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# **Some Early History of Data Security**

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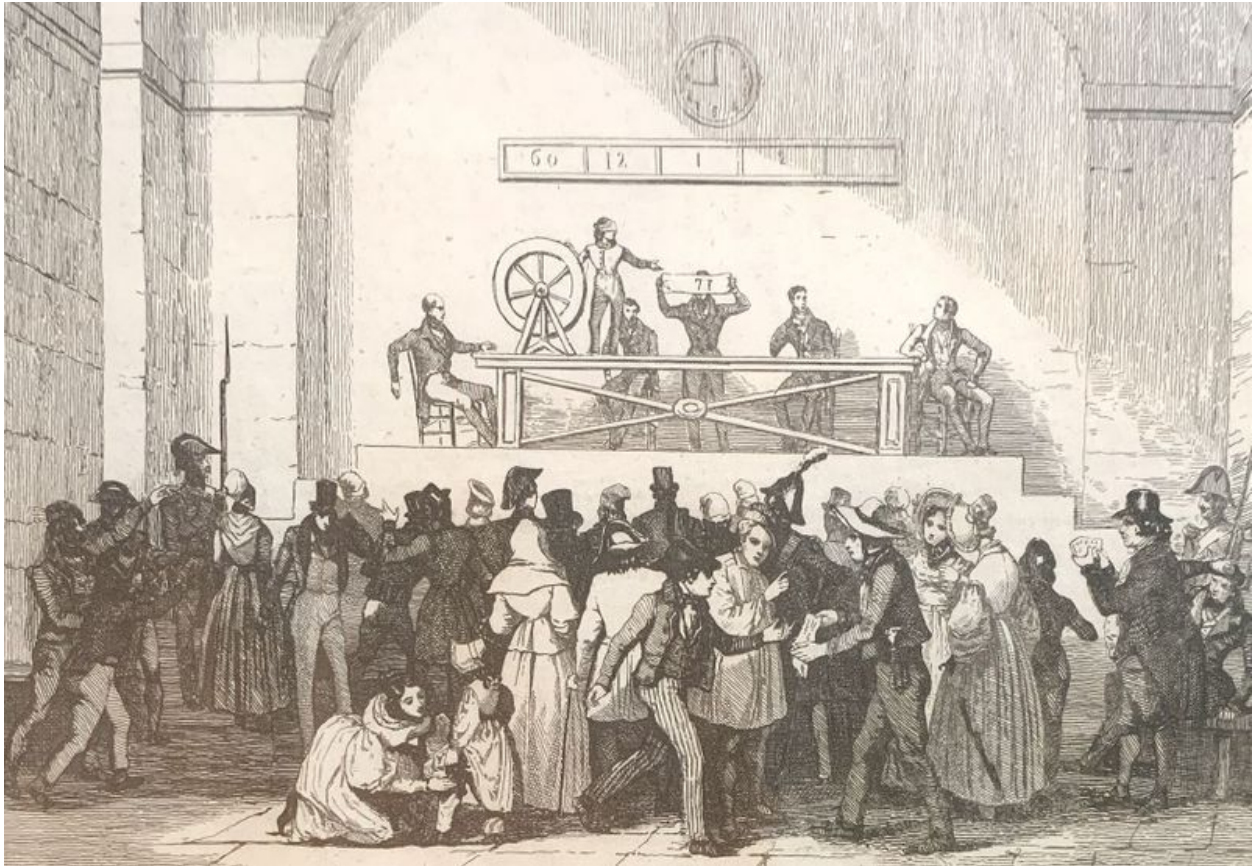
**Column Editor's Note:** Gambling has long been an important, perhaps the most important, site for the development of probability. In this [Mining the Past](#) column article, Stephen Stigler shows how early modern state lotteries were also engaged in the conceptual and practical problems of data security. A successful lottery required calculating expected returns, but also attending to practical problems of fraud and deceit.

