

# THE DESCENT OF HUMAN SEX RATIO AT BIRTH

# METHODOS SERIES

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VOLUME 4

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# The Descent of Human Sex Ratio at Birth

A Dialogue between Mathematics, Biology  
and Sociology

Éric Brian

*Ecole des Hautes Etudes en Sciences Sociales,  
Paris, France*

and

Marie Jaisson

*University Francois-Rabelais,  
Tours, France*

 Springer

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 978-1-4020-6035-9 (HB)

ISBN 978-1-4020-6036-6 (e-book)

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Published by Springer,  
P.O. Box 17, 3300 AA Dordrecht, The Netherlands.

*www.springeronline.com*

*Printed on acid-free paper*

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# CONTENTS

<b>Foreword</b>	<b>vii</b>
<b>Note on Translation</b>	<b>xi</b>
<b>Introduction</b>	<b>xv</b>
<b>Chapter 1</b> <b>Physico-Theology and Mathematics (1710–1794)</b>	<b>1</b>
<b>Chapter 2</b> <b>Physiology, Probabilities and Statistics (1795–1830)</b>	<b>27</b>
<b>Chapter 3</b> <b>Statistical Sources, Law and Medicine (1846–1876)</b>	<b>59</b>
<b>Chapter 4</b> <b>Selection, Sexes and Statistics (Since 1871)</b>	<b>87</b>
<b>Chapter 5</b> <b>A Sociological Issue and its Perversion (1898–1942)</b>	<b>121</b>
<b>Chapter 6</b> <b>A Stochastic Re-Evaluation</b>	<b>145</b>
<b>Conclusion</b>	<b>177</b>

<b>Appendix A</b>	
<b>Condorcet (1743–1794)</b>	<b>187</b>
<b>Appendix B</b>	
<b>Charles Darwin (1809–1882)</b>	<b>197</b>
<b>Appendix C</b>	
<b>Maurice Halbwachs (1877–1945)</b>	<b>207</b>
<b>Appendix D</b>	
<b>Sex Ratios at Birth and the Calculus of Probabilities</b>	<b>221</b>
<b>List of References</b>	<b>231</b>
<b>Index</b>	<b>251</b>

## FOREWORD

This book has been written for the critical attention of researchers who rarely work together: mathematicians, biologists, historians, philosophers, social scientists and historians of the sciences. Its object – how close the numerical ratio of the two sexes at birth may come to some regularity – is in fact almost three centuries old, which is more than the collective memory of any of these disciplines or the individual consciousness of the specialist scholar can generally envisage. But whether we like it or not, if the conclusion were to be drawn tomorrow that a fairly stable proportion could be measured (perhaps the proportion of the two sexes, perhaps another), then it would be one of the epistemological registers examined in our enquiry that would come into play. Sometimes figures seem to have too much to say for themselves; they happen to give off the musty smell of theology, to lead readers towards the evasion of phenomena that are actually relevant, to draw them into the twists and turns of uncontrolled philosophies of history and philosophies of sciences. . . It then falls to those who have made science their profession to exercise a threefold control over figures: control through the technical coherence of formal methods of calculation, control by matching the conceptual analytical devices to the object as studied, and control through the relevance of the intellectual genealogies that these methods and these concepts involve. Clearly, since the book will be read from the point of view of more than one discipline, these controls will be exercised in different ways. This does not matter, as long as, when all is said and done, this threefold control remains manifestly cogent every time.

The plan for this book arose when several contextual factors came together. At the end of the academic year 2002–2003, following discussions held at the Institute for Advanced Studies in Berlin (the *Wissenschaftskolleg*), we were left wanting to go further into a dialogue between the social sciences and the biological sciences. We felt it was indispensable to locate objects likely to stimulate such encounters (like the analysis of the proportion of the two sexes) and then move on to take a serious look at

previous states of tension between the disciplines around these objects – tensions that might be both very old and very much alive. All these things would be difficult to put across in a symposium, much easier to introduce through a book. A book could also draw on re-examinations of research on the history of social sciences in the 18th and 20th centuries, in which we had recently taken part. Finally, a book would be able to respond to a critical set of circumstances peculiar to the social sciences by suggesting the possibility of a new conception of the long historicity of the sciences, and consequently the opportunity for re-examination at the borders of other disciplines, most particularly where mathematical thinking or biological facts are involved. At this point, our project received the attention and encouragement of Daniel Courgeau and Robert Franck: without them, the methodological purpose of this study would probably not have found the more favourable conditions that have allowed it to take the concrete form of a book.

