# HISTORY OF STATISTICS 1650-1930 - EUROPE AND SWEDEN

### An obscure critical tradition of social science statistics

#### Olle Sjöström

#### Introduction.

Is it possible to explain - convincingly - that an "old critical tradition of statistics" is *an important and interesting complement* to the "modern statistics tradition"?

The question underlies a book of mine on Swedish statistics, a regional history that developed from a broad background in European statistics and empirical philosophy.<sup>1</sup> The title of this article, presenting only some major lines of discussion in my book, is motivated by an emphasis on the European history of statistics.

My interest in early statistics began with some orientations to be found in my basic education at the University of Uppsala.<sup>2</sup> More determined efforts were my own research and some lectures at the University of Stockholm around 1980. It continued in a project on "education for the application of statistics" financed by the Office of the Chancellor of the Universities and Colleges in Sweden. More systematic research became possible when I left my statistical practice in 1995, resulting in the book mentioned above.

Important for my endurance with the history of statistics was that I got support for challenges in my statistical practice, including teaching at the university. The early theoretical discussions of statistics had as focus knowledge formation through *the practice of statistics* and the inherent qualities of the method of statistics. Even the role of the statistician and the demands on the talents needed were discussed. Noteworthy and interesting was the connection between statistics and empirical philosophy and its critical tradition. All these qualities in the history of statistics enlivened my then current practice of statistics.

The "modern statistics tradition" began to appear between the Great Wars at the same time as "the old tradition" began to fade. The future "Icons" of statistics – R A Fischer in experimental statistics, J Neyman and E S Pearson with survey sampling, and others - shaped the new *formal inference* of statistics. Probability models came into the forefront and the demands on mathematical study for students and researchers grew successively. The former theory of statistics, centred around knowledge dissemination and the inherent qualities of the statistician's work, was replaced by applied mathematical method as theory.<sup>3</sup> And the history of statistics transformed into a history of probability and its applications.

For social science applications of statistics the development of sample survey techniques was very important. Control of sampling and non-sampling errors made economic efficiency in conducting surveys possible upholding demands on sampling errors and better control of non-response and measurement errors. "Total survey error models" was one of the main headings in my own education and in my later practice and teaching.

But these kinds of controls are not fully realized today. The problem of non-response has grown considerably and makes interpretations of results doubtable. One of the ideals of survey error models,

<sup>&</sup>lt;sup>1</sup> Svensk statistikhistoria – en undanskymd kritisk tradition, (*Swedish Statistics History –an obscure critical tradition*,) Gidlunds förlag 2002, ISBN 91-7844-619-8. In Swedish and with a short abstract in English.

<sup>&</sup>lt;sup>2</sup> Professor Herman Wold held lectures and wrote later a textbook in Swedish with historical orientations.

<sup>&</sup>lt;sup>3</sup> The concept of "statistical method" also became diffuse. In his presidential address Leslie Kish deplored "the double identities": theory  $\equiv$  mathematics  $\equiv$  method. JASA Vol 73 (1978), page 1-6.

to communicate errors to users, is far from accomplished. And many statistical surveys are conducted without the ideal of "total error control" as a pre-requisite.

It is my impression that we, as statisticians, avoid these problems and hide behind technicalities and generally complains about "the evils of the world".

In the spirit of "the old tradition" we can be inspired to meet these challenges in an open and more responsible way. While the central aim for "old theory" was the dissemination of statistical results more serious efforts from statisticians today are required, for example, deeper research into the increase of non-response - in order to seek remedies.

More generally, the old critical tradition of statistics can contribute to making the ethical aspects of statistical practice more obvious. The emergence of statistics from the period of Enlightenment and the delicate role of the statistician between service to "authority" and social responsibility is an interesting story that can attract social science students – a stimulating complement to the "hard" mathematical curriculum. It is also a good preparation for a future profession as a statistician in social science applications, including appointments in State and local community service and journalism. In the latter we have too little of statistical competence in Sweden.

The disposition of this article is the following.

- 1. The Forefathers: John Graunt and Hermann Conring.
- 2. Broadening of statistics applications, debates about theory and empirical philosophy in Europe, 1850-1900: Adolphe Quetelet, Karl Knies and Gustav Rümelin.
- 3. Empirical philosophy and a critical statistical tradition: Francis Bacon, John Stuart Mill and Christoph Sigwart.
- 4. Swedish statistics in its heyday, 1890-1930.

## 1. The pioneers

Since the middle of the 17th century the history of statistics has been a broad cultural and intellectual story about different applications and ideas about the State and society. In the second part of the 18th century, during the Age of Enlightenment, statistics even became a fashionable science, a science with pretensions to comparing and evaluating the European states. To seek a balance between, on one hand, free research and, on the other, service to the State and society became a part of the critical tradition of statistics.<sup>4</sup>

The establishment of *statistical bureaus* followed in the 19th century in central and local administration. Statisticians became a recognized professional group in Europe, often referred to as researchers and respected as disinterested officials. They were especially active in developing social research investigations including economy and social welfare.

Two pioneers, however, lived in the 17th century. They were both under the influence of the programme that Francis Bacon had established at the beginning of the century. We meet an eager amateur scientist in London, *John Graunt*, and a professor of political science in the German town of Helmstedt, *Hermann Conring*.



On the left: John Graunt (1620-1674), portrait unknown, tradesman in London and pioneering researcher. The data he used was the death rolls published as warnings of the plague. The results were reported in a research paper sponsored by the Royal Society of London in 1662 with the title *Political Observations on the Bills of Mortality*. Graunt is the founder of the *English* statistical tradition.