**Keywords:** data security, lottery, history

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The central focus of my book *Casanova's Lottery* (University of Chicago Press, 2022) is an early version of Lotto that was introduced in France in 1758 and the lessons we might learn about risk from its reception over the 80 years that it flourished. The French, like other European states, sought new sources of income that did not arouse anger in the people, and lotteries were a convenient answer, a voluntary tax. Lotteries, however, required security against fraud, and such measures had to be both robust enough to safeguard the State's money and simple enough to actually be used. Data security here was not distinct from the lottery; it enabled the lottery to survive and to be scaled over time. Lottery security and success were intertwined.

Their particular choice was a simple game: each month, tokens numbered 1 through 90 were mixed in a wheel of fortune, and then five tokens were drawn without replacement while an expectant crowd watched (Figure 1). For its first 2 decades the bettors would have a choice of betting that a specific number from 1 to 90 will be among the five, betting on a pair of numbers, or betting on a set of three numbers being among the five chosen. One franc paid for a ticket on a single number would return 15 francs if successful; if on a pair, 270 francs; if on a set of three, the return would be 5,520 francs. For these to be fair bets (without expected loss), the payouts would have been 18, 400.5, and 11,748 francs, respectively. Note that the payouts were fixed; there was no 'parimutuel pool,' as we have today, to protect the State from a great many people betting on the winning numbers by limiting the total payout—with bad luck the State could lose money on any drawing. Casanova, when faced with that objection, quickly replied that would be a benefit: the bettors would be breaking down the doors to buy more tickets at the next drawing.



**Figure 1.** A contemporary sketch of an early drawing. The public were invited, and the drawing was by a blindfolded orphan.

The lottery was a great success. Soon there were two drawings a month; by 1803 they had reached 15 drawings a month. Soon there were 80 agencies in Paris selling tickets; eventually there were over a thousand agencies in France, and even more during the Napoleonic empire. The list of available bets increased over time: for example, investing a franc on the full set of five numbers could return 1,000,000 francs (a fair bet would have returned 43,949,268 francs).

The success depended on solving some difficult problems involving data security. For the French lottery they needed a way to link numbers bet to tickets sold, and thereby guard against the possibility of counterfeit tickets, as well as be sure crooked agents did not sell tickets after the result of the drawing was known. Starting in 1758, the scheme involved a receipt being issued to the bettor at the sales point (Figure 2), and a record of the sale was sent to the central office where an official ticket would be printed (Figure 3), to be returned within a couple of days to the sales agent and then be picked up by the bettor before the drawing. In the 1780s this cumbersome procedure was slightly simplified, by offering as an alternative to bettor-suggested bets, a set of preprinted random tickets not requiring a second printing, much like today's 'pick six' choices (Figure 4).

LOTTERIE ROYALE  
DE FRANCE

Bur. N° 116

Bur. N° 306

premier TIRAGE

le 17 Juin 1786

J'AI reçu la somme de

4000

pour  
placer au Tirage prochain sur les Nombres ci-après.

*Le Sieur de Lamoignon*

Extr. simp. à

Amb. simp. à

Terne..... à

Quarternes... à

Quins..... à

Extr. dét... à

Amb. dét... à

*vingt mille*

*vingt mille*

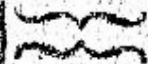
La présente Reconnoissance doit être rapportée & échangée contre le Billet avant le Tirage, attendu que les Lots ne seront payés que sur les Billets, & non sur les Reconnoissances, conformément à l'Arrêt du Conseil du 30 Juin 1776 : les Actionnaires s'assureront de plus de l'uniformité de leurs Reconnoissances avec les Registres, lesquels feront foi & seront admis en preuve; & dans le cas de quelque différence, entre lesdites Reconnoissances & les Registres, les Actionnaires ne pourront prétendre autre chose que la restitution de leurs mises, conformément à l'Arrêt du Conseil du 27 Septembre 1760.


