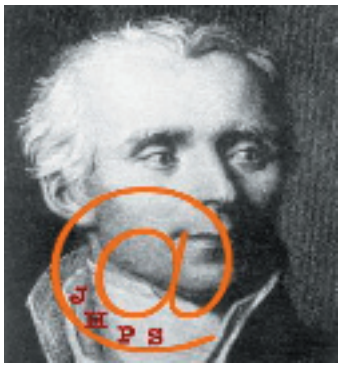


Journ@l Electronique d'Histoire des Probabilités et de la Statistique

Electronic Journ@l for History of Probability and Statistics

Vol 1, n°1; Mars 2005

Probability, biology and sociology in the human sex-ratio at birth
A note on the trace of the First World War

Éric BRIAN[1] and Marie JAISSON[2]

Résumé

La conjoncture postérieure à la Première Guerre mondiale fournit un cas expérimental qui permet de saisir les diverses modalités des effets de ce conflit sur l'élaboration de la conception de la sociologie quantitative chez Maurice Halbwachs – une tentative de dépassement de la morphologie sociale durkheimienne fondée sur une rencontre avec le calcul des probabilités. L'étude du sex ratio humain à la naissance fut l'objet de prédilection de ses recherches à cet égard. L'examen critique de ses résultats empiriques permet de réévaluer les phénomènes qu'il entendait cerner.

Abstract

The aftermath of the First World War provides an experimental opportunity for investigating the variety of modalities given by this conflict to the formation of Maurice Halbwachs' conception of quantitative sociology – an attempt based on probability to go beyond Durkheim's initial understanding of social morphology. The study of the Human sex ratio at birth was the focus of Halbwachs' investigation. A critical elaboration of some of his empirical results sheds new light upon the variability of the phenomenon he studied.

1. Why sex ratio at birth after the First World War? [3]

Recently Annette Becker remarked that while studying Maurice Halbwachs' intellectual biography (1877-1945) she had to face a "striking paradox". As the successor of the French founder of sociology – Emile Durkheim (1858-1917, [15]) – and perhaps one of the best informed scholars in Europe about the relationship between social sciences and mathematics, Halbwachs seemed to Becker to have worked during the 1920's to remove the war that he and his generation had survived from his own domain of reflection. It was as if, "he had decided not to mention it in his own works" ([1], 151-152). Such a statement seems to us difficult to argue in light of the newly-released correspondences exchanged during the 1930s between the two founders of *Les Annales*, Marc Bloch (1886-1944) and Lucien Febvre (1878-1956). The book provides a good taste of the intellectual and pragmatic atmosphere among this group of scholars, including Halbwachs ([10]), which was unified by their experiences at the new French University of Strasbourg and their desire to gain access to top Parisian academic positions ([2]). Their common experience had been forged from their involvement in military action and in the wartime mobilisation of civil society. Because they were in charge of educating younger generations – viewing this function as a social and political mission – their memory of the wartime period was constantly reactivated. The mutual evaluations and the judgements about other colleagues that these documents display (which can also be seen in many other similar sources [50]) were expressed in the very vocabulary of their wartime experience.

1 EHESS, 10 rue Monsieur le Prince, 75006 Paris and INED, 133 boulevard Davout, 75020 Paris. brian@ehess.fr

2 Université de Tours, 3 rue des Tanneurs, 37000 Tours and LASMAS-CNRS, 59 rue Pouchet, 75017 Paris. jaisson@univ-tours.fr