In the middle: Hermann Conring (1606-1681), German polyhistor, adviser on European politics and physician-in-ordinary to several sovereigns in Europe. His lectures on politics delivered at the University of Helmstedt from 1660 were the start of the *German* statistical tradition.

On the right: Pehr Wargentin (1717-1783), "the father of Swedish statistics", astronomer and mathematician, secretary of the Swedish Royal Academy of Science from 1749 and responsible for the *Tabellverket* – a system of population statistics based on the local parish church registers, given for each region and for the whole country. He became interested in the social history of the Swedish people since the end of the 17th century. The sad effects of the Swedish wars (under Charles XII) were clearly visible and Wargentin became an urgent advocate of peace in a series of papers from the Royal Academy. They were translated into German and English and his fame as a statistician grew in Europe far into the 19th century.

<sup>&</sup>lt;sup>4</sup> Hoock 1979.

Pehr Wargentin was a researcher in astronomy with very broad interests. For his Master's degree he wrote a thesis on Niccolo Machiavelli, the political philosopher who lived in the early 16th century. Wargentin took an active interest in social issues and he wrote a History of Stockholm, the capital of Sweden, in his old days.

Wargentin was appointed as secretary of the Royal Swedish Academy of Science in1749 and was put in charge of the *Tabellverket* that had been started earlier.

I admit that one or a few years' data ... is not enough to base reliable calculations on. Some years with infectious diseases cause greater damage than usual, several years of poverty prevents an increase in the population .... For that reason we can expect more light to be shed on population conditions if we are able to study more groups of people and the more numerous the better  $...^{5}$ 

Wargentin was aware of uncertainties because of few observations and he used his critical ability in natural science, his accuracy and his criticism of the sources. He studied earlier works, from John Graunt and Hermann Conring to Johann Petter Süssmilch, learning different calculation techniques. He came in contact with Gottfried Achenwall, a German professor in Prussia, who in 1748 renamed his science - from "Political Science" to "Statistik"! Another contact was August Schlözer, who later succeeded Achenwall as professor and published extensively in the statistical field.

These contacts made Wargentin a man of influence in European statistics. The *Tabellverket* was a unique data base at the time and Wargentin's papers made the results interesting and respected for their quality. In the foreword of his book *Observations on Reversionary Payments*, Richard Price writes that he finds in Wargentin's papers "more distinct and authentic information on the subject of human mortality than I have ever met before", and in a later book, *Essay on the Population of England*, that Wargentin's calculations "exceed in correctness everything of this kind". Price wishes, "that similar observations were made in other kingdoms under the direction of men equally able and ingenious as Mr Wargentin".<sup>6</sup>

The conflict between the English and German statistics traditions turned out to be serious in the early 19th century but ended in a sort of complex integration. Wargentin came to exert influence on European statistics long after his death, thanks to his close connection with both the German and English traditions in his works.

#### The early pioneers

*John Graunt* published his results in 1662 after several years of consistent work on the *Bills of Mortality*, the weekly reports on deaths and causes of deaths that had been stored since the end of the 16th century.<sup>7</sup> Graunt was inspired by the "democratic research programme" (Francis Bacon), inviting all kinds of people committed to research work, and reached astonishing results with respect to the population of London, categorized by age and sex, and by causes of death. His criticism of his sources was excellent and he made models for inference from samples and for prognoses.

The results were analysed and discussed in his paper and he suggested solutions to different problems. We can call them social welfare proposals.

In the early 1670s, *Hermann Conring* gave lectures to future civil servants and prospective functionaries in the growing mercantile enterprises. The lectures, which became known from the notes of a diligent student, were of an inquiring nature, critically comparing a number of European states. They were given in Latin and contained information that was politically sensitive.

#### Why did Professor Conring, together with Graunt, become the two fathers of statistics?

The two pioneers were first seen as contradictory and in the early 1900th century – more than a hundred years after their deaths – they were the cause of a hard fight between statisticians in the German tradition and those in the English tradition. It was a serious identity crisis for many statisticians and theoretical questions about statistics as applications and as a university subject were

<sup>&</sup>lt;sup>5</sup> Hofsten 1983, s 77. Wargentin in his second essay of six, published in 1854-1855 in the "Proceedings of the Royal Swedish Academy of the Sciences".

<sup>&</sup>lt;sup>6</sup> Nordenmark 1939, in Swedish.

<sup>&</sup>lt;sup>7</sup> Graunt 1662.

brought up for discussion. There was a reconciliation with respect to statistics in social science applications. Statistics as exploring "numerical facts", from planned statistical investigations or assembled for other purposes, was no longer regarded in opposition to statistics as an evaluative and critical profession in central and local administration.

Pehr Wargentin had an influence on this reconciliation. As engaged in politics and social affairs and as a keen calculator of meaningful results from the *Tabellverket* he was a forerunner in learning from both the German and the English statistics traditions. As an important example, he brought insights into the effects of war and poverty on the Swedish population from the late 17 th century forward.

In the early 19th century statistical investigations were discovered *as a method* applicable to medicine, meteorology and geology. That was the beginning of a debate and some literature sought an answer to the question "What is statistical method?". Statistics was later, in the second half of the 19th century, defined as *a general method* that could be applied to all problems that concerns inference from "a part to the whole", from samples to populations. Statistics had been recognized as one of the lines of development of empirical philosophy since the 17th century.

