldrich (2007, -9a and -9b). Keynes approached Borel's book with idiosyncratic requirements–he wanted a searching discussion of fundamental ideas and also confirmation of his suspicion that there was something wrong with Pearson's work–and he (1910, p. 171) was rather disappointed:

> It would have been interesting to learn what comments a first-rate mathematician, coming to the subject without prejudice, would find to make on the logical pre-suppositions of the current theory; but M. Borel only displays his knowledge of the preliminary difficulties, which lie thinly concealed beneath an indisputable superstructure of mathematics, by his skill in avoiding them. A foreign criticism also of Professor Karl Pearson's mathematical investigations in probability and the theory of error would have been very valuable at the present time, and well within M. Borel's own province; but he contents himself by mentioning, in passing, their existence.

Although the book did not address Keynes's concerns, he recommended it as "sounder than M. Poincaré, but not so solid as M. Bertrand"–Keynes liked to display his connoisseurship.

Borel's popular work, *Le Hasard*, was reviewed by a more representative figure, the medical statistician and Pearson disciple, Major Greenwood (1880-1949). Greenwood (1914) liked the book remarking that "It speaks well for the intellectual curiosity of the French-reading public that this work has reached a second edition," but the praise was qualified, "M. Borel's discussion of statistical biology is confessedly incomplete, and may not appear altogether satisfactory to the English reader."

In Paris March reviewed Yule's *Introduction to the Theory of Statistics*. March (1911b) saw the book as defining a stage in the development of statistical theory as Westergaard's *Grundzüge der Theorie der Statistik* had twenty years before but, instead of reviewing the progress point by point, March concentrated on one side of the book, the treatment of association which used the nomenclature of Jevons's system of formal logic. In 1912 March published a translation of Pearson's *Grammar of Science*; for this third edition Pearson projected a

two-volume work but only the first *Physical* volume ever appeared. This had only one section bearing on statistics, "The category of association, as replacing causation," but March was very impressed with it and the *Journal* published his translation of it–(1912c). Pearson's *Tables for Statisticians*, received an enthusiast welcome from Alfred Barriol (1915, p. 222): "les membres de la Société de Statistique de Paris tiennent à honneur de s'associer aux collègues de M. Pearson pour lui adresser de vives félicitations et des remerciements chaleureux." Barriol (1873-1959) an actuary, was secretary of the Société from 1909 to -41 and very prominent on the French scene, as Depoid's (1959) obituary brings out. Since his death Barriol has attracted attention in the literatures on stochastic finance and on human capital; for the former see Jovanovic and Le Gall (2002) and for the latter see below. Barriol was assiduous in sending his works to the Society's library but none of his books appears to have been reviewed in London.

March was very visible in the Société but, as a sponsor of new methods, he seemed as isolated as Edgeworth had been in London before the arrival of Bowley and Yule. His colleagues at the SGF, Marcel Lenoir and Henri Bunle, produced interesting work but Lenoir did not contribute to the *Journal* –for him, see Le Gall (2007)–and Bunle only a paper (1911) in correlational demography similar to Yule's work. March's SGF was nothing like as effective in producing mathematical statisticians as Pearson's University College.

6 The Great War and after: institutions and people

On December 10 1914 the Council of the Society considered two letters from Paris. The minute book records:

> Read a letter from the Statistical Society of Paris conveying a message of sympathy to the Society in regard to the War, and ordered that the Foreign Secretary be requested to address a letter in like spirit to the Statistical Society of Paris.
>
> Read a letter from the Statistical Society of Paris asking what action, if any, this Society will take in regard to its German Fellows and Honorary Fellows, as they would like to act in accord with this Society in the matter. The Hon. Foreign Secretary was requested to express the desire of the Council to act in harmony with the Statistical Society of Paris, but to point out the technical difficulties involved in the exclusion of Honorary Fellows.

The Society and Société had concerted their actions in forming the Institute–and possibly on other occasions–but these letters from 1914 are the only ones in the Council's minutes that required some action. The issue of German Fellows does not appear in the minutes of later meetings but in March 1915 the Société excluded German fellows–see Depoid (1961, p. 105).

Journ@l électronique d'Histoire des Probabilités et de la Statistique/ Electronic Journal for History of Probability and Statistics . Vol.6, n°2. Décembre/December 2010

In the Great War there was scientific cooperation between Britain and France–Borel was involved–but there does not seem to have been any sense in either country that statisticians *per se* be mobilised for the war effort. For four or five years normal statistical activity was suspended as the war took men into the armed forces and redirected the work of those who stayed behind. The war itself could be the object of statistical study: Guyot (1914), Crammond (1915) and Boag (1916) considered its cost with reference to Barriol's (1910, -11) estimates of the value of life; Kiker and Cochrane (1973) review this work. Recording, the basic operation in demography, took a new form: in his obituary of Jacques Bertillon, a British public health expert Arthur Newsholme (1922, p. 622) describes how Bertillon was superintendent of the department that collected and arranged the statistics of war losses: "The writer's most vivid recollection of Dr. Bertillon is of him in the large offices devoted to his work, where some hundreds of clerks were employed in the analysis of regimental losses." The British mathematicals did all kinds of work: Pearson and his group computed for ballistics instead of biometry; his best mathematician, Herbert Soper, joined up aged fifty; Fisher tried to but was rejected and taught in school, taking the place of somebody who was fit; Keynes developed his other career as a monetary economist and rose in the Treasury; Pearson's old students, Yule and Snow, went to the Army Contracts Department of the War Office and continued into administration; another old student, Greenwood, was in charge of a medical research sub-section at the Ministry of Munitions. In their leisure time the statisticians continued their research but very little of scientific value came out of their wars–perhaps only Greenwood and Yule's (1920) paper on the compound Poisson distribution which was about accidents in munitions factories.

In his presidential address to the Society Sir Henry Rew (1921, p. 2) set out to "take stock of the position in which the war has left us." Rew was an official statistician and for him statistics meant information. The Society's greatest asset was its library–"of national service during the war by providing ready access to information urgently required by the Government in relation to questions of trade, population and finance in the belligerent and other countries." (p. 2). The Society had long pressed for better official statistics and the experience of war added urgency; Rew (pp. 10-14) detailed some previous attempts and another is described by Desrosières (1998, pp. 176-7). Barnard and Plackett (1985, p. 33) summarise the Society's latest proposals and the official response:

> A. L. Bowley saw a need to extend Government responsibility for statistics and to coordinate the work of different departments. Accordingly, he proposed a Central Thinking Office of Statistics and the creation of a trained statistical officer class in the Civil Service. Many of his ideas were embodied in a formal petition made in 1919 by the Royal Statistical Society, but Government considered the proposals to be impractical.

Such changes came during and after the next world war–the war that turned Barnard and Plackett into statisticians–when statistics and statisticians had a greatly enlarged role.

Journ@l électronique d'Histoire des Probabilités et de la Statistique/ Electronic Journal for History of Probability and Statistics . Vol.6, n°2. Décembre/December 2010

The Société was also involved in efforts to reform official statistics. Borel, who had gone far in government, led the attempt but, as in London, it failed; see Desrosières (1998, pp. 157-9) and Catellier and Mazliak (2009). There were new institutions in Paris: the Institut de statistique de l'université de Paris (ISUP) was formed by Borel, March–now retired from the SGF–and Faure in 1922 and in 1928 the Institut Henri Poincaré (IHP) was inaugurated with Borel at its head; for these institutions, see Colasse and Pavé (2002) and Catellier and Mazliak (2009) and, for the courses they gave, Meusnier (2006). Borel was responsible for teaching mathematical statistics at the ISUP but after a year Georges Darmois (1888-1960) took over the course. From a background in differential geometry and the theory of relativity Darmois would become the dominant figure in mathematical statistics in France; see Dugué (1961) and Bru (2001). Borel's vision of probability in *Le Hasard* had a non-social part and that was realised in the IHP which brought together international work on probability and physics; the first visitors from Britain were the theoretical physicists, Dirac and Fowler. The IHP was funded in part by the Rockefeller Foundation which made numerous important contributions to science in post-war Europe–see Siegmund-Schultze (2001, ch. V). Darmois also became involved with the IHP which had acquired a third person interested in statistics, Maurice Fréchet (1878-1973). Fréchet was an analyst but in the 20s he began working on probability. His first probability book was an elementary book on probability theory he wrote with the sociologist M. Halbwachs, *Le Calcul des probabilités à la portée de tous* (1924). The book appealed to the applicability of probability to motivate the study although the book contained surprisingly few applications. However Fréchet wrote papers on such mainstream topics as life expectancy (1924) and the distribution of income (1927). Armatte (2001) reviews Fréchet's statistical career and Siegmund-Schultze (2009) and Catellier and Mazliak (2009) discuss the origins of the IHP.

In Britain there was modest expansion at Pearson's University College and at Bowley's London School of Economics–at both institutions the teaching of statistics went back to the 90s–and the London School of Hygiene and Tropical Medicine created a chair of epidemiology and vital statistics (with Greenwood as first occupant) in 1928 but the critical development was the creation of a statistics department around R. A. Fisher (1890-1962) at Rothamsted agricultural research station. Ronald Fisher was trained as an applied mathematician–applying mathematics to physics–but from his earliest days he applied himself to biometry, genetics and mathematical statistics. When he went to Rothamsted in 1919 Fisher became involved with empirical investigations and added the design and analysis of experiments to his portfolio. Fisher's interest in economics and demography–the traditional subject matter of statistics–was confined to a small area of overlap with biology or eugenics and thus he was much less of a traditional statistician than, say, Fréchet. In the 30s Fisher became a mainstream figure when the Statistical Society moved the stream by creating an industrial and agricultural research section with its own journal. In 1933 Karl Pearson retired and his University College empire was divided–the Galton Laboratory to Fisher and the Department of Applied Statistics, to Karl's son, Egon Pear-

son; from 1934 to 38 Jerzy Neyman (1894-1981) would be the leading figure in Pearson's section. In 1932 Cambridge University, the British centre for mathematics, began to teach mathematical statistics. For Fisher see Box (1978) and Aldrich (2003/10) and for the institutional developments, Aldrich (2009, -10b).