3 Both authors thank Luke Miner for his revision of this text.

But it has not only been a matter of personal judgement. European researches in social sciences were deeply affected by the collective experience of the continental tragedy. During the aftermath of the war, many authors in France – including some close to Halbwachs and Febvre like the geographer Albert Demangeon (1872-1940, [12]) and the economist Adolphe Landry (1874-1956, [43], 107-165) – had published books on the so-called "decline" of France or Europe, if not of the "white races" ([3]; [11]). This movement of publications has been analysed as a typical post-war phenomenon by several authors ([14]; [17]). It has been related to and sometimes explicitly grouped with a similar movement visible in the German academic world. The name of Oswald Spengler (1880-1936) has been attached to this type of literature, which combines an accessible academic style and an apocalyptic philosophy of history ([60]). Some German statisticians have worked out demographic variations on Spengler's themes ([8]; [41]). Here again, historians have shown that for Germany the post-war background was relevant in order to explain this movement ([37]; [61]). We know today with certainty that the two most prominent among those authors, Friedrich Burgdörfer (1890-1967) and Richard Korherr (1903-1989), later became active Nazi scientists ([65]; [68]). But their international identification as such and an evaluation of their actual level of scientific activity, especially among the French scholars during the 1930's, was not so simple even if their activities were public in Germany. The general mood carried in these kinds of writings has been identified as pro-fascist or proto-Nazi by scholars like Halbwachs or, dealing with Spengler, as pieces of "opportunistic historiography" by Febvre. It thus follows that the German statisticians and the French sociologists were reading each other, together involved in some level of competition about population studies on both sides of the Rhine. A similar configuration operated between Italian statisticians and French sociologists and statisticians ([16]; [39]; [40]). Several international meetings in Rome, Berlin, and Paris had shaped the conjuncture of this system of scientific challenges ([32]) and reactivated the same level of international activity among statisticians that Europe had displayed from the mid 19th Century up until 1914 ([5]; [49]; [52]; [67]) .

But in Halbwachs' own case, the experience of the war had exercised some other kind of influence. His post-war academic activities were at the University of Strasbourg, which became in 1919 an important player in the political agenda of reintegration of Alsace-Lorraine, the part of pre-1870 France that Germany had ruled between the Franco-Prussian war and the First World War. Once this region had become "French" again, one major institutor of this governmental policy was Albert Thomas (1878-1932), previously Minister for military production during the wartime government ([10]). Halbwachs was one of his close collaborators during that ministerial period, and he quickly became one of the newly nominated professors in charge of the academic side of the local action. Both Thomas and Halbwachs were concerned with the development of economic statistics. Both were socialists and both had been in the same class at the *Ecole normale supérieure*.

The *Universität Strassburg*, as promoted during its German period, had been one of the most active in the German Empire. For example, Wilhelm Lexis (1837-1914) taught statistics there in the mid 1870's, as did Richard von Mises (1883-1953) from 1909 to 1918. In 1919, the French government kept the very same infrastructure for its *Nouvelle Université de Strasbourg,* while sending in many of its best young scientists.

Most of them were *normaliens* and had obtained the degree that was the first step in their academic careers – the *agrégation* – during the same few years at the beginning of the 20th Century: Halbwachs, who taught philosophy in Strasbourg, obtained this diploma in 1901; his colleague, philosopher Henri Wallon, in 1902; the same year Febvre, professor in History at Strasbourg, and Thomas both became *agrégé*s d'histoire et de géographie,

followed by Bloch, himself a historian, in 1908; Maurice Fréchet (1878-1973), university professor of mathematics in the same university, was also a *normalien* and graduated as *agrégé* in his domain in 1903. The University of Strasbourg during these years was like a think-tank made up of a generation of forty-year-old professors who shared a common vision of their task in Alsace based on: the promotion of French science in the face of the international challenge of pre-war German science, a systematic inquiry about foreign and German post-war science, and the training of the regional middle class and elite in accordance with the norms of the French ideal of Science and Republic of that time. Such a general agenda explains the unusual cooperation between a mathematician and a philosopher – namely Fréchet and Halbwachs – in the teaching of probabilities and the writing of one of the most synthetic books on the state of the art in the 1920s ([33]). The fact is that it is not difficult to trace this episode in later publications of both authors (for instance [18], [27] and [30]).

But as shown in an interview given in 1982 by Henri Bunle (1884-1986) – in 1919 chief of the French statistical local bureau – Thomas's activism induced a competition between many protagonists of the French statistician scene in Strasbourg ([13]). At stake was the creation in France of a prototype of a statistical bureau in the German style. This project was directed by *normaliens* and not "statisticians" from the state office, the *Statistique générale de la France*. Most of "statisticians" – but not Bunle – were former students of another French elite school: the *Ecole polytechnique*.

Halbwachs, who had studied statistics in Germany during the pre-war period ([32]) – meeting Lexis in Göttingen a short time after the publication of [46] in 1903 – and who was close to Thomas, was certainly one of the agents in this project, and in all likelihood the "*normalien littéraire*" (*i.e.* non-mathematician) Bunle could not remember his name during his interview ([13] in the current issue of this journal). In any case, Halbwachs prepared a paper on the state of statistics in France and the text circulated in such a way that it was eventually published in Prague in 1931 ([26] ; on the special connexion between Prague and Strasbourg, see the article in the current issue of this review published by V. Havlová, L. Mazliak and P. Šišma).