Le Porteur a donné le N°

Fait à Paris

en cas de substitution.

*1786*  
*1786*

1775. | P. O. | 40. |  | 455 | 1775.

LOTÉRIE DE L'ÉCOLE ROYALE MILITAIRE.  
TIRAGE D'AVRIL   
MIL SEPT CENT SOIXANTE-QUINZE.

POUR le paiement fait par le Porteur du présent Billet de la  
Somme de 248 il lui sera payé  
par le Caissier Général de ladite Loterie, suivant la mise ci-dessous  
spécifiée, quinze fois la mise pour chaque Extrait, deux cent  
soixante-dix fois la mise pour chaque Ambe, cinq mille deux cents  
fois la mise pour chaque Terme, qui peuvent résulter des Nombres  
ci-après qui seroient sortis de la Roue de Fortune audit Tirage. 2

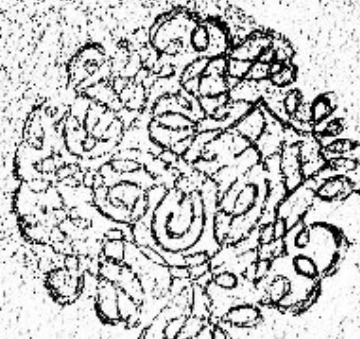
- 5 Extr. à quarante-huit sols
- 10 Amb. à douze sols.
- 10 Term. à douze sols.

- N<sup>o</sup>. 8. Antoinette Vichy.
- N<sup>o</sup>. 17. Claude Vitry.
- N<sup>o</sup>. 43. Marg. Jourdain.
- N<sup>o</sup>. 76. Michel Dufresne.
- N<sup>o</sup>. 86. Jeanne Daniel.





*Transfert par Comptoir*

*BUSARD & Co*



1783

Bur. 18.   E<sup>n</sup>. 743.

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LOTERIE ROYALE DE FRANCE.

**LE SECOND TIRAGE**

TIRAGE D'AVRIL.

MIL SEPT CENT QUATRE-VINGT-TROIS.

POUR le paiement fait par le Porteur du présent Billet de la somme de *Sen Mille Deux Sols* il lui sera payé par l'Administration, suivant la mise ci-dessous spécifiée pour chaque Lot, savoir par Extrait simple 15. fois la mise, par Ambe simple 270. fois, par Terme 5500. fois, par Quaterne 75000. fois, par Quine 1000000. de fois, par Extrait déterminé 70. fois, & par Ambe déterminé 5100. fois.

10 Amb. simp. à quatre sols.	2	} 6 <sup>e</sup> 10
10 Terme.....à deux sols.	1	
5 Quaterne...à dix sols.	2	
1 Quine.....à vingt sols.	1	

N<sup>o</sup>. 27. Isabelle.  
 N<sup>o</sup>. 36. Victoire.  
 N<sup>o</sup>. 50 Perpetua.  
 N<sup>o</sup>. 67. Ovide.  
 N<sup>o</sup>. 74. Brigitte.

*Blanquet De Loterie*

A study of these tickets illustrates the efforts made to prevent counterfeiters. The most common way counterfeit was found to be the simple alteration by hand of the printed numbers, such as turning '5' to '8.' In the ticket

from April 1775 (Figure 3), five numbers were listed to be used for several bets, 25 separate bets in all. On the ticket, each number is paired with an orphan's name (a winning orphan would receive a small payment from the State, restricted for use as a dowery or some other life improvement), and accompanied by a hard-to-duplicate pattern coding the number. Above these codes, another hard-to-duplicate pattern coded the date of the draw (April 1775). There was also a real signature as well as a printed signature and a complicated seal.