The war almost put an end to our third organisation, the ISI: its continued existence was in doubt for it was not clear whether there could be cooperation between the statisticians of the two sides–international mathematical congresses stopped being fully international–and its function was in question as the League of Nations spawned new bodies with statistical responsibilities; Nixon (1960, pp. 27ff) describes the difficulties and how they were overcome. Desrosières (1998. p. 155) comments on how the formation of institutions connected with the League of Nations–and later the United Nations–changed the role of the ISI: "This would allow the ISI to devote itself henceforth to the discussion and diffusion of mathematical methods resulting from biometrics and English statistics." It took the ISI a very long time to take advantage of this new freedom.

The first post-war meeting of the ISI was held in 1923 in Brussels and meetings continued until 1938 when the meeting in Prague was abandoned after the first day for business to resume in 1947. The ISI's practice was to set up commissions of inquiries into particular topics: reports would be prepared and discussed and then resolutions passed at the biennial meeting. March and Bowley–who was Treasurer 1923-37–were conscientious participants and often involved in discussions. For the Brussels meeting March (1924) prepared a report on indices of economic conditions and Bowley was one of the discussants. Bowley and March were both interested in the Harvard Economic Service in America and in the business barometer it developed and set up similar economic services; from Friedman's (2009) recent account of the Harvard Service, it is clear that London and Paris communicated with Harvard but not so clear whether they communicated with each other. One of the Institute discussions has become celebrated, that on the "representative method" at the Rome meeting in 1925 which concluded a debate about the value of sample surveys that had begun in the 1890s. Two reports were produced, one by Bowley and one by the Dane Adolphe Jensen. Bowley's (1926) report was the most ambitious piece of mathematical statistics that had been presented at the Institute and was his own main achievement in the field. March was one of the discussants; the occasion is treated from various points of view by Kruskal and Mosteller (1980, pp. 185-7), Desrosières (1998, pp. 234-5) and Aldrich (2008c). March and Bowley continued to attend meetings and discuss their common concerns until March's death in 1933.

There were other links between London and Paris but none seemed so strong as those through the Institute. In 1925 Fisher published a note in the *Comptes Rendus* in response to a piece by Romanowsky–a Russian who also published in *Biometrika*–on the English subject of correlation. Both notes were communicated by Borel but this exchange between two outsiders seemed to attract no local attention. Fisher, like Karl Pearson, was an eugenist and in 1926 he and March were corresponding about a French publication of one of his articles. (March did not penetrate Fisher's statistics and the review of March's textbook

by J. O. Irwin (1931) was unsympathetic.) It is striking that in Siegmund-Schultze's (2001, pp. 288-301) list of the Rockefeller fellows in mathematics up to 1945 there are only two links between France and Britain. One–in the 30s–was direct and is considered in the next section but the other in the 20s was indirect, via Poland: Neyman had support to work with Karl Pearson in London and with Borel in Paris–a nicely symbolic pairing. The most international of British mathematicians, G. H. Hardy, worked with mathematicians of many nationalities but not French. It was not that Britain was insular and France isolated for mathematicians in both countries had international connections–it just looks as though they had no connections with each other. That must be an over-statement for Edward Collingwood (1900-1970), Borel's obituarist, went from Cambridge to Paris on a travelling scholarship in 1924 with the purpose of hearing him; Collingwood (1959, p. 496) recalled that Borel made him very welcome.

In the war years and the immediate post-war period the Society looked abroad, comparing war experience–as in Greenwood and Thomson's (1919) note on English and German diets–or contemplating post-war possibilities as in Mantoux's (1917) discussion of trade with France. The interest them seemed to subside with the *Journal* publishing about one item a year from abroad: the United States and Italy sent most–4 each–and the other contributions were widely dispersed but there were no articles by French authors. This fits in with the wider picture presented by Tombs and Tombs (2007, p. 523) who argue that in this period Britain and France were not interested in each other: "Academic contacts, never vigorous, dwindled in the 1920s [...] Before 1914, some 200 French students annually attended courses at British universities; by 1926 there was only one." The *Journal* was publishing much less news–foreign or domestic–than it had in the 19th century: there were no articles about France and only two about Germany (the most written about country)–on the hyperinflation (Bresciani Turroni (1926)) and the number of Jews in Germany (Yule (1933)). There were no contributions from Germany. The *Journal* went on reviewing foreign books but it missed completely the explosion of probability in France; when Keynes stopped reading probability, it seemed that the Society did too. The only works on probability theory reviewed in the inter-war period were by Castelnuovo and Cramér; the former failed to impress Isserlis (1920) but the latter impressed Bartlett (1938a); Bartlett is discussed in the next section.

The 1930s saw the creation of two new international scholarly societies with objectives related to those of the societies and Institute–the Econometric Society and the Institute of Mathematical Statistics; Louçã (2007) and Stigler (1996) describe their origins. The Econometric Society promised a mathematical treatment of a subject that had always been a central concern of the old societies and the IMS promised to nurture what had been a very subsidiary activity. The IMS was an American society which went international and the society and its journal, the *Annals of Mathematical Statistics*, only came to be important in the 1940s. The Econometric Society was thoroughly international from the beginning; Aldrich (2010a) describes how mathematical statisticians figured in the society. The French and the British participated in the Society–Bowley

and François Divisia (1889-1964) were Presidents of the Econometric Society and of their local societies and there were British and French contributions to the journal *Econometrica*–but the energy came from elsewhere and the main international interactions were between other nationalities. The dynamo of the econometric movement was the Norwegian Ragnar Frisch, who like Neyman, had spent time in London and Paris in the 20s and published in *Biometrika* and the *Comptes Rendus.* In the 30s they were both at large and may have done something to bring London and Paris together; Frisch's 1933 lectures at the IHP have just been edited by Bjerkholt and Dupont-Kieffer (2009).

7 Fisher and the IHP mathematicians 1934-40

In 1934 Anglo-French statistical relations took on new depth when Ronald Fisher began interacting with some of the mathematicians at the IHP. One expression of the new relationship was the visit: Darmois's student, Daniel Dugué, spent 1937-8 in London, Fisher lectured in Paris in 1938 and Darmois visited London in the totally changed circumstances of 1940. The contacts came about both in the traditional way–through the Institute–and in new ways. Not only was more going on but private letters have survived to amplify the public record; the letters I have used are in the Fisher Archive of the University of Adelaide–some are printed in Bennett (1990) and some are on the Library's website. Similar paper trails for earlier periods appear not to have survived.

Fisher's links were with Fréchet and Darmois–and later with Dugué–and not with the IHP director, Borel. The seniors were Society or Société members but their interactions did not involve these bodies, nor were their reputations based on work done under the societies' auspices. Fisher joined the Society in 1921 and became President in 1952 but in between were ups and downs–see Aldrich (2010b)–and he was never a Society man like Edgeworth, Yule and Bowley, or March and Barriol in Paris. Borel was President of the Société in 1922 but his only previous publication in the *Journal* was his 1920 scheme for reorganisation. Darmois had published one paper in the *Journal* when he became President in 1938. Fréchet joined the Société in 1936 and had produced the first series of papers on mathematical statistics to appear in the *Journal* before he became President in 1948. Borel, Fisher, Fréchet and Darmois belonged to an international network of mathematicians. There had been international congresses since 1897 and Fisher and Fréchet both attended the one in Toronto in 1924. Borel, Fréchet and Darmois attended the famous Bologna meeting in 1928 but Fisher only sent a paper. In the 30s Fisher left the mathematics conference circuit and spent more time at genetics meetings.

1934 was the Society's centenary and–nearly–the Institute's 50th birthday and a joint celebration was held in April with the Society providing the hospitality and the Institute the conference. From the programme it seems that the cause of mathematical statistics had not progressed: the combined section on statistiques démographiques et mathématiques had only a report by Fréchet on the use of the correlation coefficient (see below) and an article by Irwin

on statistics in psychology. Borel, Darmois and Fisher toasted the Society–the banquet seating plan is in the Society's archives–but did not give papers at the conference. Fréchet and Fisher probably met for they were already corresponding. Fréchet would be Fisher's most constant Parisian correspondent and their letters have the most scientific interest: the subjects varied–in 1934 it was correlation, in 1940, fiducial probability–but the pattern was the same–Fréchet questioned and Fisher explained, or tried to. The interest was all on one side: in 1938, when Fréchet sent Fisher his new book, Fisher replied, "It is extremely good of you to have sent to me your fine volume on the Calculus of Probabilities, which I am extremely glad to possess." Fisher had no fondness for academic probability, yet was a brilliant unschooled probabilist as Kendall's (1990, p. 34) anecdote indicates, "Will Feller used to say that if Kolmogorov had not written his 1931 paper, the whole of stochastic diffusion theory would eventually have been pieced together starting with the ideas in Fisher's [*Genetical Theory of Natural Selection* (1930a)].

