



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

*Electronic Journ@l for History of
Probability and Statistics*

Vol 4, n°1; Juin/June 2008

www.jehps.net

Condorcet and Borda in 1784. Misfits and Documents

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This issue on the history of social mathematics is a fine occasion for promoting the digital library accumulated by the Bibliothèque nationale de France in Paris (www.gallica.fr) and for displaying beyond the circles of Condorcetian erudition the Condorcet-Borda file related to the mathematics of elections. The two names are well known. Their works, associated with the years 1781 (Borda) and 1784 (Condorcet), are often mentioned, but are less well known. (See Iain McLean's and Arnold Urken's articles in this issue for the latest commentaries on this matter.) Some fables also run through the collective memory of science. Some authors have commented upon the near-coincidence of the two dates of publication and the physical proximity of the two academicians who were both at the Paris Academy of Sciences. Some have imagined a dialogue, if not a controversy. Studies published during the two last decades provide some insight into this seeming connection.

The relevant literature runs from French-style erudition to specialized publications in the history of social choice theory. Large sections from the documents we are presenting today have been edited and commented on in the mid-1990s (Brian, 1994; Bru and Crépel, 1994; McLean and Hewitt, 1994; McLean and Urken, 1995). In France, the intensity of scholarship increased following the collective works produced in the context of the bicentennial commemoration of the French Revolution and of Condorcet's death (RS, 1988; Crépel et Gilain, 1989; MEFIM, 1996; Chouillet et Crépel, 1997). More recent works on Condorcet may be considered in this light, too (Schandeler et Crépel, 2004; Crépel and Rieucan, 2005). The last of these is a very recent dissertation carried out as a systematic philological inquiry in order to analyse the density of the philosophical references made by Condorcet in his works on the mathematics of elections (Mammone-Rinaldi, 2008). It should be mentioned, too, that this kind of work on the

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archives of the Academy of Sciences at the end of the 18th century has sparked the production of a specific literature where at issue are the relationship between historians of science and archivists and the possibility of more systematic studies of the treasures kept by this company (Brian et Demeulenaere-Douyère, 1996). Lastly, the example of the Condorcet-Borda enigma has been discussed in the context of the recent re-evaluation of archives for the study of the history of sciences (Brian, 2001).

Before sending the reader to the reproductions of the original material, let us make this long story and historiography short. (Those expecting more details should go through the reference literature mentioned above.) The date of 1781 is a fake. The story really begins the 14th of July of 1784, exactly five years before a date of some importance in the history of democracy. It should be mentioned that at the time Condorcet and Borda, both mathematicians among the members of the Paris Academy of Sciences, were in opposite camps both from a scientific and from a political point of view. Borda was part of Buffon's clique and a supporter of Necker's political action. (Necker was three times principal minister, in 1776-1781, in 1788-1789, and in 1789-1790.) Condorcet was d'Alembert's spiritual son, and the past decades until his mentor's death in 1783 there was a constant academic fight between Buffon's and d'Alembert's camps. Condorcet was also a close friend of Turgot, the political antagonist of Necker. (Turgot was finance minister in 1774-1776; he died in 1781.) And in 1783-84, Condorcet was the most influential scientist connected with the new government that claimed to reactivate Turgot's politics. The reform of that period was the establishment of a new system of provincial assemblies, in order to institute new forms of tax collection and of local administration. Both parties tried to implement provincial assemblies. But Turgot's line was to give a stronger power to local deliberative assemblies.

In the first years of the 1780's, Condorcet finished two of his main mathematical works, the first one being his treatise on integral calculus, the second a set of memoirs on the calculus of probability. In the summer of 1784, he undertook a third work he conceived as the application of the two previous steps and as a matter of public interest: the analysis of electoral decisions. Condorcet was Permanent Secretary of the Academy of Sciences, and as such in charge of all official publications of the company. He therefore was officially acting on its behalf, and he frequently had to appeal for votes (McClellan, 2003). This means that Condorcet was not only a mathematician dealing with elections, but an expert on concrete electoral operations. This point is highly relevant for understanding the *Essay on Elections* that was ultimately published in 1785. Most of his work dealt with what Condorcet would have considered as distortions of fair votes. He wanted to analyze the preconditions of this kind of vote, building through his analysis a set of hypotheses and results that could shape a normative understanding of electoral procedures. This was the political application that accompanied the mathematical elaboration.