As the years went on, the lottery grew immensely. For claims of very large prizes, the agency would seek a confirmation with the entries in the books in the main office, but for smaller prizes they wanted to pay quickly to encourage reinvestment. Before paying the bettor, the agent would be expected to check that the coded patterns matched the codes for the designated number on a master sheet. The orphan's name was also a security check (as well as a form of virtue signaling); it too should be checked with a master sheet. By the 1780s the lottery managers realized that the agents ignored much of this and that simply attaching a woman's first name to the number was sufficient—the agents had no grasp of patterns and no patience for constantly changing lists of names, as any successful orphan was immediately replaced on the list. But they could, in time, remember 90 women paired with 90 numbers in a list that did not change. So in 1776, the orphans and patterns for the numbers were dismissed, leading to a ticket like that from February 1783 (Figure 4). Very strong security meant little if the agents did not use it.

In 1798, the lottery began a major expansion, and further streamlining of the process was required. A reliable estimate of the number of bets placed in the 36 years after 1798 when better records than earlier are available is that about 2.5 billion bets were made, 70 million bets per year! So they eliminated the individually printed ticket and relied entirely upon a more carefully executed version of the original receipt, with the unambiguous writing of numbers as key, with underscores and overscores, with numerals separated by equal signs, and with stylized versions of the numerals (Figures 5, 6, 7). A claimed winning ticket would then be simply compared with a counterfoil in the agent's office, with checking for large prizes requiring further examination.