An amazing piece of information is provided in Bunle's interview, not about the tension among French statisticians, but on some of the exchanges between German and French statisticians from 1918-1920. At his local statistical bureau, Bunle asked his "French" assistants (Alsatian clerks who were considered French) to learn the *savoir faire* of their "German" predecessors (sometimes Alsatian clerks who saw themselves as German). He has recapitulated this episode in crude terms showing that his ignorance about the German statistical standards was on par with his contempt for French philosophers.

> "**HB** – I had recruited Alsatian-Lorrainers of sound stock. I had put them beside those guys. I told the Germans: 'I have put Alsatian-Lorrainers beside you so that you can train them fully on what you have to do. You won't be able to leave the place before my men say they know the job'. So, since the Germans wanted to go, everything turned out OK.
> **AD** – Were those Germans specially trained?
> **HB** – I don't know. They got a degree. But you know, Statistics at that time did not exist." ([13]).

No one knows whether Halbwachs worked with some of Bunle's clerks, but it seems very unlikely. However, the fact is that Halbwachs did work on local social security records which were maintained using German standards. And, in fact, one can detect similarities in

his computational sampling methods and those later theorized by Richard von Mises ([48] ; for further comments see [32]).

In consequence, Halbwachs' scientific activity emerged not only from a post-war context, but also from his generation's collective experience of the war and its aftermath. Therefore it seems difficult to argue that he ignored these manifold contexts. In fact he did more, taking the case of the war as an experimental device for improving his conception of the relationship between probability and sociology ([7]). After his early works and throughout his life, he studied both as a philosopher and as a quantitative statistician the many authors who wrote on this topic from the 17th century up through the 20th century ([21] ; [22] ; with additional elements in [32]). During the 1920s and 1930s, he focused this survey on one topic: the study of the sex ratio at birth. He found there a counterpart to Durkheim's emblematic analysis of suicide ([15] ; [25]). His line of reasoning preserved the experimentalism of Emile Durkheim and François Simiand (1872-1935) ([58] ; [59] ; see [66]) and substituted their positivism with a sophisticated understanding of probabilities ([7] ; [24] ; [30]).

Commenting on his own results about the sex ratio at birth and its variation during the war years in France, Halbwachs wrote : "There is no doubt that this is the first time someone can prove in a rigorous manner that variations in the ratio of males at birth are no simple acts of randomness" ([32]). Let's go back to the genealogy of this conjecture. The scientific discussion of human sex ratio at birth had been the favourite subject, at many different time periods, of mathematicians and statisticians seeking to elaborate what is now the probabilistic formulation of the binomial test ([34]; [35]). During the 18th century, their attention had been drawn to the topic by the publication of several physico-theological articles, specifically those of Johann Peter Süssmilch (1707-1763, [64] studied in [56]). Laplace (1749-1827), in some of his earliest probabilistic works, addressed the observed regularity of a greater number of male births than female births from both theoretical and empirical perspectives ([44]). According to Laplace, the sex ratio could be thought to be caused by a random phenomenon based on a single parameter and with a probability a little higher than 50%. His colleague and competitor Condorcet (1743-1794) believed neither the theological nor the Laplacian arguments ([4]). He speculated that humanity could influence the level of its own sex ratio and he conceived of "moral effects" on the proportion of both sexes at birth ([9]). During the 19th century, statisticians and mathematicians compiled data, and occasionally improved their understanding of binomial statistics ([63]). One major occasion of technical clarification occured in 1830 when, in order to cut these debates short, Poisson (1781-1840) reformulated the mathematical ground for the analysis of this kind of distribution ([51]).