Being the authority on publishing the memoirs of his fellow academicians, Condorcet had to follow the same rule for his own publications. Any book to be officially printed was supposed to get an approval of the Academy. (This is a time of censorship, and the Academy had a quasi monopoly on the scientific press). Concretely and usually, this meant the designation of two referees who were supposed to write a report to be read to the assembled academy and...a vote. This is why, the 14th of July 1784, Condorcet officially expressed the intention to publish a new book dealing with “the application of analysis to the decisions based on the plurality of votes.” (See Document 1.) Two of his closest colleagues got the charge. They gave account of the book three days later. There is joke among those who in the past decades have worked on the *Essay* of 1785, that as far as we now, there is no reason to doubt that in all the years there have been more than a dozen of readers of the whole *Essay*, including its preliminary discourse. And those alive today having shared this experience have spent more than three days in doing so. As a result, there is a strong motive to believe that the actual author of the well-documented and clearly-argued report was Condorcet himself.

Obviously, Borda reacted before the 21st of July. The fact is that very day he read a memoir in order to claim for some kind of priority, insofar as far as he had already presented to the company work on a similar subject in 1770. No historian so far has been able to exhibit such a memoir or an archival trace of it. But it is true that at the end of the 1760's there was a lot of discussion about reforms of the academic institution (Brian, 1995; Chouillet et Passeron, 2003). Given the antagonism between d'Alembert's and Borda's camps, it is realistic to consider that the latter would have discussed the form of academic election in these kinds of circumstances. And it is highly probable that d'Alembert considered such a gesture with contempt and that Condorcet had no occasion to see it as a serious matter of science. It is so true that Borda's memoir, as it was published after the events of July, 1784, only deals with the arithmetic of votes, certainly commenting on aspects of the well-known paradox of today, but without any reference to the theory of probability. Just like Laplace and in competition with him, Condorcet spent a dozen of years to find a path to escape from d'Alembert's rejection of the application of mathematical analysis to human affairs, and he would not have been convinced by any arithmetical trick.

But Condorcet wanted the *Essay* to be quickly published. So, as a master of academic politics, he simply facilitated the quick publication of Borda's memoir. This is why a paper, supposedly read in 1770, actually presented in 1784, was published in an official academic volume for the year 1781 – the one under press in July, 1784 (see Document 2). Being Secretary of the Academy, and therefore editor in charge of the summaries published in the first section of the yearly volumes, Condorcet found an occasion to comment on Borda's voting method. In this short account that was also published in 1784, Condorcet concedes the arithmetical result, what we call “the paradox” and the relevance and originality of the observations. But he deals with them as if it were a matter of measuring a physical phenomenon. It is about quantities, combinations,

pluralities and values, but not about truth and probabilities, like in his own *Essay on Elections*. In his terms, as stated elsewhere, Borda's approach was only "*physicaille*," whereas his own represented a "*métaphysique du calcul*." The deal was done, and nothing could stop the publication of Condorcet's *Essay*, especially if the author added a few paragraphs to its preliminary discourse that developed his comments of 1784 (see Document 3).

Three years later, in 1788, Condorcet – back again in the opposition after Necker's first comeback to the Ministry – published his *Essay on Provincial Assemblies*, a book supposed to explain the principles and reasons for the implementation of a neo-Turgotian policy. This work was deliberately a political intervention against the government, and it was for its author an occasion to advocate the scientific innovations produced in the Academy that could justify such an ambitious reform. But doing so Condorcet was too late: the mobilisation of the old system of the Estates General was now on Necker's agenda. (Turgot had been against such an appeal.) The pages about Borda's memoir given in the first appendix of the first volume of the *Essay* of 1788 develop Condorcet earlier comments. But once again, the fundamental argument concerning probability is not discussed, even if our geometer and activist could have conceived it. The reason pertains to the aim of the book: it is written for the edification of the new citizens, those who should be interested in the implementation of the new type of provincial assemblies. So this was not the place for discussing the most difficult issues in analysis, like in the *Mémoire sur le calcul des probabilités* published a few years before in the academic volumes, but the one for a simple arithmetic example that could demonstrate that the matter is not so easy, and that mathematics could be helpful.

So from a strict historical standpoint, it is difficult to argue without over-interpreting the documents that there was a dialogue between the two academicians. For similar reasons, there is no room for any explicit controversy, even if we can be sure that the two scientists did not share the same understanding of the topic. And last, there is no secret in the coincidence of the two publications, and there is no reason to overemphasize the face value of their dates of publication. Condorcet's *Essay on Elections* of 1785 and Borda's memoir of 1784 emerged directly out of the tensions inside the Academy, and only meshed one with the other by dint of the institutional logic of this peculiar organization. To be sure, both authors reflected upon elections. They both expressed the academic experience of counter-intuitive electoral results. These are the kind of things that provoke intellectual curiosity and upon which a mathematician could well meditate. But their two mathematical styles and ambitions are actually distinct, and we do not have any evidence for an actual scientific discussion here. Dealing with these two attempts, comparing them and establishing their preconditions and potential – so close as they were one to the other in time and space, but so far apart in the world of mathematics – is not the subject of history of science but the one of the sociology of mathematics and philosophy of social choice theory.

