ough one produced up to its time. This includes the printed version of 1663, several decades thereafter. In addition to the probability calculations there are informative and detailed discussions of methods of cheating at cards and dice so that the player might beware.

Girolamo Cardano

b. 24 September 1501 • d. 21 September 1576

There are other hints in several places that a rudimentary probability calculus was well-known prior to 1654. For example, the Pardoner in Chaucer's *Canterbury Tales* states two events which are the sums of throws of two dice. The events are assigned as the chances between the Pardoner himself and another person. Both events, throwing a seven and throwing a three or five, are equiprobable.

The problem that led to the development of the probability calculus by Pascal and Fermat, followed three years later by Huygens's *De Ratiociniis in Ludo Aleae*, was the problem of points. This is the second strand to the history of the development of the probability calculus. The problem of points, or the division of stakes in a game which is terminated early, was a long- standing mathematical problem rather than a practical gambling problem. Most serious gamblers would continue until the game was finished or would cast lots for the stake. Discussions of the problem of points have all so far been found in mathematical works while the strictly combinatorial probabilities associated with dicing and cards have been found in other works. This assumes that Cardano's *Liber de Ludo Aleae* is treated as a gambling manual rather than a work in mathematics.

The earliest known result for the problem of points is from a manuscript dated to about 1400. It is part of a collection of arithmetic and algebraic works.

The author tackles the problem for the situation in which the first player to win three games, among two playing the game, wins the stake. Using algebraic, rather than combinatorial or probabilistic arguments, the unknown author correctly solves the problem when the game is stopped after one player is leading the other by a score of two to zero. However, when the score is three to zero and the object is to win four games, the author has trouble with the solution and gives up without completing it. The first printed reference to the problem of points is in a 1494 work by Luca Pacioli, a Franciscan friar and itinerant mathematics teacher, who eventually became a professor of mathematics at the University of Milan. His solution to the problem of points, which is completely fallacious, also involves no probability arguments or combinatorics. Throughout the sixteenth century several other Italian mathematicians, including Cardano, Tartaglia, Peverone and Forestani tried their hands at this problem and published what little success they had with the problem in their mathematical works. Within this group the problem of points appears to be a mathematical curiosity of intellectual rather than practical interest.

The few probability calculations that have been made prior to 1654 have been reviewed in Coumet (1965), David (1955), David (1962), Hald (1990), Kendall (1956), Schneider (1988), and Todhunter (1865). Some other discussions about early probabilistic concepts and possible probability calculations are found in Bellhouse (1993), Bellhouse and Franklin (1997), Hacking (1975), and Rabinovitch (1973).

— David Bellhouse

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17th Century