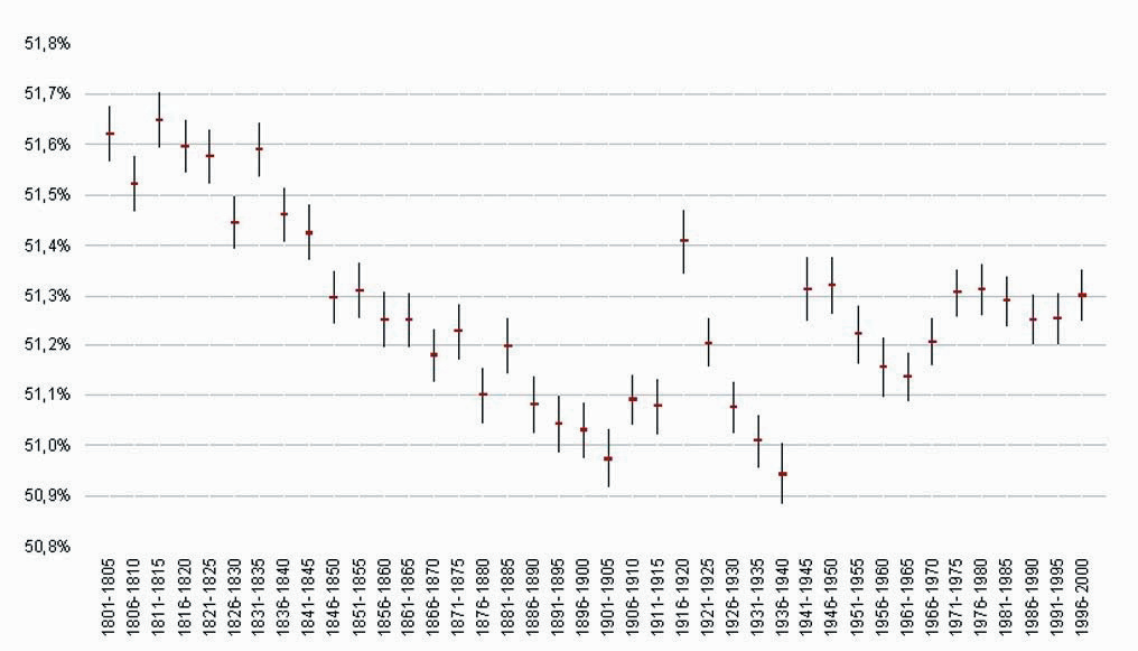
In 1933 and 1936 ([27]; [29], both in [32]), Halbwachs did not use a biological argument on chromosomes in order to study the sex ratio at birth. Furthermore, much like his contemporaries, he had no clear conception of the tensions between Laplace and Condorcet over the analytical theory of probabilities. Instead he addressed a previous attempt by the Italian statistician Corrado Gini (1884-1965) to provide a biological foundation for demographic phenomena ([19]). In performing his analysis from a scientific perspective, he deliberately challenged both the Italian school of statistics ([23]; [28]) and the English and American development of eugenics ([32]; [53]), finding some help in the works of Robert Kuczynski (1876-1947). Meanwhile, he reached a larger audience with the publication of his results in the columns of the *Encyclopédie française* edited by his friend and colleague Febvre ([29]). The public curiosity that this article attracted was no doubt fed by other publications on similar topics written by medical doctors (for instance [55]).

2. Striking sex ratio at birth then and now

Halbwachs had been struck by the increase of the proportion of male births during the First World War ([29], 82.10-82.11 ; [32], 275-276). However, he followed a false premise (the idea that there could be some cyclic dependency between the difference of ages among the parents and the probability of sexes at birth) and used an inadequate statistical index ([27]; [29]; [32]). The concept of sex ratio indices deserves a mathematical clarification ([32], 169-197 ; for the demographic background on the topic see [38]; [57]). Currently some specialists employ the number of male births per 100 female births just like Süssmilch and Quetelet ([36]), while others prefer the proportion of male births out of the total number of births ([36]; [47]). However, since Laplace and Poisson, a minimal hypothesis consists in considering that the probability of a newborn being recorded as either male or female is uniform for all cases observed, each case being independent from the others ([44]; [45]; [51]). For a given set of observations, in so far that *M* male cases and *F* female cases have been numbered, and in light of Poisson's paper and the later developments based upon it ([51]), the index $m = M/(M+F)$ does display a fine probabilistic behaviour. This is the only reason to accept any mathematically controlled inferences based on *m* ([20]). In this situation it is well known that the degree of confidence of such an inference, the number *N* of cases concerned and the width of the deviation possibly observed between the observed *m* and the theoretical binomial probability μ, are tied together (for instance Proba ($| m - \mu | \geq 1/N^{½}$) $\leq 4.55\%$). In order to check today if there could be a historical variation in the human sex ratio at birth, as Halbwachs pointed out ([27]; [29]) and as Condorcet imagined it ([9]), we need both this statistical device and a larger amount of cases.