The *Descent of human sex ratio at birth* follows and extends another book that we prepared together, in which several other authors also collaborated: the critical edition of a very little-known text published in 1936 by Maurice Halbwachs and Alfred Sauvy, *Le Point de vue du nombre* (published by INED, Paris, 2005). In parallel, we have also written a sociological work that aims to define the stochastic nature of social phenomena through a case study: *Le Sexisme de la première heure* (Raisons d’agir, Paris, 2007). Between them, these three works are interrelated in the same way as – to evoke a famous precedent on which we shall comment later – the Introduction to the *Théorie analytique des probabilités* (1812) and the *Essai philosophique sur les probabilités* (1814). Some elements of the first are taken up and extended in the later works. However, each has a different objective: *Le Point de vue du nombre* (2005) gives an account of a collective scholarly enquiry, addressed to historians of the social sciences; with *Le Sexisme de la première heure* (2007), arguments are presented to social scientists in favour of identifying a new sociological object and demonstrating the relevance of a new approach; and here, methodical thinking that crosses several disciplines – different forms of mathematics, biology, the social sciences – is submitted to the judgment of specialists and of epistemologists. The three volumes together come from the same work in progress, a project whose aim is the reflexive re-examination of the social sciences.

After our stay in Berlin, several stages in our research were discussed within an institutional triangle in Paris, marked out by the beacons of the *Institut national d’études démographiques* (the National Institute for

Demographic Studies - INED), the *École des hautes études en sciences sociales* (the School for Advanced Studies in Social Sciences - EHESS) and the completely new *École d'économie de Paris* (the Paris School of Economics - PSE). Discussions with our colleagues at the *Centre Maurice-Halbwachs* (CNRS-EHESS-ENS-UCBN-EEP) and the *History and Populations* research unit (INED) were always particularly fruitful. In addition, the publication of this book, and notably its translation, would not have been possible without INED funding and without the support of its Director, François Héran, himself active in these scientific discussion networks. We are also very grateful to Karen George for the quality of her work in translating and fine-tuning the English manuscript, and for the relevant exchanges that we had with her in the course of this work. Finally, Catriona Dutreuilh, Translation Coordinator at INED, and Evelien Bakker, Associate Publishing Editor for Social Sciences at Springer, followed the preparation of this publication considerably and efficiently. We hope that everyone who has played a direct or indirect part in the preparation of this book will find that its publication brings echoes of the intense moments we have shared – which, for us, were indispensable.

Paris, October 2006

## NOTE ON TRANSLATION

In working on this book, we have found ourselves following Ariadne's thread to a series of clues that bind the calculation of the proportion of boys and girls at birth to a body of works that have appeared in various places, in various languages – English, German, French, Italian, Latin – and at various dates from the 18th to the 21st centuries. . . . In doing so, we have had to assess the important part played in the formation of contemporary sciences by the – sometimes long-standing – circulation of published works, of words, of methods and of indices, of the intellectual transfers that have accompanied this circulation, and most particularly of the variations, ambiguities and shifts inherent in them – all 'failings' stigmatized by academic standards from a regulatory point of view, but where a virtue can be made of necessity only as long as they pass unnoticed by the critics

In these conditions, it is important to make clear to the potential reader of this work – we imagine a student or a scientist, conversant with the English language in its early-21st-century international written form – that it was first written in French by authors who regard this language as their critical working tool: that is, they situate themselves within intellectual traditions consolidated in France during the 20th century (a claim of social science maintained throughout that century and marked by the activities of three journals – Emile Durkheim's *L'Année sociologique*, Henri Berr's *La Revue de synthèse* and Lucien Febvre's and Marc Bloch's *Les Annales*; by an attention to epistemology, in the wake of Gaston Bachelard's works; and by participation in current renewals of the social sciences). The authors' next step was to establish a second version of the manuscript, close to the first but conceived specifically for an international readership. The third stage was for this new version to be translated into English – targeted at our student or scientist, whether native English speaker or well-read non-native specialist – while recognizing the impossibility and inappropriateness of rendering scholarly French in the common denominator of "English as a Foreign Language". It was decided to adopt the "Oxford" spelling conventions

preferred in most British English academic publications, conventions which are most comfortable for an international readership. Detailed discussions between the authors and the translator then helped to perfect the resulting manuscript. Finally, the translator established the definitive text, to which a few proofreading corrections have subsequently been made.