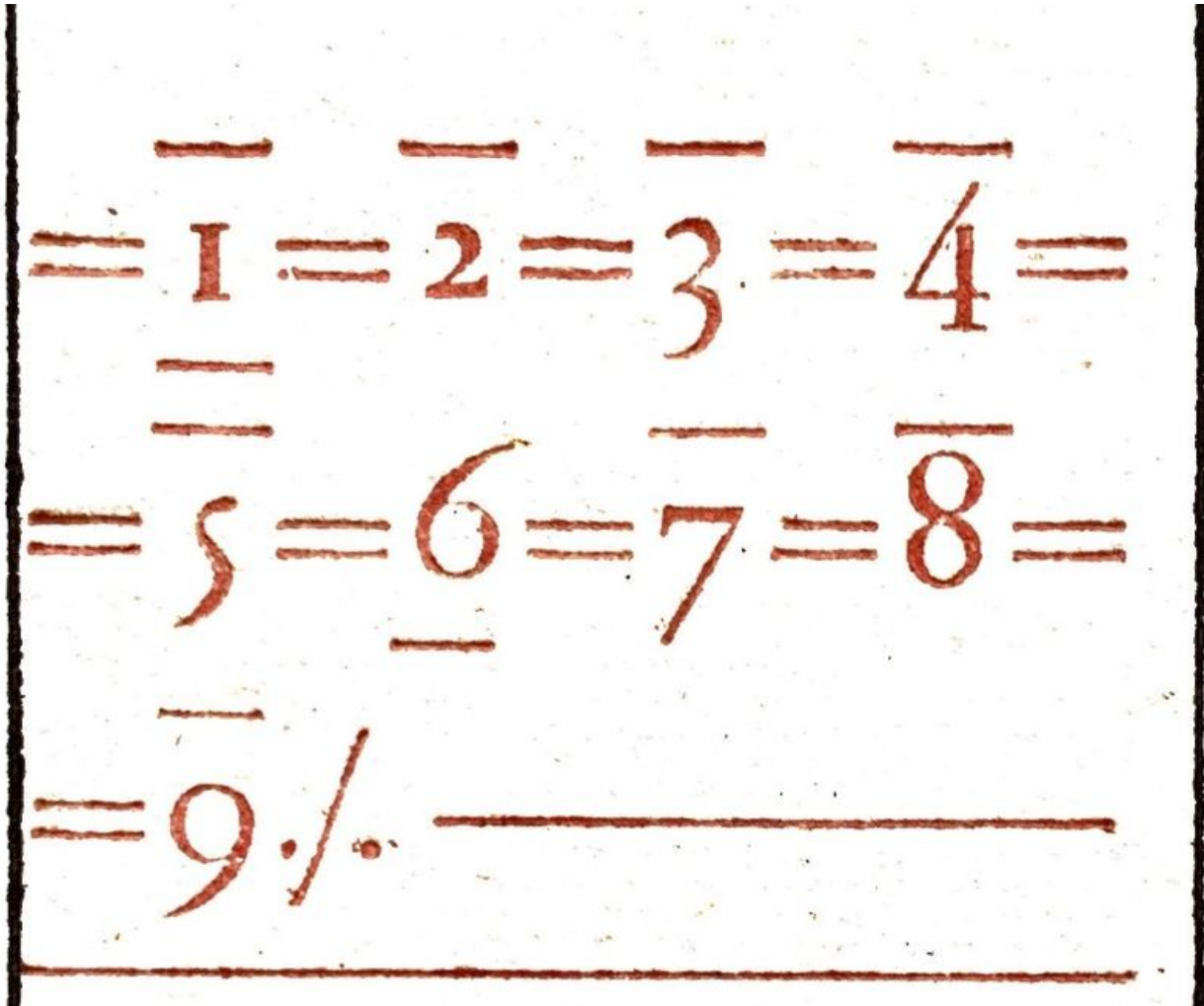


Figure 5. A model for registering bets after the revolution, from a manual for agents, showing how to add upper- or lower-scores to the handwritten numbers, how to separate choices by equal signs, and how to mark the end of the bet by './.'



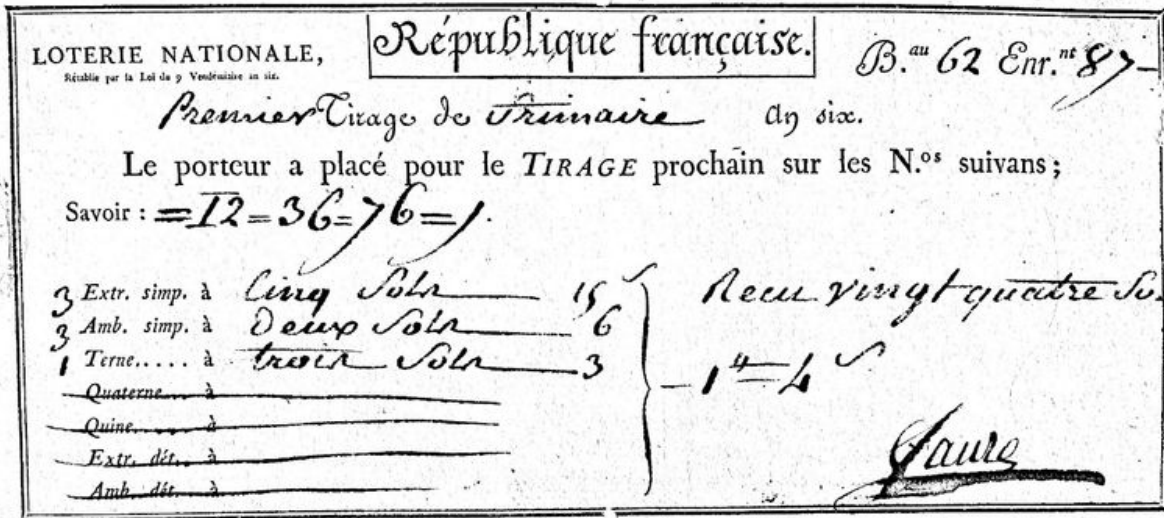


Figure 6. A ticket from the first drawing after the revolution indicating bets on three numbers “= 12 = 36 = 76 = 1.” The bets were on all separate numbers (three bets), all pairs (three bets), all triples (one bet); seven bets in all. Only the first ‘1’ was scored above and below.