The French administration has recorded 168,442,939 births between 1801 and 2000. This is an average of around 4,200,000 cases for five consecutive years with a degree of confidence of 95%, and an amplitude of around 0.01% for the interval centred on each computed sex ratio ([32]). Figure 2 below displays the variation of quinquennial sex ratios at birth during these two centuries. The graph shows both the level of the sex ratio (above 50.8%) and the confidence interval at 95% around each result.

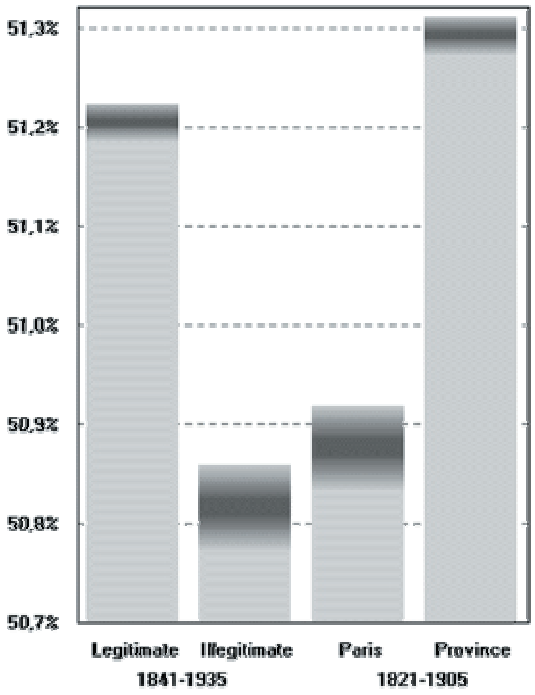
Figure 2. Sex ratio among live-births in France, 1801-2000.



The graphic can be summarized in the following fashion: (1) it is highly improbable that there was no long-term decrease in the sex ratio in France from 1831 until 1905; (2) along similar lines, stark increases of sex ratios during the two World Wars should be seriously considered; (3) each post-war period displays a schema of decrease; (4) surprisingly, the period 1976-2000 appears to be characterized by a higher level of male births. Therefore the historical variability of human secondary sex ratio should be considered well founded. The two first points agree with Halbwachs' observations despite the fact that they were obtained by other means. The fourth point fits with his interpretation of the effects of social and economic crises on the level of sex ratios at birth ([29], 86.8 ; [32], 305).

Two additional results should be added before proposing an interpretation. Once more following Halbwachs the differences between sex ratios for Paris and for the rest of the country have been checked, as well as the differences between legitimate and illegitimate births (an illegitimate birth means a birth without marriage and with no legal recognition from at least one of the parents). Figure 3 below (based on Table 1 further) provides our results with indications related to confidence intervals. As can be seen, it is highly improbable that the sex ratio in Paris was equal to the averages elsewhere in France between 1821 and 1905 (similar observations in [27] and [29]). Similarly, it should be convincing that legitimate and illegitimate births displayed different sex ratios between 1841 and 1935 (during that time period Paris accounted for 5.3% of the French births and 19.3% of the illegitimate French births). It may be added that conclusions similar to the second of these two results have been constantly conjectured on smaller sets of observations since Poisson ([51]).

Figure 3. Sex ratio discrepancies (France, 19th-20th Centuries).



Halbwachs interpreted in a sociological manner the elements that our wider computation has confirmed: the simpler the social life and the simpler the moral references are in a group, the higher the male sex ratio ([25]; [29]; [32], 101-110). For Halbwachs war time periods – like any other deep crises – were periods of simplification of moral criteria. At the opposite end of the spectrum, social life in huge cities increased the exposure to a

multiplicity of moral criteria and consequently reduced the male sex ratio. However, he also considered that the social control of the marriage ages of the parents was the mediation between these social preconditions and the biological phenomenon of childbirth ([27]). We have not been able to follow this line of his reasoning, not only because of modern genetics, but also due to weaknesses in his own statistical material ([6]; [32]).

Table 1. Sex ratio discrepancies (France, 19th-20th Centuries).