To go back to 1934 and the beginning, Fréchet's opening to Fisher was the first move in a long campaign against the misuse of the correlation coefficient; Armatte (2001, pp. 25-34) follows its twists and turns. Fréchet and Fisher were both members of the Institute and their letters reflect that body's way of doing statistics by committee and resolution. In these exchanges both had multiple roles: in the Institute Fisher was a member of the correlation commission and one of several international witnesses, as a scientist, he was the leading expert on the theory of correlation for he had worked out the exact distribution theory for the various coefficients and yet he was not a fanatical correlator for he held that "the correlation technique of my distinguished predecessor [Karl Pearson]" was often less useful than his own analysis of variance (letter of 6 November 1934). In 1934 and again in -36 when correlation next came up in the Institute (the meetings being on a two year cycle) Fisher answered Fréchet's questions. In between they discussed other matters: in December 1934 Fréchet was writing about the limiting distribution of order statistics–"I have been told that we have both independently attacked the same subject or about and by methods about similar"–and referred to his own (1927) and Fisher and Tippett (1928). Fréchet asked Fisher for an off-print of that paper and also for one of Fisher (1930b), the paper that launched fiducial inference. In a PS to a correlation letter of February 1936 Fréchet reported on his visit to Russia and how Kolmogorov had pointed out that an equation Fisher had produced in a genetic context was known to physicists as "Fokker-Planck's equation." In the busiest period which we look at below–January-April 1940–they were writing about a letter a week.

Darmois was Fisher's second contact in Paris and a more important one in that he was building up statistics as a discipline while Fréchet was pursuing a private passion. Darmois's position in the ISUP and IHP has been described above and here I add something about the approach(es) to statistics he favoured. His lectures at the ISUP were published in 1928 as a book, *Statistique mathématique*. Michel Huber–March's successor at the SGF–wrote a long preface emphasising how it departed from the French tradition of a probability book with a chapter on statistics. To the English reader it resembled Yule's

Introduction or Part II of Bowley's *Elements* but with much more probability theory–including characteristic functions after Lévy–and a statistical net that extended beyond Pearson to Russian and Scandinavian authors. It was reviewed in London by Greenwood, who had come to prefer Continental mathematics–especially Chuprov's–to Pearson's, and the book suited him (1929, p. 101) very well: "this is an excellent treatise to put in the hands of statistical students with a fair grounding in mathematics who are also doing laboratory work. It might also be useful to young mathematicians who wish to have some idea of what statistics is about."

In 1934 Darmois had another book, *Statistique et applications*, a survey explaining the basic concepts of distributions and correlation and applying them to genetics, astronomy and psychology, as well as to the more traditional statistical subjects, economics and demography; it did not cover quality control and the design of experiments which were the fashion in London. The review by "H. J. B." (1936) is almost a caricature of British attitudes: there is admiration for the clear exposition "we habitually associate with the French analysts", some cross-Channel banter–Darmois illustrates using French data but he "redeems this lapse into Splendid Isolation with an excellent account of the correlation between series of events; a searching analysis of the logical problems involved is illustrated with the results obtained by Hooker and R. A. Fisher in this field"–and, of course, the French taste for the *mot juste*–liking the bits without quite liking the whole, the reviewer concedes, "chacun à son goût."

Darmois's papers (1932, -34b, -35) show his interests shifting. Darmois (1932) is based on his presentations to the IHP in 1929 and reflects the world of his *Statistique mathématique*. The recent developments paper (1934b) draws also on the work of visitors to the IHP, Frisch and another Norwegian, Alf Guldberg, and the Dane, Johan Frederik Steffensen–all had also published in Britain–and Neyman who would be the first representative of the English statistical school to visit–in 1935/6; Siegmund-Schultze (2001, p. 173) lists the visitors and Catellier and Mazliak (2009) describe the kind of statistics favoured in Paris. Darmois discusses Fisher's work on estimation–he already knew of Fisher's work in time series analysis and population genetics–yet even so his note in the *Comptes Rendus* (1935) comes as a surprise for it contained an important contribution to Fisher's theory of estimation: Darmois (1935) considered distributions admitting a sufficient statistic, what are now called the exponential, or Koopman-Pitman-Darmois, family of distributions–B. O. Koopman and E. J. Pitman were based in the United States and Australia respectively and their works appeared somewhat later.

Fisher's theory of estimation, which originated in the early 20s, had attracted some American attention (Hotelling and Doob) and Darmois was the first European to contribute to the theory. His next book, or pamphlet, *L'Emploi des Observations Statistiques:Méthodes d'Estimation* (1936) expounded afresh the theory and Darmois sent Fisher a copy. This approach was quite different from Fréchet's for it was an expression of solidarity and not of veiled criticism. Fisher replied in June 1936 thanking Darmois for his "excellent little book" and a brief correspondence on the theory of maximum likelihood ensued.

Journ@l électronique d'Histoire des Probabilités et de la Statistique/ Electronic Journal for History of Probability and Statistics . Vol.6, n°2. Décembre/December 2010

The third Parisian with whom Fisher formed a relationship was Daniel Dugué (1912-1987). Fisher, Darmois and Fréchet were of a similar age and standing but Dugué was a novice and he would look up to Fisher; see Deheuvels (1990) for a brief account of his life. The older generation were self-taught but Dugué learnt statistics from Darmois's lectures–presumably they resembled the *Méthodes d'Estimation*–and then went on to write a thesis. Perhaps the closest British parallel is Maurice Bartlett (1910-2002) who was the first theoretical statistician to come out of Cambridge after Wishart put Fisherian mathematical statistics on the syllabus; see Aldrich (2007, -09a and -10b) for more on Bartlett. Dugué's thesis was on the asymptotic properties of maximum likelihood estimators; Leloup (2010) describes the thesis and Stigler (2007) gives a perspective on the history of maximum likelihood. The thesis treated Fisher's theory using the methods of modern probability, a task nobody in Britain took on and the only British contributor to Stigler's "epic story" was Fisher himself; British attitudes to probability theory are described in Aldrich (2009a).

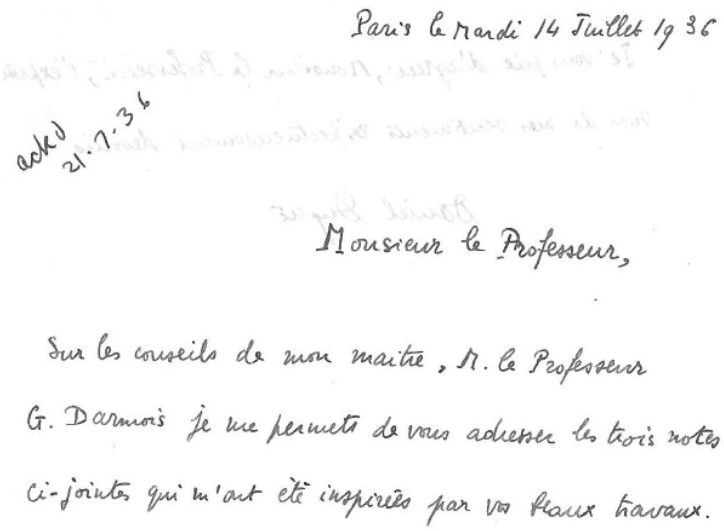
Dugué published three preliminary communications in the *Comptes Rendus* and in July 1936 he sent Fisher off-prints. He wrote on the advice of "mon maitre" and he told Fisher that his research had been inspired by "vos beaux travaux": see Exhibit IV. Fisher replied thanking him, "I am indeed glad that this interesting subject is now receiving such acute and careful analysis as that of your papers." By December Fisher was suggesting that Dugué come to London as a Rockefeller fellow; Darmois filled in forms and played his part in facilitating the stay. Fisher–like Pearson before him–encouraged people to come and learn his methods. his visitors from abroad had been either American or from parts of the Empire and were financed by their employer but now the Rockefeller Foundation was making significant contributions to the Fisher economy for it financed Georg Rasch from Denmark and Cecil Craig and William Youden from the United States as well as the establishment of a unit in the Galton Laboratory to investigate the genetics of blood groups; for details of the Rockefeller fellowships see Siegmund-Schultze (2001) and, for the serological unit, Box (1978, pp. 344ff).

Dugué arrived in London in September 1937 to spend the academic year in England. Fisher welcomed him and Fisher's daughter–Box (1978, p. 279)–recalls his boisterous introduction to the Fisher household; from Dugué's letters it seems that he made friends with Fisher's teenage son George who would be killed in the war. Fisher's impression of Dugué is caught in a comment in the Rockefeller files, quoted by Siegmund-Schultze (2001, p. 119):

> According to Fisher, D. is an excellent mathematician, a polite and very well-bred boy, who has apparently never seen a computing machine before and hesitates a little to dirty his hands with one.

A calculating machine was essential to Fisher's work as a statistician and acquiring one had been his first priority when he went to Rothamsted; the IHP

Exhibit IV: Dugué introduces himself to Fisher.



Paris le Mardi 14 Juillet 1936

acked 21.7.36

Monsieur le Professeur,

Sur les conseils de mon maître, M. le Professeur G. Darmois je me permets de vous adresser les trois notes ci-jointes qui m'ont été inspirées par vos beaux travaux.

only set up a statistical laboratory in 1937 after it had been doing statistics for some years. There was a difference of mathematical culture: although Fisher and his French colleagues thought of themselves as mathematicians, the British mathematical statisticians (until the Second World War) were trained as applied mathematicians, while the IHP mathematicians were pure mathematicians. In that regard Neyman must have seemed much less of a stranger in Paris than Fisher. The irony in Fisher's description of Dugué also reflects his sense of national differences: the French did great mathematics but were impractical and lacking in judgement. This sense was reflected in his thinking about the Bayesian argument: this great error, as Fisher saw it, was not the fault of the cautious Bayes but of the rash Laplace; Fisher's rather unconvincing history is related in Aldrich (2008a).