#### The consolidation of statistical practice.

The German state Prussia was a forerunner in official statistics. For instance, the country early introduced plans for statistical investigations emanating from a correspondence between Leibnitz, the philosopher, and Hermann Conring. The king, Friedrich the Great, wanted to show that he was an adherent of the Enlightenment ("Aufklärung") and the above-named Achenwall felt free to declare the following programme for his new science of statistics:

From the innumerable data that exist for a state, we chose those which show disadvantages and advantages in a society, and we will thoroughly ask for explanations. That means ... what makes a citizen rich or poor, contented or discontented, what makes the government loved or hated  $\therefore$ . The servant of such goals deserves to be named statistician.<sup>8</sup>

This programme for evaluation of states and regimes came subsequently to be of importance for the role of a statistical profession in central and local administration. *Statistical bureaus* were created at an increasing rate during the 19th century and the statistician assumed not only the role of technician but also of an official evaluating social and economic conditions, an area where even the bureaus took their own initiatives in carrying out investigations. Sometimes the bureaus were named "the observatories of society" with associations to research and to the astronomers who had played a leading role in the development of statistics, in Sweden Pehr Wargentin and in Belgium Adolphe Quetelet.

However, statisticians were also at the service of dominant rulers who wanted better control. This was the case with Napoleon, who saw possibilities in making uniform statistical investigations in all the countries of his new empire.<sup>9</sup>

*Private statistical associations* were formed between 1830 and 1850 in many countries: England, the United States, Ireland and Germany, to mention some of them. Statistics was associated with an interest in welfare and many private initiatives were taken to carry out social statistical investigations. Results were published in new private statistical journals, among others, the Journal of the Royal Statistical Society of London and the Journal of the American Statistical Association.<sup>10</sup>

Sweden was a little behind in statistical development. The *Tabellverket* was not so well upheld. Wargentin's successor as secretary of the Royal Academy of Science, Henrik Nikander, did see the needs but he received no money for his proposals and paid for urgent improvements out of his own pocket. Many educated Swedes saw the deficiencies of contemporary Swedish statistics and a cartographer, Carl af Forsell, wrote *Statistics upon Sweden* (Statistik öfver Sverige) inspired by the German statistical tradition. This book was a forerunner of the coming era of popular adult education.

<sup>&</sup>lt;sup>8</sup> Achenwall 1749, the foreword.

<sup>&</sup>lt;sup>9</sup> Woolf 1984, page 165.

<sup>&</sup>lt;sup>10</sup> Westergaard 1969, chap. XIII. The Era of Enthusiasm, 1830 to 1849.

The Swedish historian, Erik Gustav Geijer, was influenced by the social problems illuminated by European statistics and radically changed his political thinking, moving from conservative views to a radical liberal standpoint.

*Adolphe Quetelet* became important for the development of official statistics in Europe. His reforms of Belgian statistics in the 1840s led to similar reforms in other countries and later to a series of statistical congresses from 1853 onwards. The 1860s was the decade when new and forceful initiatives were taken in reforming Swedish official statistics – with the help of the name of Wargentin, still well known in European statistics!

## 2. The broadening of statistics applications and the debate on theory and empirical philosophy in Europe, 1850-1900

The statistical method of inquiry – as a logical sequence of planning, realization and publishing – had become established in practice as early as in the beginning of the 19th century. Several textbooks had appeared by that time. This method of inquiry was also discovered in natural science and in technology and was applied more and more frequently in new subject matter applications.

We find here the commencement of an understanding of statistics as *a general method of inquiry*, not only to be used for social investigations and social science but also for all inferential problems from samples to populations, from "the part to the whole".

The method of statistics was sometimes characterized as "rigorous" because of the strict demands on the planning, the need to be cautious in the realization phase and the high expectations on the pedagogical aspects of the presentation of the results. Here the ambitious work of Quetelet on Belgian statistics was influential. A statistical praxis began to grow in European official statistics that had a near connexion with the spirit of scientific work.

As has been said, Quetelet took the initiative in organizing *international statistical congresses*. They started in 1853 and were held until 1878, about every three years. The influence of the congresses was impressive and so was the case for Sweden. Fredrik Theodor Berg was the leader of a new statistical movement in Sweden, starting in 1858 with a new central administration, the *Statistical Table Commission* ("Statistiska Tabellkommissionen"). Berg participated in the statistical congresses from 1856 and he also made a European journey to the leading statistical bureaus. He made a long visit to Quetelet and the Belgian national statistical bureau in particular.

In the mid 19th century it was obvious that the goal of statistical investigations was not only facts about states and carrying out social and economic investigations. The aim and meaning of statistical work began to be appreciated as *knowledge formation*. It was still a matter of making inferences from samples to populations and to interpret the results. *Theoretical questions were asked relating to the essence and the limitations of the statistical method*. Statistics was paid attention to as a new branch on the tree of broad empirical tradition. It had its roots in empirical philosophy and bore a resemblance to the strict demands placed on method in the natural sciences.



Adolphe Quetelet



Karl Knies



Gustav Rümelin

1796-1874

1821-1898

1815-1889

#### Karl Knies and Gustav Rümelin

Karl Knies was the first to write a book on statistics as a science of method. In his book *Statistics as an independent science* (1848) – with the subtitle *To solve the confusion about theory and praxis in this science*<sup>11</sup> – he argued that statistics should no longer be a science of a particular social science subject but a science of method with an aim to guarantee precision for and confidence in measurements and in conducting a statistical investigation. Knies gave prominence to the English tradition as the right line of development for the future of statistics. By this time, in Germany and some other central European countries, statistics had professorial chairs that the newly appeared social science researchers (political economists, geographers, sociologists) wanted to capture. Vivid discussions on statistical theory and method now took place. Original and deep thoughts came from *Gustav Rümelin*, a philologist, politician and active statistician in the German state of Wurttemberg.