	Total live-births (M+F)	Male live-births (M)	Sex ratio (M/M+F)	Source precision (d)	Standard deviation (s)	Interval width (2.s+d)
France 1841-1935						
Legitimate	74 187 323	37 987 063	51,204%	0,005%	0,006%	0,017%
Illegitimate	6 489 889	3 297 791	50,814%	0,005%	0,020%	0,044%
France 1821-1905						
Paris	3784380	1924980	50,866%	0,000%	0,026%	0,051%
Province	75829320	38891320	51,288%	0,010%	0,006%	0,021%

Sources : INSEE (or SGF, SNS), *Annuaires statistiques*, Paris (1939-) ; Préfecture de la Seine, *Annuaire statistique de la Ville de Paris*, Paris (1906) ; H. Bunle, *Le Mouvement naturel de la Population dans le Monde de 1906 à 1936*, Paris, INED (1954).

Conclusion

In conclusion, there is no doubt that the intellectual climate during the aftermath of the First World War shaped Halbwachs concern with the sex ratio at birth. This shaping is not simply a trace of the collective tragedy, but the effect of its integration as one of the legitimate scientific issues during the post-war period. Was this attention relevant? A systematic critical analysis of Halbwachs works shows that this was the case. The social dimension of the highly complex phenomenon summarized by this numerical index of the sex ratio at birth has been established. This entailed setting the empirical examination on its probabilistic background and then reducing the confidence interval around the measure below the fluctuations to be tracked.

References

[1] A. Becker, *Maurice Halbwachs, un intellectuel en guerres mondiales 1914-1945*, Paris, Viénot, 2003.

[2] M. Bloch and L. Fevbre, *Correspondance* (ed. by B. Müller), Paris, Fayard, 3. vols., 1994-2003.

[3] F. Boverat, *La Race blanche en danger de mort*, Paris, Editions de l'Alliance nationale pour l'accroissement de la population française, 1931.

[4] É. Brian, *Staatsvermessungen. Condorcet, Laplace, Turgot und das Denken der Verwaltung*, Vienna, Springer, 2001.

[5] É. Brian, Transactions statistiques au XIXe siècle. Mouvements internationaux de capitaux symboliques, *Actes de la recherche en sciences sociales*, 145, 2002, 34-46.

[6] É. Brian and M. Jaisson, Quelle latitude l'espèce humaine a-t-elle de faire prédominer à son gré les naissances de l'un des deux sexes ?, *Cahiers du CAMS*, 241, novembre 2004.

[7] É. Brian and M. Jaisson, Nombre et mémoire. Halbwachs sociologue probabiliste, in *Erinnerung und Gesellschaft. Hommage zum Werk und Wirkung von Maurice Halbwachs*, H. Krapoth and D. Laborde (eds.), Wiesbaden, Budrich und Leske Verlag, 2005, under press.

[8] F. Burgdörfer, *Der Geburtenrückgang und die Zukunft des deutschen Volkes*, Berlin, Bevölkerungspolitischer Ausschuss, 1928.

[9] Condorcet, Tableau historique des progrès de l'esprit humain. Projets, esquisse, fragments et notes *(1772-1794)*, Paris, INED, 2005 (*Fragment 10*, 923-937).

[10] J. Craig, Maurice Halbwachs à Strasbourg, *Revue Française de Sociologie*, 20, 1, 273-292, 1979.

[11] H. Decugis, *Le Destin des races blanches*, Paris, Librairie de France, 1935.

[12] A. Demangeon, Le Déclin de L'Europe, Paris, Payot, 1920.

[13] A. Desrosières, Extrait de l'interview de Henri Bunle (1884-1986)…, Journ@l électronique d'histoire des *probabilités et de la statistique*, vol. 1, n°1, mars 2005.

[14] É. du Réau, L'Idée du déclin de l'Europe dans les ouvrages français, 1919-*1929*, DES (histoire), Université de Paris, 1968.

[15] É. Durkheim, *Le Suicide*, Paris, Alcan, 1897.

[16] G. Favero, Corrado Gini and Italian Statistics under Fascism, *XIIIth Congress of the International Economic History Association*, Buenos Aires, July 2002.

[17] R. Frank, *La Hantise du déclin. Le Rang de la France en Europe, 1920-1960. Finances, défense et identité nationale*, Paris, Belin, 1994.

[18] M. Fréchet, *Les Mathématiques et le concret*, Paris, PUF, 1955.

[19] C. Gini, *Il sesso dal punto di vista statistico*, Milano, Sandron, 1908.