It is tempting to see Dugué as a kind of ambassador to the English king: he could test out Fisher and determine whether he would make a suitable visitor to the IHP. Whether or not this was Dugué's role, in November Darmois sent Fisher an invitation to the IHP. The visit took place in May 1938; preparation was needed for lectures at the IHP were given in French and Fisher could read but not converse in French and so his text had to be translated. Fisher had made several academic trips to the United States and one to India but this was his first to the Continent. He spoke on maximum likelihood but the lecture did not appear in the IHP *Annales*; Fisher also talked to the Société de Biotypologie and a paper appeared in its journal Decades later Gustave Malécot (1911-98) recalled the IHP occasion and his part in it: Fisher was not amused when Malécot put to him that maximum likelihood assumed a uniform prior; see

Bocquet-Appel (1996, p. 107). Malécot was another Darmois student who gave a Fisher topic–the population genetics of Fisher (1918)–the modern probability treatment; see Leloup (2009). Malécot never developed the same closeness to Fisher as Dugué had: one factor was that there was much less contact and, when Malécot submitted his thesis in 1939. it appears that Fisher's copy went astray, as Fisher explained to Darmois in a letter of September 1942.

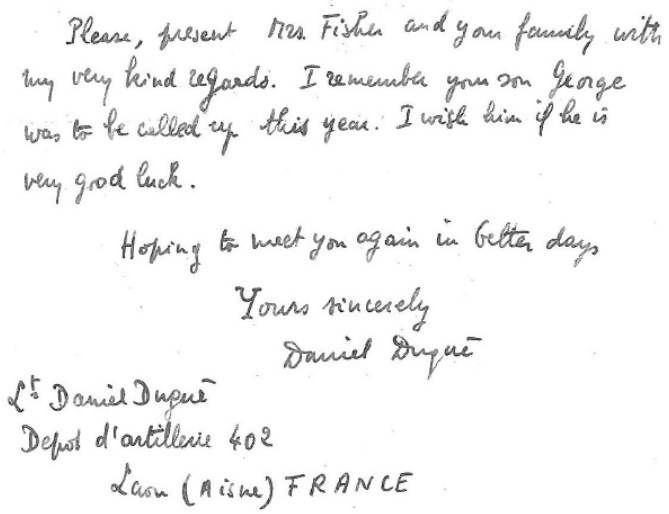
In late 1938 Fréchet was putting together a Study Meeting on the Applications of Calculus of Probability for the International Institute of Intellectual Cooperation to be held in Geneva in July 1939 and in December Dugué wrote to Fisher asking for names of suitable people in Britain and elsewhere. Fisher replied in an unbuttoned way: "As far as I can make out, there are no statisticians in Germany. You have a sample in France in M. Gumbel, and I suppose there may be others as bad where he comes from." (For Emil Gumbel, see Hertz (2001a)). One of Fisher's British names was Bartlett and afterwards Bartlett (1940, pp. 4-5) reflected on the Geneva experience:

> Some Continental statisticians feel a little aggrieved at the insularity of English statistics, and have difficulty in seeing much distinction between the theory of statistics and, say, the theory of probability developed so extensively by Laplace. We have seen that there is a partial justification for their view. It is interesting to note that the recent conference on "applications of the theory of probability" held in Geneva last summer would probably, if held in this country or America, have been called a conference on mathematical statistics. There is, however a fundamental difference of approach which prevents our identifying statistical theory with probability. The theory of probability originally developed on the Continent has now become primarily pure mathematics–in recent years a highly sophisticated branch of pure mathematics.

Bartlett had read Cramér's *Random Variables and Probability Distributions* and, while earlier British statisticians had admired Continental mathematics, he was probably the first to want to do it. By a nice coincidence his review of Cramér is printed with his review of Darmois (1936) of which Bartlett (1938b, p. 209) wrote, "To the reviewer it is a welcome indication of the growing awareness on the Continent of modern advances that have been made in the theory of statistical inference." Bartlett (1938a) expressed the wish that Cramér had applied his central limit theory to investigate the asymptotic properties of maximum likelihood without knowing that something of the kind was being essayed in Paris. Thus at the end of our period English and Continental scientific interests showed signs of converging.

Two months after the Geneva conference there was war again. From the beginning this was to be a war of applied science and this time statisticians were identified as a group that could contribute; Siegmund-Schultze (2009, p. 281) describes how the IHP was put on a war footing and quotes from a letter of October 1939 to Fréchet from W. O. Kermack a mathematical epidemiologist

Exhibit V: November 1939 and Dugué is in the army



Please, present Mrs. Fisher and your family with my very kind regards. I remember you son George was to be called up this year. I wish him if he is very good luck.

Hoping to meet you again in better days,

Yours sincerely

Daniel Dugué

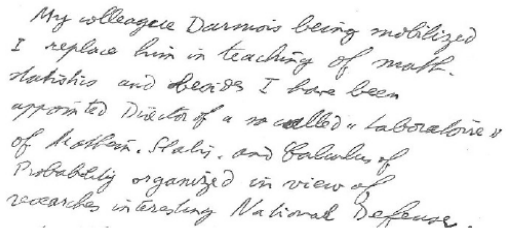
Lt Daniel Dugué
Depot d'artillerie 402
Laon (Aisne) FRANCE

in Edinburgh, " I am not aware of any statistical organisation for war purposes similar to that of which you are in control in France." Nevertheless Fisher's first war time letter from his Paris friends was from an officer in the artillery. In November 1939 Lieutenant Dugué wrote describing his circumstances and how he hoped to get a position as a liaison officer between the French and British forces; Fréchet had such work in the First World War. Dugué closed his letter "Hoping to meet you again in better days"–see Exhibit V.

In January 1940 Fisher heard from Fréchet about his new responsibilities: he had been made head of the statistics laboratory and, Darmois being called up, Fréchet had taken over some of his teaching; see Exhibit VI. Fréchet wanted to make contacts with mathematical statisticians working on national defence; Fisher appears to have given him names but was himself never involved in war work, which, given his willingness and ability, is puzzling–Box (1978, p. 384) considers some possible explanations. Fisher could be more help with Fréchet's other responsibility–the course on mathematical statistics–and over the next few months (until April 26th) Fisher tried to explain his ideas on fiducial probability and maximum likelihood. Fréchet's course can be glimpsed in a paper he published in 1943; this contains an important result, known in the English literature as the Cramér-Rao inequality after two of its other discoverers.

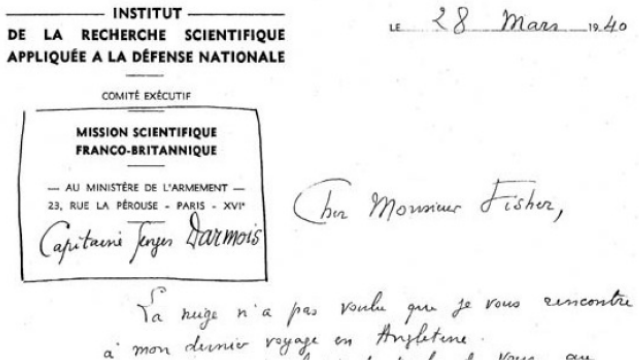
In February 1940 Capitaine Darmois contacted Fisher: he was visiting London as part of the Mission Scientifique Franco-Britannique. Fisher repeatedly invited Darmois and his wife to visit him and his family but is unclear whether he ever did: in November Darmois told Fisher that he would need a special

Exhibit VI: January 1940 and Fréchet has new responsibilities.



My colleague Darmois being mobilized I replace him in teaching of math. Statistics and decided I have been appointed Director of a so called « Laboratoire » of Statistics, Statistics and Calculus of Probability organized in view of researches interesting National Defense.

Exhibit VII: Darmois writes to Fisher in a new capacity.



INSTITUT
DE LA RECHERCHE SCIENTIFIQUE
APPLIQUÉE A LA DÉFENSE NATIONALE

COMITÉ EXÉCUTIF

MISSION SCIENTIFIQUE
FRANCO-BRITANNIQUE

— AU MINISTÈRE DE L'ARMEMENT —
23, RUE LA PÉROUSE - PARIS - XVI^e

Capitaine Jean Darmois

LE 28 Mars 1940

Cher Monsieur Fisher,

La guerre n'a pas voulu que je vous rencontre à mon dernier voyage en Angleterre.

permit to visit Fisher who had been evacuated out of London to Rothamsted. Their correspondence ranged from blood group genetics–suddenly much more important because of the need for blood transfusions on a large scale for civilian casualties of bombing–to the "problem of the Nile" Fisher's picturesque description of the problem of existence of ancillary statistics. Darmois (1946) later published some of his war-time results.

8 Conclusions

By August 1945 Fisher, Fréchet and Darmois were corresponding again. There had been enormous destruction but they had survived, Borel was still director of the IHP and there was another Fisher visit to arrange. These were continuities in a world of change: the description Kermack had given to Fréchet in 1939 no longer applied and Barnard and Plackett (1985, p. 48) conclude their account of statistics in wartime Britain, "Peace finally returned, and the statistical scene in the United Kingdom had been completely transformed by the changes which had come in response to the immense demand of war." In a bigger statistical scene Fisher was less important and his move to the chair of genetics at Cambridge

in 1943 took him away from the centre of statistics. In 1945 Darmois became director of the ISUP to be succeeded by Dugué.

The world statistical scene was even more changed for it was now dominated by the United States. Before the First World War the country seemed very far away–Martin's (1896) survey of statistics did not include it–and before the Second it had sent money and students to Europe and begun to recruit trained personnel, it had exported an assortment of statistical 'gadgets'–the Hollerith card, the business barometer and the control chart–but had not added very much to the fundamental science of statistics. The redistribution of intellectual weight affected the societies only indirectly but there was something like an American take-over of the Institute. Nixon (1960) describes these changes and Box (1978, pp. 431-5) considers them from Fisher's point of view: at a meeting in 1955 Fisher criticised the assumption of American superiority which appeared to him "arrogant and unjustified."