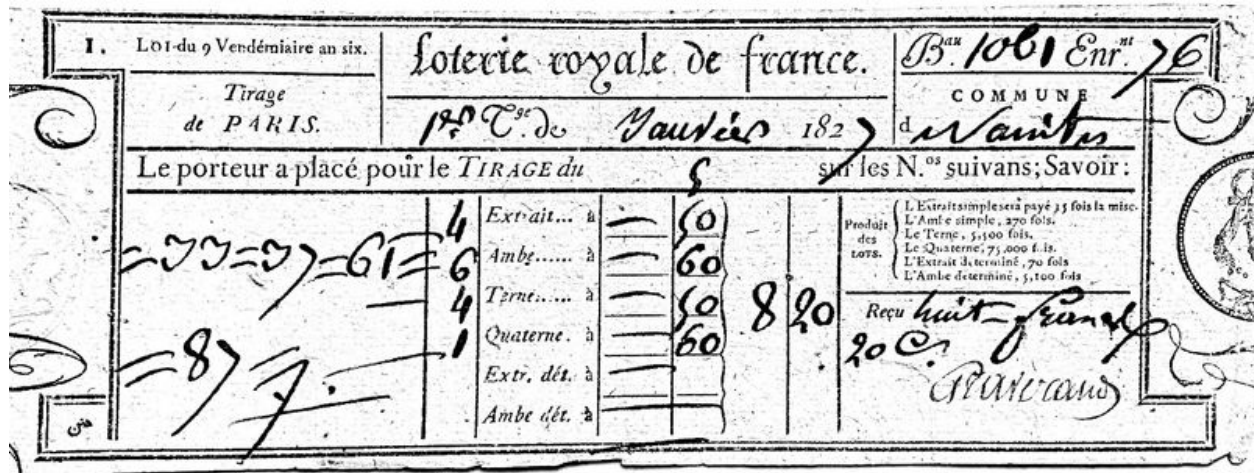


Figure 7. A ticket from the first drawing in January 1827, indicating bets on “= 33 = 37 = 61 = 87 = 1.” There were bets on all possible singles, pairs, triples, and one quadruple: 15 bets in all. Note that the use of under- and overscores other than on ‘1’ was not observed by that time.

How common were the cases of fraud? Only scant evidence survives. There are a small number of tickets in an archive showing attempts to alter numbers. What about crooked agents backdating tickets after a drawing? I found a short notice in a November 1798 official newspaper reporting that one bettor claimed an 814,000-franc prize for correctly specifying four numbers drawn, but that after investigation he and the agent in Anvers who sold him the backdated ticket were instead awarded 20 years in irons. The report added that the government announced new measures to prevent such frauds in the future. So fraud existed. But, of course, the number of

undiscovered such frauds is not known. Indeed, since all winning tickets were destroyed (to prevent reuse), all surviving tickets are losing tickets! Perhaps the strongest evidence is the careful attention paid by the lottery to educate the agents and the central office investigators on procedures to guard against fraud.

As a contrast to the French experience, a different plan for lotteries was adopted in the same period in other countries, specifically in England and Germany. It was in the form of a raffle. For example, 20,000 sequentially numbered tickets would be printed, and when all these had been sold, there would be a drawn-out drawing (taking weeks) where a number would be drawn from the 20,000 and paired with a separately drawn slip from another set of 20,000 slips with prize numbers on them (most of these were blank, so these were termed blanks lotteries in England). Here the needs for security were much less. If two people showed up with the same ticket number, the agents would know that at least one was a fraud, whereas in France there was no limit to the numbers of winners in a single drawing. And even if the prize went to a fraud, the cost to the State was not changed. The costs, if any, of insecurity would fall on the bettors, not the State. While the French had no limit on the number of sales needed to hold a drawing—they could have one every day—the English could only mount a drawing a couple of times a year due to the need to sell all 20,000 tickets each time. On the other hand, the English had a hard limit on the total payout each time, while the French depended on the law of large numbers, a law that no legislature could repeal.

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## Disclosure Statement

Stephen M. Stigler has no financial or non-financial disclosures to share for this article.

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