Rümelin had a background as teacher, headmaster and school politician. After his retirement as school minister in the state of Wurttemberg he became head of its statistical bureau in 1861 and engaged in the discussions on the theory of statistics. He wrote a dissertation in philosophy and statistics, worked as a university teacher beside his job as a statistician and ended as Chancellor of the University of Tübingen. He published essays on statistics, demography and many other subjects in *Reden und Aufsätze* 1875, 1881 and 1894.

In two essays on the theory of statistics, first published in 1863 and 1874, he does a thorough analysis of the historical development of the name of "statistics" and its meanings. He observes the development in colloquial German, in the daily press and in journals, and he concludes that the changes in the meaning of "statistics" followed statistical praxis,

if they related to states or social conditions, marriages ... or draughts of herring or slaughtered calves.

He notices that many branches of statistics had developed;

statistics about professions, agriculture, trade, crimes ... finance, military conditions, schools, churches, but also about floods, epidemic diseases, burnings, earthquakes. etc., and even about currents in air strata<sup>12</sup>

Rümelin concludes that statistics, in everyday German, is conceived of *as a method* - not as a science for particular subjects. Statistics, as a science of method, is a branch of logic. He refers to the philosophical work of Cristoph Sigwart, *Logik*, whose first edition appeared in 1873. It is the first philosophical treatise that classifies statistics as a practice and as a science. Sigwart had studied literature, statistical work and held discussions with statisticians.

In the mid 19th century there was a broad statistical praxis in Europe and well developed groups of professional statisticians were formed. Rümelin asks himself what skills can be demanded of a statistician. He emphasizes the responsibility for the accuracy of measurements and observations and for making critical analyses and pedagogical presentations. His view of the necessary talents and of the professional training of a practising statistician was the following.

It is wrong to say that the statistician only measures, counts and tabulates numbers. The statistician needs a broad general education with considerable subject matter knowledge and a combinational talent connected with sharp logic. That the statistician should service several sciences and different applications requires two qualities especially... an ability to think clearly and a certain degree of encyclopaedic knowledge.

Rümelin describes the general character of statistical method as follows.

The statistical method is used when there are variable attributes ... and they are found everywhere in all manifestations of nature. ... It serves all empirical sciences where groups of defined objects are at the centre

<sup>&</sup>lt;sup>11</sup> Knies 1850.

<sup>&</sup>lt;sup>12</sup> Rümelin 1875, page 265 ff.

of interest and is used in the same way in all applications, but is not of the same importance for all applications.

The method is of essential importance for the social sciences, "in those combines in a manifold way, physical, psychological and ethical aspect ... and places especially strict demands on planning, analyses and reporting of results."

#### August Meitzen

Meitzen held the chair of statistics in Berlin and published a textbook, *Geschichte, Theorie und Technik der Statistik* (1886). He makes serious appeals in the foreword.

In my opinion it is most necessary to make the logical character and the logical seriousness in statistical applications clear and to seek to disseminate the knowledge of this necessity into common knowledge. The dream-like misuse of statistics, found in no other science, would ... be most satisfactorily done away with by means of a theory which emphasizes distinctly the logical requisites and the logical limits of statistical knowledge.<sup>13</sup>

From a historical perspective Meitzen distinguishes the following conceptions of *the theory of statistics*.

- As "knowledge of the State" in the German tradition (Conring Achenwall Schlözer) where different methods could be used.
- As *laws* in human manifestations. Süssmilch and Quetelet sought for laws in the physical and moral manifestations in social contexts.
- An independent and new research methodology that had received scientific recognition in political and social sciences.
- A pure view of statistics as applied logic, a scientific method applicable to Event Spaces for practical and scientific use. This methodology is to be seen along with other kinds of methodologies: philosophical critique, hermeneutics and mathematics.



Fredrik Berg (1807-1883)

#### Fredrik Theodor Berg and Swedish official statistics

Fredrik Theodor Berg was a man of two careers, one as a research-oriented doctor and the other as a practising statistician. On his gravestone is written the epitaph "Doctor and statistician". Between 1850 and 1880 Berg reconstructs Swedish official statistics in a very consistent way. To prepare the ground for the project he undertakes a European journey, mentioned before, making acquaintances with the foremost statisticians. "The name of Wargentin opens all doors", he writes in a letter. Berg makes plans for a statistical library and sends home publications, journals, books and textbooks.

The *Statistical Table Commission* is created as a government office in 1858 and a *Statistical Journal* in 1860. In the following years statisticians are recruited, for other government offices as well, and Berg works on a ground plan for Swedish official statistics, published in 1870 in the *Statistical Journal*.

Berg is an intermediary to his colleagues regarding the European debate on statistical theory and method. The papers of Gustav Rümelin were well-known and the philosophical works of Christoph

<sup>&</sup>lt;sup>13</sup> Meitzen 1891, foreword.

Sigwart were used as textbooks at the University of Uppsala. Even if Swedish statisticians did not write much on statistical theory and method, I am convinced that they got theoretical support for their statistical works in Sweden from readings and discussions.

## 3. Empirical philosophy and a critical statistical tradition

A main line of argument in empirical critical philosophy supports us in our everyday quest for knowledge. Statistics, as a method, developed successfully contributing a new kind of rigour to this quest, *in seeking imperfect knowledge*. Francis Bacon writes about "intermediate axioms that are the true and living ones, on which the affairs and fortunes of mankind are built". John Stuart Mill terms this kind of knowledge "empirical laws", a generalization that must be questioned but plays an important role in everyday life. The German philosopher, Christoph Sigwart, is the first to place statistics in a philosophical system – as a special form of applied logic. He characterizes statistics as "an approaching method", which means on the way towards full explanation or laws of nature. These philosophical perspectives can renew and deepen our perspectives on "statistical description" or "statistical survey", to the advantage of statistics education and of furnishing ideas in applications.