Let us clarify the perspective adopted by the authors and the translator. Since each chapter deals with a particular place and moment, the context and the vocabulary of that era and that setting have governed the choice of expressions used. It is important to combat the effects of anachronistic reformulations, which very often arise whenever authors from days gone by are mentioned. Without entering into a case-by-case discussion – which would overload this Note and, in passing, open any number of Pandora’s boxes for the historian of sciences and the rigorous scientist to delve into – let us simply say that the vocabulary of objectivization, of calculation, of estimation, of probabilities and of statistics has here been chosen to be as close as possible to that of the authors commented on and has as far as possible been verified in the historical archive of the Oxford English Dictionary. With the best-known of these authors who did not write in English, the translation of their works (where this exists by way of a standard edition) often appeared at a much later date than the initial publication, or else became established in an intellectual context somewhat foreign to the one in which the work was produced. This is most particularly true for Condorcet, Laplace, Comte and Durkheim. Therefore we have adopted the policy of relying on available standard translations, while correcting them where they have departed too much from our requirement to restore the original. (The variations that we offer our reader appear in italics in the extracts concerned, and are duly acknowledged.)

Beyond these general indications, we should add that we found two groups of expressions hard to untangle. The first group is marked out by the English expressions *human race*, *human species*, *humanity*, *human beings*, *mankind* and *humankind* and their French counterparts *l’espèce humaine*, *l’humanité*, *les êtres humains*, *l’Homme*, *le genre humain*. Each of these terms would require a historical semantic study that has no place here (as this book appears, work is already going on in this field in several parts of Europe). We have preferred the use of *humankind* in order to express what is meant in French – at the time of the Enlightenment, in Condorcet for example, or even today – by the words *l’espèce humaine* or *l’humanité*: that is, *human beings* as a whole considered from a normative point of view and without distinction or connotation of race, condition or gender.

To many English readers, the word *humankind* may appear to be a 20th-century artefact, contrived to meet a particular purpose: this is far from the case – it has an honourable pedigree, attested in the 17th century from the Restoration poets and in the 18th from Alexander Pope. Throughout our text, therefore, *humankind* is used by design, and any other variations that appear have been chosen deliberately, taking into account any connotations they may carry.

A second group of expressions relates to the system of qualifying *male/female* in English in order to distinguish the sexes or the genders. In English, this vocabulary is common to the description of human beings and the description of other animals. In French, *homme/femme* or else *masculin/féminin* is used when referring to human beings, with *mâle/femelle* generally reserved for other animals. The use of the latter about human beings in French would indicate the deliberate choice of a degrading vocabulary. As we shall see, for the issues that we are opening up here, we must take seriously the fact that some authors view the analogy between *humankind* and the other *animal species* as obvious, others as unfounded and others again as problematic. Therefore it is important to proscribe the unthinking use of *male/female* when exploring and reconstructing the body of work that forms the object of our study. The authors would like to add that – still themselves deeply shocked at the use of the terms *male* or *female* in relation to human beings – they are pleased to take comfort in knowing that this proscription has been followed in the translation of their work.

Éric Brian, Marie Jaisson, Karen George.  
December 2006.

## INTRODUCTION

It would be unwise to reopen the issue of analysis of the proportion of the sexes at birth without taking to heart Corrado Gini's warning, given a century ago, laying bare the futility of such a quest. From the very first pages of his thesis (1908), the statistician Gini (1884–1965) invoked his distant predecessors: the French doctor who worked in Leiden, Charles Drelincourt (1633–1697), and the Göttingen naturalist, Johann Friedrich Blumenbach (1752–1840):

“Even before the 19th century, Drelincourt had already listed 262 ‘unfounded’ hypotheses on the nature and cause of sex, while Blumenbach had observed acerbically that there was nothing to prove that Drelincourt’s own hypothesis was not No 263. Since then, the number of hypotheses has more than doubled – including, of course, Blumenbach’s own theory of *Bildungstrieb*. And this number continues to grow day by day.” (Gini, 1908, pp. 8–9)

We shall be discussing the calculation of the proportion of the sexes at birth in human beings, but not “the cause of the sexes”, which has been debated in vain since Antiquity. Consequently, our work will cover almost three centuries of studies, as it is only since the early 18th century that scholars have taken this proportion as an object of research. From that time forward, it has often been regarded as almost constant. Nowadays, following Ronald A. Fisher (1890–1962), the view is taken that the trend of the sex ratio is, in principle, to adjust towards a balance of the two sexes. However, the persistent, exactly equal difference in this proportion at birth, and even its relatively small variations have provided food for thought for theologians, mathematicians, social scientists and biologists ever since the first calculations were made, even up to the present day. At the end of the 19th century, the economist and statistician Francis Y. Edgeworth (1845–1926) noted that the phenomenon of the regularity of the ratio between the two sexes at birth lent itself to academic approaches and constructions relevant to various disciplines, but irreducible from one discipline to another.