Statistics also changed. The mathematical statistics project finally overtook the original project of procuring, arranging and publishing facts calculated to illustrate the condition and prospects of society; people like Fisher and Darmois acquired leading roles in their societies and in the Institute. Naturally, with a new identity, statisticians viewed their past differently. The change is amply illustrated by the ISI volume, *Statisticians of the Centuries*, edited by Heyde and Seneta. The founders of the ISI are absent and the only members of the founding generation included are Lexis and Georg von Mayr (1841-1925): Hertz (2001b) describes this archetypal professor bureaucrat and his opposition to mathematical statistics. The London and Paris mathematicals, beginning with Jevons and Borel respectively, are there but from the earlier era only Farr and Florence Nightingale (1820-1910) are included. Nightingale had advanced ideas on the use of statistics in running hospitals and was the first woman to become a Fellow of the Statistical Society (in 1858); see Stone (1997) and Stone (2001). There is nobody from the early days of the Société; there are biographies of three probabilists–Cournot (1801-1877), Bienaymé (1796-1878) and Bertrand (1822-1900)–who were of an age to be in the Société but were *not*. It was quite out of character for the *JSSP* to publish an article by Bienaymé in 1876–a republication in fact of an article first published in 1855.

Perhaps the last words can go to Maurice Fréchet whose dates 1878 and 1973 span enormous changes. Fréchet outlived many younger contemporaries, including Darmois and Fisher–when the latter died Fréchet (1963, p. 169) wrote to the President of the Royal Statistical Society:

> Les statisticiens du monde entier savent quelle dette ils doivent á 1'école statistique britannique, et, en particulier, aux deux grands savants qui ont, l'un créé, l'autre transformé la statistique mathématique, Karl Pearson et Sir Ronald Fisher.

The tribute is witness to two changes, the rise and globalisation of mathematical statistics and the identification of "1'école statistique britannique" with the Royal Statistical Society–a society to which Pearson never belonged. When it

was Fréchet's turn to be remembered, the obituary in London reflected even more startling changes. It was written by David Kendall (1918-2007), the leading British probabilist–for most of Fréchet's lifetime there had been no such creature. Even more remarkably, the Fréchet Kendall (1977, p. 688) celebrated was not the probabilist and statistician but the analyst who had introduced the concept of compactness in 1906.

References

Aldrich, J. (2001/10) *Karl Pearson: A Reader's Guide*, website http://www.economics.soton.ac.uk/staff/aldrich/kpreader.htm

_____ (2003/10) *A Guide to R. A. Fisher*, website http://www.economics.soton.ac.uk/staff/aldrich/fisherguide/rafreader.htm

_____ (2007) "But you have to remember P. J. Daniell of Sheffield", *Journal Electronique d'Histoire des Probabilités et de la Statistique*, **3**, (2), pp. 58.

_____ (2008a) R. A. Fisher on Bayes and Bayes' Theorem, *Bayesian Analysis*, **3**, 161-170.

_____ (2008b) Keynes among the Statisticians, *History of Political Economy*, **40** (2), 265-316.

_____ (2008c) Professor A. L. Bowley's Theory of the Representative Method, University of Southampton Economics Discussion Paper No. 0801.

_____ (2009a) England and Continental Probability in the Inter-War Years, *Journal Electronique d'Histoire des Probabilités et de la Statistique*, **5**, (2), pp. 24.

_____ (2009b) Burnside and his Encounters with "Modern Statistical Theory," *Archive for History of Exact Sciences*, **63**, (1), 51-79.

_____ (2010a) The Econometricians' Statisticians 1895-1945, *History of Political Economy*, **42**, 111-154.

_____ (2010b) Mathematics in the London/Royal Statistical Society 1834-1934, *Journal Electronique d'Histoire des Probabilités et de la Statistique*, **6**, (1), pp. 33.

Anon. (1838) Introduction, *Journal of the Statistical Society of London*, **1**, (1), 1-5.

Anon. (1878) Review of *Traité Théorique et Pratique de Statistique* by Maurice Block, *Journal of the Statistical Society of London*, **41**, (1), 151-154.

Anon. (1899) Sir Rawson W. Rawson, *Journal of the Royal Statistical Society*, **62**, (4), 677-679.

Anon. (1901) M. Maurice Block, *Journal of the Royal Statistical Society*, **64**, (2), 292-293.

Anon. (1909) Review of *la Société de Statistique de Paris*, *Journal of the Royal Statistical Society*, **72**, (4), 746-748.

Anon. (1911) M. Emile Levasseur, *Journal of the Royal Statistical Society*, **74**, (8), 832-834.

Anon. (1928) Yves Guyot (Sept. 6, 1843–Feb. 21, 1928), *Journal of the Royal Statistical Society*, **91**, (2), 278-279.

Armatte, M. (2001) Maurice Fréchet statisticien, enquêteur et agitateur public, *Revue d'histoire des mathématiques*, **7**, (1), 7-65.
_____ (2005) Lucien March (1859-1933): Une statistique mathématique sans probabilité? *Journal Electronique d'Histoire des Probabilités et de la Statistique*, **1**, (1), pp. 19.
_____ (2010) Sur l'historiographie de la SSP et les contenus de son Journal en matière de statistique économique, this issue of the *Journal Electronique d'Histoire des Probabilités et de la Statistique.*
"H. J. B." (1936) Review of *Statistique et Applications* by Georges Darmois, *Journal of the Royal Statistical Society*, **99**, (1), 170-171.
Baines, J. A. (1907) Congress of the International Statistical Institute, *Journal of the Royal Statistical Society*, **70**, (3), 449-454.
Barnard, G. A. and R. L. Plackett (1985) Statistics in the United Kingdom, 1939-45, Chapter 3 and pp. 31-55 of Atkinson, A. C. and Fienberg, S. E. (eds.) *A Celebration of Statistics: The ISI Centenary Volume*, New York: Springer-Verlag.
Barriol, A. (1908) *Théorie et pratique des opérations financières*, Paris: Doin.
_____ (1910) La valeur sociale d'un individu, *Revue Economique Internationale*, (Dec.), 552-555.
_____ (1911) Complément à la note sur la valeur sociale d'un individu, *Revue Economique Internationale*, (Mai), 356-361.
_____ (1915) Bibliographie: *Tables for Statisticians and Biometricians* (Karl Pearson), *Journal de la Société de Statistique de Paris*, **56**, 221-222.
Bartlett, M. S. (1938a) Review of *Random Variables and Probability Distributions* by H. Cramér, *Journal of the Royal Statistical Society*, **101**, (1), 206-208.
_____ (1938b) Review of *L'Emploi des Observations Statistiques: Methodes d'Estimation* by Georges Darmois, *Journal of the Royal Statistical Society*, **101**, (1), 208-209.
_____ (1940) The Present Position of Mathematical Statistics, *Journal of the Royal Statistical Society*, **103**, (1), 1-29.
Beaurin (1895) Incidence of Taxation on the Income of an Individual in France, *Journal of the Royal Statistical Society*, **58**, (4), 610-625.
Benini, R. (1904) Aspects arbitraires de l'interpolation des séries statistiques (traduit par Pierre des Essars), *Journal de la Société de Statistique de Paris*, **45**, 374-386.
Bennett, J. H. (ed.) (1990) *Statistical Inference and Analysis: Selected Correspondence of R. A. Fisher*, Oxford: Clarendon Press.
Bertillon, J. (1884) The Fate of the Divorced, *Journal of the Statistical Society of London*, **47**, 519-526.
_____ (1892) Morbidity and Mortality According to Occupation, *Journal of the Royal Statistical Society*, **55**, (4), 559-600.
Bertrand, J. L. F. (1889) *Calcul des probabilités*, Paris: Gauthier-Villars.
Bienaymé, I. J. (1876) Les grands nombres en statistique. Sur un principe que M. Poisson avait cru découvrir et qu'il avait appelé «Loi des grands nombres», *Journal de la Société de Statistique de Paris*, **17**, 199-204.

_____ (1877) *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **84**, 817-825.
Bjerkholt, O. and A. Dupont-Kieffer (eds.) (2009) *Problems and Methods of Econometrics: The Poincaré Lectures of Ragnar Frisch, 1933*, London: Routledge.
Block, M. (1901) Revue des principales publications économiques de l'étranger, *Journal des Économistes*, **65**, 46-72.
Boag, H. (1916) Human Capital and the Cost of the War, *Journal of the Royal Statistical Society*, **78**, (1), 7-17.
Bocquet-Appel, J.-P. (1996) Interview de Gustave Malécot (mai 1993, avril 1994), *Bulletins et Mémoires de la Société d'anthropologie de Paris*, Nouvelle Série. Tome 8 N°1-2, 105-114.
Borel, E. (1908) Sur l'analyse des courbes polymorphiques, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **146**, 1304-1305.
_____ (1909a) Sur l'emploie de la méthode différentielle pur la comparaison des statistiques, *Bulletin de l'Institut International de Statistique*, **18**, 283-288.
_____ (1909b) Sur l'étude des variations des quantités statistiques, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **148**, 1585-1587.
_____ (1914) *Le Hasard*, Paris: Alcan.
_____ (1920) La Statistique et l'Organisation de la présidence du Conseil des Ministres, *Journal de la Société de Statistique de Paris*, **61**, 9-13.
Bowley, A. L. (1901) *Elements of Statistics* (in the 4th edition of 1920 the mathematical Part II was greatly enlarged), London: King.
_____ (1909) A Suggestion for the International Comparison of Wages by Use of the Median, *Bulletin de l'Institut International de Statistique*, **18**, Book 1, 552-556; discussion 57-60.
_____ (1926) Measurement of the Precision Attained in Sampling, *Bulletin de l'Institut International de Statistique*, **22**, Suppl. to Book 1, 1-62.
_____ (1928) Rapport sur les salaires comme éléments du coût de production, *Bulletin de l'Institut International de Statistique*, **23**, Book II, 452-496.
_____ (1928) L'étude des éléments statistiques les plus instructifs en vue des prévisions économiques a rassembler dans les principaux pays, *Bulletin de l'Institut International de Statistique*, **24**, Book II, 220-229.
Box, J. F. (1978) *R. A. Fisher: The Life of a Scientist*, New York: Wiley.
Bresciani-Turroni, C. (1929) Movement of Wages in Germany During the Depreciation of the Mark and After Stabilization, *Journal of the Royal Statistical Society*, **92**, (3), 374-427.
_____ (1937) On Pareto's Law, *Journal of the Royal Statistical Society*, **100**, (3), 421-432.
Broch, O. I. (1885) The Agricultural Crisis in Europe, *Journal of the Statistical Society of London*, **48**, 297-312.
Bru, B. (2001) Georges Darmois, in Heyde and Seneta (2001) pp. 382-385.
Bru, B. and S. Hertz (2001) Maurice Fréchet, in Heyde and Seneta (2001) pp. 331-334.
Bunle, H. (1911) Relations entre les variations des indices économiques et le mouvement des mariages, *Journal de la Société de Statistique de Paris*, **51**,