Francis Bacon (1561-1626), the English philosopher, and the cover page of his book presenting his programme for the sciences, *Instauratio Magna* or *The Great Instauration* (1620). The ship passes the pillars symbolizing classical knowledge, steering for new discoveries. Bacon elaborated a new scheme of ideas for critical empiricism and inspired the creation of the Royal Society of London and, later, the formation of corresponding institutions in other countries (Sweden in 1738).

Bacon had an important influence on the two fathers of statistics, John Graunt and Hermann Conring.

#### Bacon: "intermediate axioms"

In the middle of my life as a statistical practician I read *The Four Idols* and was impressed, feeling that I had found the deep roots of a critical tradition developing through the centuries.<sup>14</sup> This original document of philosophical critique hits the principal points of *critical ability*: to be able to unveil errors, lies and delusions – not as an end in itself but in order to build up knowledge on a safer ground. *The first kind of idols*, according to Bacon, is the tendency of the human intellect to make bold generalizations – from prejudices to elegant, sophisticated models – based on few observations and to fail to observe contradictory evidence. Bacon called them *idola tribus* (the Idols of the Tribe), our gene-determined desire to draw swift conclusions.

*The second kind of idols* relates to our limited experience and our different personal dispositions. Bacon refers to Plato's Allegory of the Cave, with the prisoners only seeing the shadows passing across the walls of the cave, and named them *idola specus* (the Idols of the Cave). He points to the influences from books, friends and our chosen authorities.

*The third kind*, "the Idols of the Market-place" or *idola fori*, derives from how we use language in social contexts. Not even definitions and explanations from men of learning are a guarantee; they can

<sup>&</sup>lt;sup>14</sup> Bacon 1998, page 53 f. Bacon 1973, page 132 f.

be misused and can "mightily entangle and pervert the judgement". Bacon sees these risks as especially serious.

*The fourth kind of idols* is the idols of the Theatre, *idola theatri*. Many of the principles and doctrines of the sciences and philosophical systems have their appreciation from tradition, credulousness and laziness.

Anthony Quinton, one of Bacon's biographers, characterizes Bacon's treatise as an analysis of "the pathology of thinking" but he adds that Bacon is an optimist, "if we are cautious, methodological and cooperative we can attain some certain knowledge of nature".<sup>15</sup>

Bacon maintains that there is a method for constructive learning that he visualizes as a ladder or a staircase.

Summary Laws, fundamental dispositions in intellect and morality Metaphysics, basic "Laws of Nature", Bacon's "forms" Physics, analysis of objects and changes, events, processes, to find causes and to manage them History, broad descriptions of objects, changes, events etc to be accessed in the learning process

**History**. Descriptions of "Nature" *in a very broad sense*, were supposed to give a basis of facts and experiences for the upper levels. They were systematic descriptions of "Nature" in today's vocabulary (biology, medicine, geology etc), systematic descriptions of objects and processes, descriptions of earlier experiments and technical achievements ("history mechanical") etc. But "History" also dealt with "Human and Civil Nature", that is biographies, history in the ordinary sense, psychology ("moral Philosophy"), descriptions of states and social life.

**Physics**. That part of learning (science) that did research on physical objects, different organisms and processes. The object was to find what could be commanded, Bacon's "Power over Nature".

**Metaphysics**. A deeper search for *forms* (formative elements) underlying the rich and confusing reality in life. It was *not* the external forms of objects but the result of those *elementary and hidden processes* that in combinations shaped the enormous manifoldness and richness in what we see, hear and feel. Bacon also called them Laws of Nature, and "they were more like the basic explanatory factors of modern physical science".<sup>16</sup> **Summary Laws** are the basic dispositions in intellect and morality, common to all learning. To these belong logic and the formation of concepts and the moral principles inherent in social life.

#### "Solid and living intermediate axioms".

Bacon has a comment on the ladder of the intellect that touches upon the inevitable hazards we live with. We are dependent on imperfect knowledge and on "making decisions under uncertainty". The comment is as follows.<sup>17</sup>

But there will be hope for the sciences when, and only when, ascent is made by the right kind of ladder, through an uninterrupted, connected series of steps, from particulars to lesser axioms, one above the other, then to intermediate axioms, and last to the most general.

Bacon adds (my italics):

## It is the intermediate axioms that are the true and solid and living ones, on which the affairs and fortunes of mankind are built.

This comment points forward to the subsequent development of statistics and its role in "Learning" – statistics as a more systematic method developing our "common and everyday" method of learning.

#### John Stuart Mill: "empirical laws" or "provisional conclusions"

*John Stuart Mill* (1806-1873) was the English philosopher that assumed the legacy of Francis Bacon.<sup>18</sup> He sharpened the analyses in two ways, first in that statistical descriptions could never bring proof or

<sup>&</sup>lt;sup>15</sup> Quinton, page 37.

<sup>&</sup>lt;sup>16</sup> Quinton, page 63.

<sup>&</sup>lt;sup>17</sup> Bacon 1998, Novum Organum, Book I, Aphorism 104, page 110.