“The familiar observation that the areas of art and science do not coincide is nowhere more strikingly exemplified than in [this] field of inquiry [...]. The fact that some five per cent more boys are born than girls is probably a mere *curiosum* in the eyes of the practitioner; yet it has a theoretical value for the biologist, especially when compared with similar observations for the inferior animals, and even plants [...]. Moreover, even if the fact were entirely isolated and remote from physiological inquiries, its investigation would still possess a scientific interest, as affording a particularly perfect study in statistical method.” (Edgeworth, 1892, pp. 337–338)

Yet recently, calculations for various regions of the world have highlighted large disparities. In rich countries, about 51.2% of births are of boys and 48.8% of girls, which is about 105 boys per 100 girls (as Edgeworth indicated), while in China the equivalent figures are in the order of 55%, 45% and 122 per 100... In these very recent conditions, work on human sex ratio at birth has seen a real resurgence, now combining new contributions from demography, economics and biology. Therefore it is important nowadays to question what may appear to be an invariable feature of the study of sex ratio: for three centuries, it has always brought into opposition various established disciplines of the time. In our eyes, a true renewal of research on this terrain calls for a critical evaluation of what therefore seems to be a *de facto* given, specific to the conditions of knowledge of the phenomena captured by the ratio. It must be accompanied by an epistemological and methodological diagnosis of whether this state of affairs is necessary, and – why not? – for proposals that might offer new ways of reconstructing the phenomenon.

How could we construct a critical perspective that would allow us to include three entire centuries of “conflicts of the faculties” about the degree of regularity of the proportion of the sexes at birth? The history of the calculation itself would not teach us much: it is by and large a matter of a simple ratio of one number to another... Throughout these three centuries, it has always been known how to establish this calculation. Yet it has constantly been understood in different ways: as the comparative state of enumerations, as the arithmetical ratio, as the comparison of the chances of one or the other of the two sexes being born, as relative frequency, as the measure of a greater facility of the birth of one of the two sexes, as the estimate of a probability of one sex at birth, as the comparative assessment of the probabilities of survival of the two sexes... all these conceptual developments are compatible with the same ratio. The history of the calculation process cannot be divorced from the history of these

developments, and we find ourselves faced with transformations in shifting configurations of academic specialisms in various eras. The historiographies of mathematical, biological or sociological ideas, for exactly symmetrical reasons, would not offer any help if we were to consider them individually.

So the policy we shall adopt is to study various moments in the history of the uses of a formal method – the calculation of the proportion of the sexes at birth – while also highlighting the tensions between the academic specialisms involved in its interpretation and reconstructing how, from one period to another, the products of these old tensions have been integrated into the collective memories of later specialisms. In doing so, for each period that we consider, we shall seek to highlight several elements for analysis. The first of these will be the objects to which scholars devoted themselves in former times: for example, humanity understood as a whole, the human species viewed by implicit or explicit comparison with animal or plant species, populations at the national or other scales, social groups. Secondly, we shall seek to account for the dependence of scholars on empirical material: registers, compilation operations, calculation methods, the handling of uncertainties and errors. A third category of issues will also guide our study, that of the institutional frames in which work on the proportion of the sexes at birth has been situated: the backdrop of academic institutions (both scholarly societies and universities) and the disciplinary claims specific to the intense quest from which the early works came. Finally, we shall seek to retrace as precisely as we can the conditions of transmission and the means of communication between the different works on which we are commenting. Taking stock of all this will allow us to give an outline of the history of the social division of labour of the calculation of the sex ratio that will illuminate the very specific conditions of each given time – conditions in which numerical abstraction was able to meet particular theoretical concepts, where what mattered at different times was, for example, the arguments of theologians or even naturalists, or a deterministic philosophy of the sciences, or a conception of probability.