80–91.
Campion, H. (1949) International Statistics, *Journal of the Royal Statistical Society*, **101**, (1), 206-208.
Catellier, R. and L. Mazliak (2009) The Emergence of French Statistics: How Mathematics entered the World of Statistics in France during the 1920s, *Revue d'histoire des mathématiques*, forthcoming.
Cheysson, (1882) The Organisation of Government Statistical Offices, *Journal of the Statistical Society of London*, **45**, 606-623.
Chevalier, M. (1860) Opening address at the first meeting, *Journal de la Société de Statistique de Paris*, **1**, 1-6.
Chuprov, A. A. (1925) On the Asymptotic Frequency Distribution of the Arithmetic Means of n Correlated Observations for Very Great Values of n, *Journal of the Royal Statistical Society*, 88, (1), 91-104.
Colasse, B. and F. Pavé (2002) L'Institut Henri Poincaré aux sources de la recherche opérationnelle. Entretien avec Bernard Bru, *Gérer et Comprendre*, **67**, 76–91.
Collingwood, E. F. (1959) Emile Borel, *Journal of the London Mathematical Society*, **34**, 488-512.
Craigie, P. G. (1913) Alfred de Foville, *Journal of the Royal Statistical Society*, **76**, (7), 707-708.
Crammond, E. (1915) The Cost of the War, *Journal of the Royal Statistical Society*, **78**, (3), 361-416.
Cullen, M. J. (1975) *The Statistical Movement in Early Victorian England*. Hassocks, Sussex: Harvester.
Cusso, R. (2010) Ce que la Société statistique de Paris (SSP) et les premiers congrès de statistique nous apprennent sur la statistique internationale, this issue of the *Journal Electronique d'Histoire des Probabilités et de la Statistique.*
Damiani, P. (1987) Histoire de la Société de Statistique de Paris: 1. Sa création en 1860, *Journal de la Société de Statistique de Paris*, **128**, 239-242.
_____ (1988a) Histoire de la Société de Statistique de Paris: 2. De 1860 à 1885, *Journal de la Société de Statistique de Paris*, **129**, 193-201.
_____ (1988b) Histoire de la Société de Statistique de Paris: 3. De 1886 à 1910. *Journal de la Société de Statistique de Paris*, **129**, 277-285.
_____ (1989) Histoire de la Société de Statistique de Paris: 4. De 1911 à 1935. *Journal de la Société de Statistique de Paris*, **130**, 103-111.
Darmois, G. (1928) *Statistique mathématique*, Paris: Doin.
_____ (1932) La méthode statistique dans les sciences d'observation, *Annales de l'Institut Henri Poincaré*, **3**, (2), 191-228.
_____ (1934a) *Statistique et applications*, Paris: Colin.
_____ (1934b) Développements récents de la technique statistique, *Econometrica*, **2**, (3), 238-248.
_____ (1935) Sur les lois de probabilité à estimation exhaustive, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **200**, 1265-1266.
_____ (1936) *L'Emploi des Observations Statistiques: Méthodes d'Estimation*, Paris: Hermann.

_____ (1937) Sur le rendement des observations statistiques, *Journal de la Société de Statistique de Paris*, **78**, 310-319.
_____ (1946) Resumés exhaustifs et probleme du Nil, Note presented 15 July 1942, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences* , **222**, 266-268.
Deheuvels, P. (1990) Obituary: Daniel Dugué, *Journal of the Royal Statistical Society A*, **153**, (1), 99-100.
Delboy, P. A. (1884) The Present Position of Spain Compared with Other European Countries, *Journal of the Statistical Society of London*, **47**, 150-163.
Depoid P. (1959) Alfred Barriol, 1873-1959, *Revue de l'Institut International de Statistique*, **11**, 97-99.
_____ (1961) Contribution à l'histoire de la Société de Statistique de Paris, *Journal de la Société de Statistique de Paris*, **102**, 81-191.
Desrosières, A. (1998) *The Politics of Large Numbers: A History of Statistical Reasoning*, a translation of the French text of 1993, Harvard University Press.
Dieulefait, C. (1934) Contribution a l'étude de la théorie de la corrélation, *Biometrika*, **26**, (4), 379-403.
Droesbeke, J.-J. (2005) Les Racines de la société française de statistique, *Journal de la Société Française de Statistique*, **146**, (4), 6-22.
_____ (2010) La statistique belge en 1860 et ses relations avec la France, this issue of the *Journal Electronique d'Histoire des Probabilités et de la Statistique.*
Dugué, D. (1936a) Sur le maximum de précision des estimations gaussiennes à la limite, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **202**, 193-195.
_____ (1936b) Sur le maximum de précision des lois limites d'estimation, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **202**, 452–454.
_____ (1936c) Sur certains modes de convergence de lois d'estimation, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **202**, 1732-1734.
_____ (1937) Application des propriétés de la limite au sens du calcul des probabilités a l'étude de diverse questions d'estimation, *Journal de l'École Polytechnique* 3e série (n. 4), 305–373.
_____ (1961) Georges Darmois, 1888-1960, *Annals of Mathematical Statistics,* **32**, (2), 357-360.
Edgeworth, F. Y. (1885) Methods of Statistics*, Jubilee Volume, Statistical Society of London*, 181-217.
_____ (1889) On the Application of Mathematics to Political Economy, *Journal of the Royal Statistical Society*, **52**, (4), 538-576.
_____ (1889) *Calcul des Probabilités.* Par J. Bertrand, *Journal of Education*, **11**, 592.
_____ (1895) On Some Recent Contributions to the Theory of Statistics, *Journal of the Royal Statistical Society*, **58**, (3), 506-515.
_____ (1896) Supplementary Notes on Statistics, *Journal of the Royal Statistical Society*, **59**, (3), 529-539.

_____ (1909) On the Application of the Calculus of Probabilities to Statistics, *Bulletin de l'Institut International de Statistique*, **18**, Book 1, 505-536.
Durand, A. and L. Mazliak (2010) Borel et son apprentissage du hasard, manuscript.
Elliott, C. and R. W. Farebrother (1994) Subject Index of Obituary Notices 1839-1993, *Journal of the Royal Statistical Society, A*, **157**, (1), 165-171.
Esquirou de Parieu, F. (1861) On Taxes Upon Enjoyments (Impots sur les Jouissances), *Journal of the Statistical Society of London*, **24**, (2), 167-197.
Falguerolles, A. de (2010) «Les Précurseurs de la Société de Statistique de Paris» de Fernand Faure, this issue of the *Journal Electronique d'Histoire des Probabilités et de la Statistique.*
Fisher, R. A. (1918) On the Correlation between Relatives on the Supposition of Mendelian Inheritance, *Transactions of the Royal Society of Edinburgh*, **52**, 399-433.
_____ (1922) On the Mathematical Foundations of Theoretical Statistics, *Philosophical Transactions of the Royal Society, A*, **222**, 309-368.
_____ (1925) Sur la solution de l'équation intégrale de M. V. Romanovsky, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **181**, 88-89.
_____ (1930a) *Genetical Theory of Natural Selection,* Oxford: Oxford University Press.
_____ (1930b) Inverse Probability, *Proceedings of the Cambridge Philosophical Society*, **26**, 528-535.
_____ (1938) Quelques Remarques sur l'estimation en Statistique, *Biotypologie*, **6**, 153-158.
Fisher, R. A. and L. H. C. Tippett (1928) Limiting forms of the Frequency Distribution of the Largest or Smallest Member of a Sample, *Proceedings of the Cambridge Philosophical Society*, **24**, 180-190.
Flux, A. W., Rew, R. H. and G. U. Yule ("Honorary Secretaries") (1913) The Fourteenth Session of the International Statistical Institute, *Journal of the Royal Statistical Society*, **77**, (1), 69-78.
Fournier de Flaix, E. (1886) Le jubilee-volume de la Société de Statistique de Londres, *Journal de la Société de Statistique de Paris*, **27**, 222-223.
_____ (1886) The National Wealth of France Compared with Other Countries, *Journal of the Statistical Society of London*, **49**, 186-200.
de Foville, A. (1879) The Influence of the Price of Goods on the Movements of the Foreign Trade of France, *Journal of the Statistical Society of London*, **42**, (4), 848-857
_____ (1885) La Statistique et ses Ennemis, *Jubilee Volume, Statistical Society of London*, 87-95.
_____ (1910) Emile Cheysson, *Journal of the Royal Statistical Society*, **73**, (3), 254-256
Fréchet, M. (1906) Sur quelques points de calcul fonctionnel, thése de doctorat publ., *Rendiconti del Circolo matematico di Palermo*, **22**, 1–74.
_____ (1924) Sur une formule générale pour le calcul des primes pures