<sup>&</sup>lt;sup>18</sup> Anschutz 1953.

natural laws, only what he named "empirical laws". In Mill's System of Logic (1843) we read the following

In the spontaneous operations of nature there is generally such complication and such obscurity, they are mostly either on so overwhelmingly large or so inaccessibly minute a scale, we are so ignorant of a great part of the facts which really take place, and even those of which we are not ignorant are so multitudinous , and therefore so seldom exactly alike in any two cases, that a spontaneous experiment ... is commonly not found.<sup>19</sup>

The comment is pertinent to the results of statistics, what we call estimates, correlation studies, explanatory and explorative studies and statistical experiments. Mill points out that the results from statistics show possibilities for the future – to proceed to less provisional conclusions or find the laws behind phenomena. Still, statistics can lead to more certain conclusions, with fewer risks in comparison with our general observations and common sense conclusions.

Mill points out that "empirical laws" are of fundamental importance in our daily life and in practical work and activities.

Like Bacon he also writes extensively about "the Idols" and stresses the importance of accurate observations and source criticism.

The second and new contribution from Mill is *his discussion of probability models* with reference to Laplace. It is a critical discussion about the possibilities to "grasp nature" entitled "Of Approximations, Generalisations and Probable Evidence". He is a forerunner of the (much later) modern English statistics tradition. His main philosophical work, *System of Logic*, had a wide and

long-standing influence in England.



John Stuart Mill (1806-1873)



Christoph Sigwart (1830-1904)

#### Christoph Sigwart: "an approaching Method"

The first philosopher who collaborated with practising statisticians, especially Gustav Rümelin and August Meitzen, was Christoph Sigwart. He treats statistics *as a method* in his main work, *Logic I-III* (1878), which can be said to correspond to Mill's *System of Logic*. His view on statistics is reflected in the following statement. In a statistical investigation

is no longer the precise location of the object in place of interest, not either the individual differences in other respects (for the not considered variables). The individual vanishes.

Sigwart refers to the conscious limitation of the number of variables in planning a statistical investigation and claims that this limitation is, at the same time, a special quality of the statistical method. He makes a comparison with our natural curiosity manifested in our spontaneous quest for knowledge, in which we do not make these restrictions but seek freely and without restrictions. The

<sup>&</sup>lt;sup>19</sup> Mill, J S: System of Logic, Vol I, 4th edition 1856, p. 425.

individual *does not* vanish - at the expense of the rigour of restraints. We can call it common empirical knowledge, as a type even gossip. More respectful terms are *qualitative methods*.

It is interesting to follow how Sigwart discusses our need for both ways to knowledge, they are *complementary*. How could a statistical investigation be planned without earlier empirical knowledge of different kinds, qualitative and quantitative? How could the results of a statistical investigation be analysed and discussed in pure isolation?

Sigwart formulated a philosophical view of statistics both as applications and as a science. He treated statistics as a part of inductive method and characterized statistics as "an approaching method", getting closer to finding causes and laws.

Here we find an agreement between the philosophers. Bacon's "intermediate axioms", Mill's "empirical laws" and Sigwart's "approaching method" point towards the same essence of the statistical method.

I draw the following conclusions in my book.

The support from empirical philosophy for responsible, cautious and hard work with empirical measurements, and gradually gained knowledge, were certainly important for the acceptance of statistics during the 19th century, of statistics as a meaningful activity and as worthy of a more clear scientific formulation as a method. The understanding that a collective collaboration was needed and that different talents were used is found both in Bacon ("democratic science") and Mill. It supported the conscious organizational formation of statistical associations and offices and, not the least, the development of an alert statistical profession. (Sjöström 2000, p. 97)

How can statistics today benefit from these philosophical views and the statistical praxis of the 19th century? As the content of statistics, by that time, was mostly what we now call statistical surveys we have a much needed beginning of *an epistemology for statistical surveys*, no longer to be found in statistical research papers or textbooks. In statistics education we get an interesting perspective on "statistical description", and the concept of statistical method can more clearly be associated with knowledge formation in society.

For statistical research more independent and critical research on official and public statistics is offered. Important empirical research on the role, conditions and results of statistical praxis can reemerge. Critical research on how statistical competence performs, and is permitted to perform, has no place in statistical and political sciences research today.

## 4. Swedish statistics in its heyday, 1890-1930

Swedish statistics have deep roots in European statistics. The first example is *Pehr Wargentin* and his sources of inspiration – from John Graunt and some other "political arithmeticians" and Hermann Conring to his contacts with statisticians of his own generation in the era of Enlightenment. The most important were Johann Petter Süssmilch, Georg Achenwall and August Schlözer.

Wargentin's treatises and extensive correspondence also had an influence on the subsequent development of European statistics. As has been remarked, he combined the English and German traditions half a century before the integration of those traditions in central European statistics began. The second example is *Fredrik Theodor Berg* and his European journey in the 1860s and his many new contacts with statisticians and statistical bureaus.

The third is the knowledge in Sweden of the philosophy of Christoph Sigwart and of the writings of Gustav Rümelin. Sigwart's Logic was a main textbook in high-level university courses in philosophy in Uppsala, even during a few decades of the 20th century. In some articles we find that Rümelin was known but I have not found these connections reflected in any Swedish scientific papers.

On the fertile ground of European statistics Fredrik Theodor Berg started a new era for Swedish statistics. Berg created an organizational framework, educated and recruited statisticians and, which is of special importance, elaborated a *Master Plan* for a long-term development of Swedish official statistics (Berg 1870).

The inheritance from Berg was taken care of by *Gustav Sundbärg*, an early disciple of Berg's. Sundbärg worked together with a new generation of very active statisticians. A private professional association, *Statistiska föreningen*, was set up in 1901. Some 25 *statistical bureaus* in government agencies were established and the role of statistics - and especially of the statisticians - were thoroughly discussed in two governmental committees.