[20] I. Hacking, *An Introduction to Probability and Inductive Logic*, Cambridge University Press, 2001.

[21] M. Halbwachs, *Leibniz*, Paris, Delaplane, 1906[1] ; Paris, Mellottée, 1928[2] ; *ibid.*, 1950[3].

[22] M. Halbwachs, La Théorie de l'Homme moyen. Essai sur Quetel*et et la statistique morale*, Paris, Alcan, 1912[1] ; *ibid.*, 1913[2].

[23] M. Halbwachs, review of [19] in L'Année sociologique. 1909-*1912*, XII (1913), 826-830.

[24] M. Halbwachs, L'Expérimentation statistique et les probabilités, *Revue philosophique*, 96, 1923[1], 340-371 ; in [31], 1972[2], 275-307.

[25] M. Halbwachs, *Les Causes du suicide*, Paris, Alcan, 1930[1] ; PUF, 2002[2].

[26] M. Halbwachs, La Statistique et les sciences sociales en France, in La France d'aujourd'hui. Livre de lectures à l'usage de l'Ecole des *Hautes Etudes Commerciales de Prague* (sous la dir. de J. Čada), Prague, Spolek posluchačů komerčního inženýrství, 1931[1], 272-286 ; in [32], 2005[2], 369-380.

[27] M. Halbwachs, Recherches statistiques sur la détermination du sexe à la naissance, *J. Soc. Stat. Paris*, 74, 1933, 164-195 ; in [32], 2005[2], 381-404.

[28] M. Halbwachs, Les Facteurs biologiques de la population, *Revue philosophique*, 119, 1935, 285-303.

[29] M. Halbwachs *et al.*, Le Point de vue du nombre, in *Encyclopédie Française*, 7, 1936, 76.3-94.4 ; in [32], 2005[2], 205-365.

[30] M. Halbwachs, La Statistique en sociologie, in Centre international de synthèse, La Statistique…, Paris, P.U.F., 1944[1], 113-134 ; in [31], 1972[2], 329-348.

[31] M. Halbwachs, *Classes sociales et morphologie*, Paris, Minuit, 1972.

[32] M. Halbwachs *et al.*, *Le Point de vue du nombre*, M. Jaisson and É. Brian (eds.), Paris, INED, 2005.

[33] M. Halbwachs and M. Fréchet, *Le Calcul des probabilités à la portée de tous*, Paris, Dunod, 1924.

[34] A. Hald, *A History of Probability and Statistics, and their applications before 1750*, New York, Wiley, 1990.

[35] A. Hald, *A History of Mathematical Statistics from 1750 to 1930*, New York, Wiley, 1998.

[36] I. C. W. Hardy (ed.), *Sex Ratios. Concepts and Research Methods*, Cambridge University Press, 2002.

[37] H. Hoherz, *Klassenkampf oder Verweigerung ? Geburtenrückgang und demogra-phischer Wandel in der politischen Diskussion des Spätphase des deutschen Kaiserreichs, unter besonderer Berücksichtigung der* ‚Gebärstreikdebatte', Magister Arbeit, Univ. Marburg, 1984.

[38] J. Houdaille, « Le rapport de masculinité », *Population et sociétés*, Ined, septembre 1973, n°61.

[39] C. Ipsen, *Dictating Demography. The problem of population in Fascist Italy*, London, Cambridge University Press, 1996.

[40] G. Israel and P. Nastasi, *Scienza e razza nell'Italia fascista*, Bologna, Il Mulino, 1998.

[41] R. Korherr, *Geburtenrückgang*, Munich, Süddeutsche Monatshefte, 1927.

[42] R. Kuczynski, *The Balance of Births and Deaths*, New York, The Macmillan Company, 1928.

[43] A. Landry, *La Révolution démographique. Etudes et essais sur les problèmes de population*, Paris, Sirey, 1934[1] ; INED, 1982[2].

[44] P. S. Laplace, Sur les naissances, les mariages et les morts à Paris depuis 1771 jusqu'en 1784, *Mém. Acad. Sc.*, Year 1783 (1786), 693-702.

[45] W. Lexis, « Das Geschlechtsverhältnis der Geborenen und die Wahrscheinlichkeitsrechnung », *Jahrbücher für National-ökonomie und Statistik*, 27, 1876, 209-245.