d'assurance, sur la vie, *Proceedings of the International Congress of Mathematics, Toronto,* **2**, 857–865.
_____ (1926) Une nouvelle représentation analytique de la répartition des revenus, *Bulletin de l'Institut International de Statistique*, **22**, 547-549.
_____ (1927) Sur la loi de probabilité de l'écart maximum, *Annales de la Société polonaise de mathématiques*, **5**, 93–116.
_____ (1935) Rapport de la commission d'étude de l'usage du coefficient de corrélation, *Bulletin de l'Institut International de Statistique*, **28: 2**, 25–52.
_____ (1937) Rapport de la commission d'étude de l'usage du coefficient de corrélation, *Bulletin de l'Institut International de Statistique*, **29: 3**, 318–322.
_____ (1938) *Recherches théoriques modernes sur le calcul des probabilités*, 2e livre: *La méthode des fonctions arbitraires. Les évènements en chaîne dans le cas d'un nombre fini de cas possibles*, in E. Borel (ed.) *Traité de calcul des probabilités et de ses applications*, t. I, fasc. III, livre II.
_____ (1943) Sur l'extension de certaines evaluations statistiques au cas de petits échantillons, *Revue de l'Institut International de Statistique*, **11**, 183-205.
_____ (1963) Letter to the President of the Royal Statistical Society, *Journal of the Royal Statistical Society A*, **126**, (1), 169-170.
Fréchet, M. and M. Halbwachs (1924) *Le Calcul des probabilités à la portée de tous*, Paris: Dunod.
Friedman, W. A. (2009) The Harvard Economic Service and the Problems of Forecasting, *History of Political Economy*, **41**, (1), 57-88.
Gain, E. (1904) Étude Biométrique sur les Variations de la Fleur et sur L'Hétérostylie de *Pulmonaria Officinalis* L., *Biometrika*, **3**, (4), 398-458.
Galton, F. (1885) The Application of a Graphic Method to Fallible Measures (with discussion), *Jubilee Volume, Statistical Society of London*, 262-271
Goldman, L. (1983) The Origins of British 'Social Science': Political Economy, Natural Science and Statistics, 1830-1835, *Historical Journal*, **26**, (3), 587-616.
Greenwood, M. (1914) Review of *Le Hasard* by E. Borel, *Journal of the Royal Statistical Society*, **77**, (8), 866-867.
_____ (1929) Review of *Statistique Mathematique* by G. Darmois, *Journal of the Royal Statistical Society*, **92**, (1), 100-101.
Greenwood, M. and C. M. Thomson (1919) A Note on German and English War-Time Diets, *Journal of the Royal Statistical Society*, **82**, (1), 78-80.
Greenwood, M. and G. U. Yule (1920) An Inquiry into the Nature of Frequency Distributions Representative of Multiple Happenings with Particular Reference to the Occurrence of Multiple Attacks of Disease or of Repeated Accidents, *Journal of the Royal Statistical Society*, **83**, (1), 255-279.
Guyot, Y. (1902) The Sugar Industry on the Continent, *Journal of the Royal Statistical Society*, **65**, (1), 419-446.
_____ (1914) The Waste of the War and the Trade of Tomorrow, *Nineteenth Century*, **76**, (July-Dec.), 1193-1206.
Henninger, W. (1934) Die nationalen Statistischen Gesellschaften, *Algemeines Statistisches Archiv*, **24**, 185-207.
Hertz, S. (2001a) Emile Julius Gumbel, in Heyde and Seneta (2001) pp. 406-409.
_____ (2001b) Georg von Mayr, in Heyde and Seneta (2001) pp. 219-222.

_____ (2001c) Ladislaus von Bortkiewicz, in Heyde and Seneta (2001) pp. 272-277.
_____ (2001d) Wilhelm Lexis, in Heyde and Seneta (2001) pp. 204-207.
Heyde, C. C. (2001) George Handley Knibbs in Heyde and E. Seneta (2001) pp. 257-260.
Heyde, C. C. and E. Seneta (eds.) (2001) *Statisticians of the Centuries*, New York: Springer.
Hilts, V. L. (1978) Aliis Exterendum, or the Origins of the Statistical Society of London, *Isis*, **69**, (1), 21-43.
Irwin, J. O. (1931) Review of *Les Principes de la Methode Statistique avec Quelques Applications aux Sciences Naturelles et a la Science des Affaires* by Lucien March, *Journal of the Royal Statistical Society*, **94**, (3), 439-442.
Isserlis, L. (1920) Review of *Calcolo delle Probabilità* by Guido Castelnuovo, *Journal of the Royal Statistical Society*, **83**, (2), 290-292.
Jevons, W. S. (1866) Brief Account of a General Mathematical Theory of Political Economy, *Journal of the Statistical Society of London*, **29**, (2), 282-287.
_____ (1878) Bibliography of Works on the Mathematical Theory of Political Economy, *Journal of the Statistical Society of London*, **41**, (2), 398-401.
John, V. (1883) The Term "Statistics", (translation of *Der Name Statistik-eine etymologisch-historische Skizze*), *Journal of the Statistical Society of London*, **46**, (4), 656-679.
Jovanovic, F. and P. Le Gall (2001) March to Numbers: The Statistical Style of Lucien March, *History of Political Economy*, **33**, (Supplement), 86-110.
_____ (2002) Genèse et nature de la Théorie de la spéculation: les contributions de Louis Bachelier et de Jules Regnault à la théorie financière et à l'économétrie, pp. 165-202 of J.-M. Courtault and Y. Kabanov (eds.) (2002) *Louis Bachelier, aux origines de la finance mathématique*, Besançon: Presses Universitaires Franc-Comtoise.
Kang, Z. (1992) La société de statistique de paris au XIXe siècle: un lieu de savoir social, *Les Cahiers du Centre de Recherches Historiques*, **9**,
Kendall, D. G. (1977) Maurice Fréchet, 1878-1973, *Journal of the Royal Statistical Society A*, **140**, (4), 566.
_____ (1990) Andrei Nikolaevich Kolmogorov (1903-1987): the Man and his Work, *Bulletin of the London Mathematical Society*, 31-47.
Keynes, J. M. (1910) Review of *Éléments de la Théorie des Probabilités* by E. Borel, *Journal of the Royal Statistical Society*, **73**, (2), 171-172.
_____ (1921) *A Treatise on Probability*, London: Macmillan.
Kiker, B. F. and J. L. Cochrane (1973) War and Human Capital in Western Economic Analysis, *History of Political Economy*, 375-398.
Knobloch, E. (1987) Emile Borel as a probabilist, pp. 215-233 of L. Krüger et al. (1987).
Krüger, L., L. J. Daston and M Heidelberger (eds.) (1987) *The Probabilistic Revolution. Volume 1: Ideas in History*, Cambridge Mass.: MIT Press.
Krüger, L., G. Gigerenzer and M. S. Morgan (eds.) (1987) *The Probabilistic Revolution. Volume 2: Ideas in the Sciences*, Cambridge Mass.: MIT Press.

Kruskal, W. and Mosteller, F. (1980) Representative Sampling. IV. The History of the Concept in Statistics, 1895-1939, *International Statistical Review*, **48**, 169-195.
Le Gall, P. (2007) *A History of Econometrics in France: from Nature to Models*, London: Routledge.
Leloup, J. (2009) L'entre-deux-guerres mathématique à travers les thèses soutenues en France, Thèse de doctorat, Université Pierre et Marie Curie, Paris.
Levasseur, E. (1883) Review of the General Results of Demography Applied to Political Economy, *Journal of the Statistical Society of London*, **46**, (2), 351-367.
_____ (1885a) La Statistique graphique, *Jubilee Volume, Statistical Society of London*, 218-250.
_____ (1885b) Emigration in the Nineteenth Century, *Journal of the Statistical Society of London*, **48**, (1), 63-81.
_____ (1887) The Tables of Mortality and Survivorship, *Journal of the Royal Statistical Society*, **50**, (3), 547-569.
_____ (1892a) Area and Population, *Journal of the Royal Statistical Society*, **55**, (2), 298-311.
_____ (1892b) The Russian Famine, *Journal of the Royal Statistical Society*, **55**, (1), 80-87.
Lexis, W. (1909) Rapport sur la statistique de la tuberculose, *Bulletin de l'Institut International de Statistique*, **18**, Book 1, 297-304.
Liegaard, A. (1884) Immigration into the United States, *Journal of the Statistical Society of London*, **47**, (3), 496-516.
Loua, M. T. (1885) Rapport sur le vingt-cinquième anniversaire de la fondation de la Société, *Journal de la Société de Statistique de Paris*, **26**, 357-368.
Louçã, F. (2007) *The Years of High Econometrics. A Short History of the Generation that Reinvented Economics*, Routledge, London and New York.
MacKenzie, D. A. (1981) *Statistics in Britain 1865-1930: The Social Construction of Scientific Knowledge*. Edinburgh: Edinburgh University Press.
Macrosty, H. W. (1934) *Annals of the Royal Statistical Society 1834-1934*, London: Royal Statistical Society.
Malécot, G. (1939) *Théorie mathématique de l'hérédité mendelienne généralisée*, Thèse de doctorat, Faculté des sciences de Paris.
Mantoux, P. (1917) Trade with France Before and After the War, *Journal of the Royal Statistical Society,* **80**, (3), 383-410.
March, L. (1898) Salaires, quelques exemples de leur distribution, *Journal de la Société de Statistique de Paris*, **37**, 193-206 and 241-248.
_____ (1905) Comparaison numérique de courbes statistiques, *Journal de la Société de Statistique de Paris*, **44**, 255-277.
_____ (1909) De l'application de procédés mathématiques à la comparaison des statistiques, *Bulletin de l'Institut International de Statistique*, **18**, Book 1, 254-264; discussion 53-57.
_____ (1910) Essai sur un mode d'exposer les principaux éléments de la théorie statistique, *Journal de la Société de Statistique de Paris*, **51**, 447-486.
_____ (1911a) Nécrologie: Sir Francis Galton, *Journal de la Société de Statistique de Paris*, **52**, 203-204.