It was expected that the statistical bureaus should take the initiative in carrying out social and economic investigations. The results from some investigations played a major role in the full emergence of parliamentary democracy in 1917 and in 1921, the year that women were given the right to vote.

Gustav Sundbärg's statistical works inspired the government to establish a professorial chair in Uppsala in 1910 but the response from inside the universities was not enthusiastic. Sundbärg, and the professors after him, were mostly on leave of absence. The grants for education and research were scarce fore many years. A second chair in statistics, in the university town of Lund, was created in 1926.



Gustav Sundbärg (1857-1914) was the most active collaborator in Swedish statistics around 1900, took the initiative in creating the private professional association, Statistiska föreningen, in 1901 and was appointed to the first professorship in statistics in Uppsala in 1910.

Even as a schoolboy *Gustav Sundbärg* was given a scolarship and for the money he bought a wellknown almanac, Almanac de Gotha. He became interested in the demographic facts of the European states and his interest persisted. At 18 he sent a manuscript to Fredrik Theodor Berg for publication in *Statistisk tidskrift* and after some corrections the article, about Swedish county demographics, was published in 1876.

After his matriculation Sundbärg pursued his studies at the University of Uppsala to become a teacher. He practised as a teacher for a couple of years and, at the same time, he maintained his interest in demography, especially in the great emigration from Sweden during the second half of the 19th century.<sup>20</sup>

After short periods of statistical practice at the central bureau of statistics he got an appointment there. Now he performed broad and intense statistical work in different fields, keeping up contacts and carrying on discussions with colleagues and was the main initiator of the above-mentioned statistical association (Statistiska föreningen).

*Pontus Fahlbeck* held a professorship in history and political science in Lund and he stimulated students to become statisticians. It was especially the case with three of his students who took their doctor's degree in statistics, Theophil Andersson, David Bergström and Henning Elmquist. Elmquist became director general and Andersson head of division in a new civil service department, the *Royal Board of Social Affairs*, set up in 1912. Bergström served as a minister in liberal governments and contributed actively to the development of the professional role of statisticians through the creation of statistical bureaus.

<sup>&</sup>lt;sup>20</sup> During the period 1866-1895 nearly 800 000 Swedes emigrated, most of them less than 35 years old.



Pontus Fahlbeck (1850-1923) converted his professorship in history and political science to statistics and political science in 1890. Three of his students wrote doctoral dissertations on statistical subjects. They contributed successfully to Swedish statistics in different ways, two of them as administrators in leading positions and one as a politician favouring the creation of new statistical bureaus.

Among the civil service departments the Royal Board of Social Affairs played the most active and influential role for the development of new statistical investigations. It was founded in 1912 and had two statistical bureaus. A journal was started, *Sociala meddelanden* ("Social communications"), and it took over the role of a journal for statisticians from *Statistisk tidskrift* ("Statistical Journal") that was discontinued in 1913 (started 1860, published anew in 1952-1983)

#### The statistical bureaus and a Swedish theory for the statistical profession

Two departmental committees started work in 1908 on a reform to make government administration more efficient and more active in their service to citizens and to government. *Lawyers and statisticians* worked together in these committees to formulate "a Swedish theory" for the profession of statistics in government and administration. They stressed the importance of the bond uniting subject matter problems and subject matter knowledge on one hand and statistical work on the other:

This bond has to be stronger and more developed so that social statisticians would work inside social administrations.... Thorough knowledge of and good insights into the social fields are necessary for social law-making as well as for social statistics at work.

This standpoint was also kept for other application fields of statistics, that is for other statistical bureaus. It was more systematically developed by the above-mentioned Theophil Andersson in a dedication publication for professor Fahlbeck on his 65th birthday. Andersson had earlier held a docentship at the University of Lund and had worked near Fahlbeck.

This view of, or theory of, statistical work was founded on actual experiences and on several years of discussions in *Statistiska föreningen*. It was also a development of the traditions from Fredrik Theodor Berg and Gustav Sundbärg, both preferring a decentralized governmental statistics.

The acceptance of a statistical profession in *central* government led to the formation of statistical bureaus or offices in Swedish *local* government.



Theophil Andersson (1869-1943) held a docentship in statistics was head of division in the Royal Board of Social Affairs in 1912-1935 and was the statistician that most clearly formulated a theoretical standpoint on government statistics.

#### **Nordic Statistical Journal**

The intellectual stimuli to practising statisticians came in the late 19th century and continued at the beginning of the 19th century. They came from the statistical congresses and from international books and journals. A private statistical journal was published in 1922-1932, *Nordisk statistisk tidskrift* ("Nordic Statistical Journal"). It had interesting surveys and articles by well-known statisticians (for instance A A Chuprow, L v Bortkiewicz and H Cramér). The enthusiastic founder, Thor Andersson, had a doctor's degree in political economy and had been an industrial leader in Sweden with international connections.

#### A politician and a teacher of statistics – Rickard Sandler (1883-1964)

As a very young politician and teacher at a folk high school he learned about new statistical investigations on salaries and fortunes in Sweden. For his lectures he published the text-book *Sweden as it is now* (1911) with very clear tables and diagrams showing the uneven distribution of wealth. Sandler made a brilliant political career up to the post of Swedish prime minister in 1924 -1926 but then he chose to be director general of the Swedish central statistical bureau from 1926 to 1932. At the beginning of his term of office he wanted to present the essence of statistics in a number of radio lectures to the Swedish people. He did it in an excellent way and the titles were: *Luck and bad luck - the law of large numbers, How people are enumerated, Rich and poor among us, From the cradle to the grave in the registers of statistics, Will our children live longer than we?* 

It was no longer agitation but exemplary and thought-provoking popular adult education. The lectures were published as a book (Sandler 1928) which is still a masterpiece to be inspired by.