Documents (in chronological order)

[Document 1]

Paris Academy of sciences, *Procès-verbaux*, year 1784, t. 103 [official manuscript ; 35 mm microfilm copy, CNRS, 1962 ; digitalized version, BnF-Gallica, ref. FRBNF37572027]. <http://gallica.bnf.fr/Catalogue/noticesInd/FRBNF37572027.htm>

p. 1 (pdf), f° 175 v°. — Meeting of the 14th of July 1784, “le Ch[evali]er de Borda” and “le M[arqu]is de Condorcet” are among the participants (top of the page). Condorcet informs the Academy that he will publish a book entitled “Application de l’analyse (*sic*) aux décisions qui se font à la pluralité des voix” and asks, as usual in similar circumstances, for two referees in order to get the necessary approval of the Academy (lines 7-4 from bottom of the page).

p. 2 (pdf), f° 181 r°. — Meeting of the 17th of July 1784, with “le Ch[evali]er de Borda” and “le M[arqu]is de Condorcet” (top of the page).

pp. 3-7 (pdf), f° 185 v°/187 v°. — That day, the referees Bossut and Coulomb read their report based a manuscript version of the *Essay on Elections*.

p. 8 (pdf), f° 188 r°. — Meeting of the 21st of July 1784, “le Ch[evali]er de Borda” and “le M[arqu]is de Condorcet” being present (top of the page).

p. 9 (pdf), f° 189 r°. — That day, Borda reads a memoir mentioned as related to the probability of elections (top of the page).

[Document 2]

Histoire de l'Académie royale des sciences avec les mémoires de mathématique et de physique tirés des registres de cette Académie, année 1781. Paris, Imprimerie royale, 1784 [digitalized version, BnF-Gallica, ref. FRBNF32786820].

<http://gallica.bnf.fr/Catalogue/noticesInd/FRBNF32786820.htm>

Condorcet as Permanent Secretary of the Academy of Sciences was the editor of this yearly volume of proceedings. The contents for the year 1781 to be printed in 1784 had been established in April, a few months before. Borda’s memoir even if it had been read in July, 1784 (and not in the year 1781) was introduced at the last minute, obviously as recognition of his claim for priority expressed the 21st of July.

p. 1 (pdf), front page: date of publication 1784, which indicates the usual lag of three years for the Academy’s publications.

pp. 2-5 (pdf), p. 31-34 in the first section providing the summaries of the published memoirs. (This section was written by the Secretary of the Academy, Condorcet himself.) Condorcet gives a descriptive account of Borda's method.

pp. 6-14 (pdf), pp. 657-665 in the second section composed of memoirs given by the academicians supposedly in 1781. Borda's paper was actually read in July, 1784. On p. 6 (pdf), or 657 (2nd section of the original volume), a note justifies the publication: "the ideas contained in this Memoir have been already presented to the Academy fourteen year ago, the 16th of June 1770."

[Document 3]

Marie-Jean-Antoine-Nicolas Caritat, marquis de Condorcet, *Essai sur l'application de l'analyse à la probabilité des décisions rendues à la pluralité des voix*. Paris, Imprimerie royale, 1785 [« *Les Archives de la Révolution française* » 6.3.116, Microform, 1993 ; digitalized version, BnF-Gallica, ref. FRBNF37237493].

<http://gallica.bnf.fr/Catalogue/noticesInd/FRBNF37237493.htm>

Condorcet has changed the text of the *Essay on Elections* before sending his manuscript to the royal printer. Page clxxvii (p. 2, pdf), a "well-known geometer" is mentioned. This is Borda. The argument and a note appearing on p. clxxix (p. 4, pdf) are helpful for this identification. The argument here, just like in Borda's paper, is purely numerical.

[Document4]

Marie-Jean-Antoine-Nicolas Caritat, marquis de Condorcet, *Essai sur la Constitution et les fonctions des Assemblées provinciales*, [s.l.], 1788 [« *Les Archives de la Révolution française* » 6.3.121, Microform, 1993 ; digitalized version, BnF-Gallica, ref. FRBNF37235073].

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First appendix "On Discovering the Plurality Will in an Election". Condorcet develops his commentary on Borda's method.

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