_____ (1911b) La théorie statistique et la logique formelle à propos de 1'« Introduction » de M. Yule, *Journal de la Société de Statistique de Paris*, **52**, 416-426.
_____ (1912a) Some Researches Concerning the Factors of Mortality, *Journal of the Royal Statistical Society,* **75**, (5), 505-538.
_____ (1912b) Les moyens de rendre comparables les courbes statistiques, *Bulletin de l'Institut International de Statistique*, **19**, Book 1,?-?; discussion pp. 138-
_____ (1912c) La grammaire de la science, *Journal de la Société de Statistique de Paris*, **53**, 196-214.
_____ (1923) L'étude statistique du mouvement général des affaires, *Journal de la Société de Statistique de Paris*, **64**, 251–81.
_____ (1924) Rapport sur les indices de la situation économique, *Bulletin de l'Institut International de Statistique*, **21**, Book 2, 3-42; with discussion in Book 1, 167-174, 178-183.
_____ (1926) Observations sur la méthode représentative et sur le projet de rapport relatif à cette méthode, (Annexe D) *Bulletin de l'Institut International de Statistique*, **22**, Suppl. to Book 1, 444-451.
_____ (1928) La statistique intellectuelle, *Bulletin de l'Institut International de Statistique*, **23**, Book II, 452-496; discussion Book I, 107-110.
_____ (1930) Les éléments instructifs des prévisions économiques,*Bulletin de l'Institut International de Statistique*, **24**, 268–82.
_____ (1931) La statistique et le mouvement des affaires, *Bulletin de l'Institut International de Statistique*, **23**, 470-478.
Marshall, A. (1885) On the Graphic Method of Statistics, *Jubilee Volume, Statistical Society of London*, 251-260.
Martin, J. B. (1896) On Some Developments of Statistical Research and Methods During Recent Years, *Journal of the Royal Statistical Society*, **59**, (4), 579-628.
Mayr, G. von (1883) The Theory and Practice of Statistics, (translated excerpt from *Die Gesetzmässigkeit im Gesellschaftsleben*), *Journal of the Statistical Society of London*, **46**, (3), 461-516.
Mazliak, L. (2010) Borel, Fréchet, Darmois : la découverte des statistiques par les probabilistes français dans les années 1920, this issue of the *Journal Electronique d'Histoire des Probabilités et de la Statistique.*
Ménard, C. (1980) Three Forms of Resistance to Statistics: Say, Cournot, Walras, *History of Political Economy*, **12**, (4), 524–541.
Mespoulet, M. (2010) La section de statistique de la Société juridique de Moscou, this issue of the *Journal Electronique d'Histoire des Probabilités et de la Statistique.*
Meusnier, N. (2006) Sur l'histoire de l'enseignement des probabilités et des statistiques, *Journal Electronique d'Histoire des Probabilités et de la Statistique*, **2**, (2), pp. 20.
Neumann-Spallart, F. X. von (1885) Résumé of the Results of the International Statistical Congresses and Sketch of Proposed Plan of an International Statistical Association, *Jubilee Volume, Statistical Society of London*, 284-320.

Newsholme, A. (A. N.) (1922) Dr. Jacques Bertillon, *Journal of the Royal Statistical Society*, **85**, (4), 662-664..
Newmarch, W. (1869) Inaugural Address on the Progress and Present Condition of Statistical Inquiry, *Journal of the Statistical Society of London*, **32**, (4), 359-390.
Neymarck, A. (1889a) France, 1789-1889. An Economic Centenary, *Journal of the Royal Statistical Society*, **52**, (2), 306-338.
_____ (1889b) The Value of Personal Property in France, *Journal of the Royal Statistical Society*, **52**, (3), 475-493.
Nixon, J. W. (1960) *A History of the International Statistical Institute, 1885-1960*, The Hague : International Statistical Institute.
Pareto, V. (1897) Quelques exemples d'applications des méthodes interpolation a la statistique, *Journal de la Société de Statistique de Paris*, **42**, 367-377.
_____ (1900) Distribution de la richesse d'après le rôle de la taille, à Paris, en 1292, *Journal de la Société de Statistique de Paris*, **45**, 224-225.
Pearson, K. (1895) Contributions to the Mathematical Theory of Evolution. II. Skew Variation in Homogeneous Material. *Philosophical Transactions of the Royal Society A*, **186** 343–414.
Porter, T. M. (1986) *The Rise of Statistical Thinking 1820-1900*, Princeton: Princeton University Press.
Rew, R. H. (1909) The International Statistical Institute at Paris, *Journal of the Royal Statistical Society*, **72**, (3), 594-603.
_____ (1911) International Statistical Institute, *Journal of the Royal Statistical Society*, **75**, (1), 51-63.
_____ (1921) The Organization of Statistics, *Journal of the Royal Statistical Society*, **84**, (1), 1-21.
Romanowsky, V. (1926) Sur certaines espérances mathématiques et sur l'erreur moyenne du coefficient de corrélation, *Comptes Rendus des séances hebdomadaires de l'Académie des sciences*, **180**, 1897-1899.
Rosenfeld, F. (1997) Histoire des Sociétés de statistique en France, *Journal de la Société de statistique de Paris*, **138**, 3-18.
Roy, R. (1960) Georges Darmois, 1888-1960, *Journal of the Royal Statistical Society, A*, **123**, (4), 520-522.
Schneider, I. (1987) Laplace and Thereafter: the Status of Probability Calculations in the Nineteenth Century, pp. 191-214 of L. Krüger et al. (1987).
Schweber, L. (2006) *Disciplining Statistics: Demography and Vital Statistics in France and England, 1830-1885*, Durham, N. C.: Duke University Press.
Seneta, E. (2009) Karl Pearson in Russian Contexts, *International Statistical Review*, **77**, (1), 118-146.
Seneta, E. and I. H. Stamhuis (2009) Preface to Karl Pearson Issue, *International Statistical Review*, **77**, 1-2.
Siegmund-Schultze, R. (2001) *Rockefeller and the Internationalization of Mathematics Between the Two World Wars*, Basel: Birkhäuser.
_____ (2009) The Institute Henri Poincaré and Mathematics in France between the Wars, *Revue d'histoire des sciences*, **62**, 247-284.

Slutsky, E. (1913) On the Criterion of Goodness of Fit of the Regression Lines and on the Best Method of Fitting them to the Data, *Journal of the Royal Statistical Society*, **77**, (1), 78-84.
Stamhuis, I. (2010) German 'Knowledge of State Power' or French 'Numbers and Equations', Opinions on Statistics during the Defeat of the Dutch Statistical Society, this issue of the *Journal Electronique d'Histoire des Probabilités et de la Statistique.*
Starling, E. H. (1920) The Food Supply of Germany During the War, *Journal of the Royal Statistical Society*, **83**, (2), 225-254.
Stigler, S. M. (1986) *The History of Statistics: The Measurement of Uncertainty before 1900*, Cambridge, MA, and London: Belknap Press of Harvard University Press.
_____ (1996) The History of Statistics in 1933, *Statistical Science*, **11**, (3), 244-252.
_____ (2007) The Epic Story of Maximum Likelihood, *Statistical Science*, **22**, (4), 598-620.
Stone, M. (2001) Florence Nightingale, in Heyde and Seneta (2001) pp. 171-175.
Stone, R. (1997) *Some British Empiricists in the Social Sciences 1650-1900*, Cambridge: Cambridge University Press.
Tite, W. (1864) On the Comparative Mortality of London and Paris, *Journal of the Statistical Society of London*, **27**, (4), 479-491.
Tombs, R. P. and I. Tombs (2007) *That Sweet Enemy: Britain and France, The History of a Love-Hate Relationship*, London: Pimlico.
Tooke, T. (1855) Twenty-First Anniversary Meeting of the Statistical Society, *Journal of the Statistical Society of London*, **18**, (2), 97-103.
Volterra, V (1906) Les mathématiques dans les sciences biologiques et sociales, *Revue du Mois*, **1**, 1-20.
Westergaard, H. (1890) *Die Grundzüge der Theorie der Statistik*, Jena: Fischer.
_____ (1932) *Contributions to the History of Statistics*, London: King.
Willcox, W. F. (1934) London Meeting of the International Statistical Institute, *Journal of the American Statistical Association*, **29**, (Sep.), 310-312.
Yule, G. U. (1906) Review of *Elements de Statistique* by Fernand Faure, *Journal of the Royal Statistical Society*, **69**, (2), 444-445.
_____ (1909) The Applications of the Method of Correlation to Social and Economic Statistics, *Bulletin de l'Institut International de Statistique*, **18**, Book 1, 537-551; discussion ,
_____ (1911) *An Introduction to the Theory of Statistics*, London: Griffin.
_____ (1933) Note on the Number of the Jews in Germany, *Journal of the Royal Statistical Society*, **96**, (3), 378-480.
Yvernes, E. (1890) The Consumption of Alcohol in Various Countries, *Journal of the Royal Statistical Society*, **53**, 113-127.
Zahn, F. (1934) *50 Années de l'Institut International de Statistique*, Munich: International Statistical Institute.