#### The universities.

The universities showed little interest in the flowering statistical praxis that had grown up and no interest was shown for a theory of statistics as knowledge formation.

A thoroughly prepared proposal for a social science education in statistics appeared in 1910. The proposal was based on studies of corresponding syllabusses in Europe and experiences from such education at the University-College of Stockholm. The proposal was rejected by the universities. An influential professor of jurisprudence warned against "juridically miseducated officials" and was of the opinion that the new subjects could be placed in the study of "juridical encyclopaedia". The history of statistics - its praxis and theory development - was not to be found in the statistics syllabuses or research programmes at the universities.

As a professor in Uppsala from 1910 Gustav Sundbärg was mostly on sick leave or working on a large investigation of Swedish emigration. The same applied to his successors. From the 1930s demography, statistical techniques and applied mathematics became the main interests of statistics at the universities.

Perhaps these conditions were a strong reason behind the successive losses of statistical positions in applied social statistics. However, the statistical bureaus remained until the 1960s.

#### A perspective from popular adult education

The emergence of popular adult education in Scandinavia can be seen as a late product of the Enlightenment, allied with the temperance and evangelist movements from the mid 19th century. With liberalist and socialist ideas it obtained a very strong general influence in society. Governmental statistics came into focus because *these movements identified great shortages of the knowledge of social and economic conditions*. Statistics promised to remedy many of these shortages and to survey social and economic conditions in an accurate and, in many observers' opinion, a near scientific way. Some enthusiastic and competent social scientists became statisticians – when social science was not accepted in the universities –and they realized in an amazing way many of these prospects. A profession of statistics, with responsibility and power of initiative, won positions and were able to conduct statistical surveys that yielded significant results for the democratic breakthrough in Swedish politics. Statistics, as a broad intellectual European movement, had at last gained a foothold in Sweden.

#### Some of the references

Achenwall, Gottfried: Staatsverfassung der europäischen Reiche, 1749. Anschutz, R P: The philosophy of John Stuart Mill. Oxford at the Clarendon Press 1953. Bacon, Francis: The Advancement of Learning. Paperback edition, Dent & Sons 1973. Bacon, the Cambridge Companion to, (ed Peltonen). New York. Cambridge University Press 1996. Bacon, the Oxford Francis Bacon, Clarendon Press 2000. Bacon, Francis: NOVUM ORGANUM with other parts of The Great Instauration. Translated and edited by Urbach, P and Gibson, J. Open Court 1998. Berg, F T: Utkast till en plan för Sveriges officiella statistik. (Outline of a Master Plan for Swedish Official Statistics)) Statistisk tidskrift 1870, Numbers 1-3. Graunt, John: Natural and Political Observations upon the Bill of Mortality. 1662. Hald, A: History of Mathematical Statistics. From 1750 to 1930. Wiley & Sons 1998. Hofsten, E. Wargentin – den svenska statistikens fader. Statistiska centralbyrån 1983. Hoock, J: D'Aristote à Adam Smith: Quelques Étapes de la Statistique Allemande entre le XVIIe et le XIXe siècle. Published in: Pour une Histoire de la Statistique, Tome I. Institut de la Statistique et des Etudes Economiques (INSEE) 1979. Jensen, A: The representative Method in practice. Nordisk statistisk tidskrift 1926. Kargon, R: John Graunt, Francis Bacon, and the Royal Society: The Reception of Statistics. Journal of the History of Medicine, okt 1963, s 337 ff. Knies, K: Die Statistik als selbständige Wissenschaft: Zur Lösung des Wirrfals in der Theorie und Praxis dieser Wissenschaft. 1850. Meitzen, Av: Geschichte, Theorie und Technik der Statistik (1886, 1903). Meitzen, A: Translated into English 1891: History, Theory and Technique of Statistics. Mill, J S: System of Logic, Vol I, 4th ed.. Nordenmark, N V E: Pehr Wilhelm Wargentin - Kungliga vetenskapsakademiens sekreterare och astronom 1749-1783. Royal Swedish Academy of Science 1939. Porter, Theodore M: The Rise of Statistical Thinking, 1820-1900. Princeton Univ Press 1986. Quinton, A: Francis Bacon. Oxford University Press 1980. Rűmelin, G: Reden und Aufsätze 1875, 1881, 1894. Sandler, R: I siffrors ljus. Sju radioföredrag. (In the light of figures. Seven radio lectures) Wahlström & Widstrand 1928. Schlözer, A L: Theorie der Statistik. 1804. Sjöström, O: Svensk samhällsstatistik - etik, policy och planering, Akademilitteratur 1980. Sjöström, O: Vad är statistisk metod? Statistisk tidskrift 1983:2. Sjöström, O: Svensk statistikhistoria – en undanskymd kritisk tradition. Stigler, Stephen M: The History of Statistics - The Measurement of Uncertainty before 1900. Harward University Press 1986. Westergaard, Harald: Contribution to the History of Statistics. London 1932. Reprint: Kelly, New York, 1969. Wolf, E: Grosse Rechtsdenker. Tübingen 1951 Woolf, Stuart J: Towards the History of the Origins of Statistics, France 1789-1815. Published in: State and Statistics in France 1789-1815. Harwood Academic Publishers 1984.

©Olle Sjöström 2008