This kind of outline cannot take the place of a general history – whether of statistics, of the social sciences, or even of relationships between areas such as the calculus of probabilities or biology! Indeed, it is completely impossible in the current state of historiography to deal in a rigorous manner with all the criteria that we have just listed consistently across three centuries, even though our topic is confined to the calculation of human sex ratio at birth. Each of our chapters will serve as a case study. The way we link them together and compare them will aim to provide the reader with as relevant a perspective as possible, enriched with historical elements that were already

known or have been established through our research. Happily, a *de facto* given makes following this programme easier than it might seem at first glance. Over the three centuries, systematic sources and genuinely new work have been rare. Therefore, we have been able to organize this outline by determining to follow the fortunes of these rarities. That is why, throughout our study and our writing, we have paid careful attention to the concrete phenomena – whether legitimate or not – through which these resources have been transmitted and through which the forms taken by collective memory have been shaped in the groups of scholars concerned.

The first stage of our work is an assessment of how the scholarly world of the 18th century was able to conceive of regularity or variations in the proportion of the sexes at birth. Physico-theologians – such as John Arbuthnot (1667–1735) or Johann Peter Süssmilch (1707–1767) – and mathematicians involved in founding the analytical calculus of probabilities – Condorcet (1743–1794) or Laplace (1749–1827) – were the main players in the specialized discussions that took place within the principal learned societies of London, Berlin and Paris (Chapter 1). Secondly, in the early 19th century, there were agronomists – Charles Gilbert de Morel-Vindé (1759–1841) or Charles Girou de Buzareingues (1773–1856) –, physiologists – Johann Daniel Hofacker (1788–1828) –, organizers of statistical observations – Joseph Fourier (1768–1830) or Adolphe Quetelet (1796–1874) –, mathematicians – Fourier again, or Denis Poisson (1781–1840) – who all came into conflict around the relationships between birth figures in Paris, London, Tübingen and Brussels (Chapter 2). Then, in the mid-19th century – with Quetelet – the issue of compiling lists of birth registrations came to override the earlier debates. Different forms of production of statistics proliferated. The base provided by calculations was sealed away for a long time (Chapter 3). But in parallel, first in England, then at the turn of the 20th century in Germany and in Italy, a completely different conception of the variability of numerical indices and the conclusions that they give was consolidated in the biological literature – from Charles Darwin (1809–1882) to Ronald A. Fisher, through Francis Galton (1822–1911), Carl Düsing (born in 1859) and Corrado Gini (Chapter 4). Another route again, contemporary with the preceding one, leads to discussion of the regularity of the ratio of the sexes at birth through the sociological qualification of the empirical consistency of the social fact. This was specific to the French conception of sociology – notably of Auguste Comte (1798–1857), Émile Durkheim (1858–1917) and Maurice Halbwachs (1877–1945) (Chapter 5). But it is not enough just to give this historical deconstruction of the sex ratio as a kind of long history of the production and circulation of resources and

traces of intellectual work. We end our various journeys, therefore, in one place, where the elements we have gleaned allow us to reconstruct some of the phenomena of which the sex ratio is an indicator (Chapter 6).

We have appended three texts to this series of case studies. The first is made up of extracts from a manuscript of Condorcet's written in 1793 or 1794, where the philosopher and mathematician discusses the effects of an intervention by humankind on the chances of one sex rather than the other being born (Appendix A). To our knowledge, this represents the first time that the trend of the sex ratio at birth to adjust towards balance between the sexes was expressed as a principle. Nowadays, a principle of this kind is most readily associated with the name of Fisher (1930), while some recent commentators have also mentioned the first edition of Darwin's *The Descent of Man* (1871) and the thesis of the physiologist Düsing (1883 and 1884) in relation to this topic. The second document offered as an appendix is well known, consisting of precisely those passages that Darwin devoted to the human sex ratio at birth in the first two editions of his book, published in 1871 and 1874. The fact that the great naturalist quickly revised his thinking is well known. This has been commented on several times, so it is useful to have the text itself and its variants to hand (Appendix B). The third document is as little known as the first. It consists of extensive extracts from an article published by Maurice Halbwachs in the *Journal de la société de statistique de Paris* in 1933, where he proposed to explain variations in the proportion of the sexes at birth following a sociological analysis (Appendix C). This endeavour has remained forgotten since the Second World War. Finally, a fourth appendix supplies points of reference for the indices of sex ratio and for their links with the calculus of probabilities (Appendix D).

Our conclusion reviews these contributions from the long perspective of three centuries, a perspective that gives a better view of the importance of the phenomena of the contextualized circulation of knowledge between constituted disciplines, between varied linguistic spaces and from one scientific moment to another. Today, these journeys lead us towards questions that can reasonably be addressed to each of the disciplines concerned: mathematics, biology and sociology.