[46] W. Lexis, *Abhandlungen zur Theorie der Bevolkerungs- und Moralstatistik*, Iéna, Fischer, 1903.

[47] M. E. N. Majerus, *Sex wars. Genes, bacteria and biased sex ratios*, Princeton University Press, 2003.

[48] R. von Mises, *Wahrscheinlichkeitsrechnung und ihre Anwendung in der Statistik und theoretischen Physik*, Liepzig, Deuticke, 1931.

[49] F. X. von Neumann-Spallart, *La fondation de l'Institut international de statistique, aperçu historique*, Rome, Botta, 1886.

[50] P. Pinell, Naissance d'un fléau. Histoire de la lutte contre le cancer en France (1890-*1940)*, Paris, Métailié, 1992.

[51] S. D. Poisson, Mémoire sur la proportion des naissances des filles et des garçons, *Mém. Acad. Sc.*, 9, 239-308 (1830).

[52] T. Porter, *The Rise of statistical thinking, 1820-1900*, Princeton University Press, 1986.

[53] T. Porter, *Karl Pearson. The Scientific Life in a Statistical Age*, Princeton University Press, 2004.

[54] A. Quetelet, Sur l'Homme et le développement de ses facultés ou Essai de Physique sociale, Paris, Bachelier, 1835[1] ; later published as *Physique sociale ou Essai sur le développement des facultés de* l'Homme, Bruxelles, Mucquardt - Paris, Baillière - Saint Pétersbourg, Issakoff, 1869[2] ; Bruxelles, Académie royale de Belgique, 1997[3].

[55] J. Regnault, *Fille ou garçon ? Comment avoir fille ou garçon. Diagnostic précoce de la grossesse. Comment connaître le sexe avant la naissance*, Paris, Médicis, 1936.

[56] J.-M. Rohrbasser, *Dieu, l'ordre et le nombre. Théologie physique et dénombrement au XVIIIe siècle*, Paris, PUF, 2001.

[57] M. Schtickzelle, « Evolution of Sex-ratio at Birth in some western Countries », *Genus*, n°1-2, 1981, p. 35-60.

[58] F. Simiand, *Statistique et expérience. Remarques de méthode*, Paris, Rivière, 1922.

[59] F. Simiand, Le Salaire, l'évolution sociale et la monnaie, Paris, Alcan, 1932.

[60] O. Spengler, *Der Untergang des Abendlandes : Umrisse einer Morphologie der Weltgeschichte*, vol.1, Leipzig, Braumüller, 1918, vol. 2, Munich, Beck, 1922 (*Le déclin de l'Occident. Esquisse d'une morphologie de l'histoire universelle*, Paris, Gallimard, 1931-1933).

[61] V. Steinecke, *Menschenökonomie. Der medizinische Diskurs über den Geburten-rückgang von 1911 bis 1931*, Pfaffenweiler, Centaurus Verlag Gesellschaft, 1996.

[62] W. Stieda, *Sexualverhältniss der Geborenen. Eine statistische Studie*, Strassburg (*Statistischen Mitteilungen über Elsass-Lothringen*, V. Heft), 1875.

[63] S. M. Stigler, *Statistics on the Table. The History of Statistical concepts and methods*, Cambridge, Harvard University Press, 1999.

[64] J. P. Süssmilch, *Die göttliche Ordnung in den Veränderungen des menschlischen Geschlechts, aus der Geburt, Tod, und Fortpflanzung desselben erwiesen*, Berlin, Spener, 1741[1] (L'Ordre divin dans les changements de l'espèce humaine, démontré par la naissance, la mort et la propagation de celle-*ci*, Paris, éditions de l'Institut national d'études démographiques, 1998).

[65] A. Tooze, *Statistics and the German state, 1900-1945. The making of modern economic knowledge*, Cambridge University Press, 2001.

[66] C. Topalov, 'Expériences sociologiques': les faits et les preuves dans les thèses de Maurice Halbwachs (1909-1913), *Rev. Hist. Sc. Hum.*, 1, 1999, 11-46.

[67] H. Westergaard, *Contributions to the History of Statistics*, London, King, 1932.

[68] J. Wietog, *Volkszählungen unter dem Nationalsozialismus. Eine Dokumentation zur Bevölkerungsstatistik im Dritten Reich*, Berlin, Duncker und Humblot, 2001.