The Art of Conjecturing, together with Letter to a Friend on Sets in Court Tennis

By Jacob Bernoulli. Translated with an introduction and notes by Edith Dudley Sylla. Baltimore (The Johns Hopkins University Press). 2005. ISBN 0-8018-8235-4. xx + 530 pp. $70.00

When I took my initial glance at the dust jacket and flyleaf after opening the postal container housing Edith Sylla's translation of *Ars Conjectandi* by Jacob Bernoulli, I was expecting that the bulk of the book would be Bernoulli's classic work. I was wrong. Nearly 40% of this work contains introductory comments as well as notes on the text. Nevertheless, the entire package, excepting the postal container of course, is a very welcome addition to the literature that will be of great interest to historians of mathematics, especially to those interested in the emergence of the concept of probability or in the development of the probability calculus.

The importance of *Ars Conjectandi* cannot be understated. To quote an antiquarian bookseller on the internet (offering a copy of the original edition for £12,000), who succinctly cribbed the book's major contributions from Stephen Stigler's *History of Statistics* [Stigler, 1986, 64]:

> Bernoulli's book has variously been regarded as the beginning of the mathematical theory of probability and as the end of the emergence of the concept of probability... The book is remarkable in many aspects, from its advances in combinatorics (including the "Bernoulli numbers") to its pathbreaking analysis of the interpretation of evidence ... [and the] introduction in the fourth part of what has come to be regarded as the first law of large numbers.

In her Introduction, which covers 125 pages of the book, making it almost a book in itself, Professor Sylla provides an excellent multifaceted historical background to the writing of *Ars Conjectandi*. This background is, in the main, specific to Bernoulli's life and his interaction with other mathematicians, especially Leibniz. Sylla shows how Bernoulli's earlier academic experience, for example, his study of theology, influenced his work in probability and she traces results in *Ars Conjectandi* to Bernoulli's notebooks and to his university lectures and disputations. Layered in as well is a more general historical context. This is evident, for example, in Sylla's discussion of the role of early commercial arithmetic books in the development of the probability calculus. After describing how some early problems in probability share the same language as the division of profits in a business partnership, Sylla mentions how Jacob Bernoulli would have been familiar with commercial arithmetic books thanks to the Bernoulli family's background in business.

In her translation of the 1713 text, Professor Sylla has done an admirable job. Translators always have a difficult role to play because of the conflicts they face. At one extreme they may try to be completely true to the text and at the other they may freely adapt the text to make it easily accessible to modern readers. Sylla has been very faithful to the original. Her approach can be readily seen by comparing her edition to a much freer translation by Francis Maseres of Book II of *Ars Conjectandi* [Maseres, 1795]. Consider the second paragraph of Chapter 1 in Book II, which deals with the definition of a permutation. Sylla's translation is:

> Of the things to be permuted, however, all can be diverse or only some of them. This may conveniently be represented by using letters of the alphabet either all different or with some repeated. (p. 194)

Compare this to Maseres, who continues at great length in order to be clear about what is meant:

> The things of which we are required to discover the number or permutations, may be either all distinguished from each other by some plain mark, such as a difference of shape or colour, as cubes from spheres, or black balls from white balls; or they may be exactly like each other, so as to be liable to be mistaken one for another, as two spherical black balls of exactly the same size and weight. In the former case it will be proper to denote several things by as many different letters of the alphabet; and in the latter case it will be convenient to denote so many of the things as are exactly like each other, by the same letter of the alphabet, repeated as often as any of the said things which are like each other shall occur, as will be seen in the course of the following pages. [Maseres, 1795, 38]

Sylla's translation captures the terseness and succinctness of Bernoulli's prose, which requires the reader to pause and think about the definition. Maseres' translation is meant for someone trying to learn about permutations, perhaps for the first time.

Another difficult problem faced by a translator concerns which modern words to use in the translation. Here the difficulty is caused by the evolving interpretation of words commonly used in the probability literature. How should early concepts of the probability calculus, expressed in late 17th- or early 18th-century Latin, be rendered into English when some 21st-century uses of probabilistic words differ from their original meaning? To address this problem, Sylla has chosen consistently to render, for example, the Latin phrase *aequa sorte* as "with equal lot" where others might translate it as "with equal probability" or "with equal likelihood." The latter phrases come with 300 years of interpretative baggage; the word "lot," on the other hand, is rarely used in this sense and maintains the original meaning. Initially, I found this approach, especially with "lot," archaic and jarring. But that was perhaps intentional, since each time the phrase is encountered it reminds the reader that the approach to probability theory at its birth was different from what it is now in adulthood. For those who have a problem with some of Sylla's word choices, it would be useful to photocopy her explanation of the translation of some key words on pp. 113–123 and refer to it as you read through Bernoulli's text.

Clearly written for historians of mathematics, Sylla's translation and commentary is an excellent read and should immediately be seen as a valuable resource for those interested in the history of probability.

References

Maseres, F., 1795. The doctrine of permutations and combinations: being an essential and fundamental part of the doctrine of chances, together with some other useful mathematical tracts. B. and J. White, London.

Stigler, S.M., 1986. The history of statistics: The measurement of uncertainty before 1900. Belknap Press, Cambridge, MA.

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Arthur Cayley: Mathematician Laureate of the Victorian Age
By Tony Crilly. Baltimore (The Johns Hopkins University Press). 2006. ISBN 0-8018-8011-4. xxiii + 610 pp. $69.95
James Joseph Sylvester: Jewish Mathematician in a Victorian World
By Karen Hunger Parshall. Baltimore (The Johns Hopkins University Press). 2006. ISBN 0-8018-8291-5.
xiii + 461 pp. $69.95

It is 70 years since Eric Temple Bell christened Cayley and Sylvester the "Invariant Twins" in his well-known book *Men of Mathematics* [Bell, 1937]. This popular work, though frequently criticized by historians of mathematics for its opinionated writing and lack of historical accuracy, undoubtedly did more than any other book of the 20th century to introduce the varied personalities of our subject to a general mathematical readership. In particular, Bell's chapter on the Invariant Twins chronicles the lives and mathematical achievements of these two men, asserting that

> The lives of Cayley and Sylvester should be written simultaneously, if that were possible. Each is a perfect foil to the other, and the life of each, in large measure, supplies what is lacking in the other. Cayley's life was serene; Sylvester, as he himself bitterly remarks, spent much of his spirit and energy "fighting the world." Sylvester's thought was at times as turbulent as a millrace; Cayley's was always strong, steady, and unruffled. ... Yet these two became close friends and inspired one another to some of the best work that either of them did. [Bell, 1937, 379]

Review of Sylla's translation of Jacob Bernoulli's Art of Conjecturing, emphasising Bernoulli's success in understanding multiple quantifiers to formulate and prove a law of large numbers.Â The Art of Conjecturing, together with Letter to a Friend on Sets in Court Tennis. Translated by, Edith Dudley Sylla. [Book Review]. James Franklin. Isis 101 (1):213-214 (2010). Authors. James Franklin. Ars Conjectandi (Latin for "The Art of Conjecturing") is a book on combinatorics and mathematical probability written by Jacob Bernoulli and published in 1713, eight years after his death, by his nephew, Niklaus Bernoulli. The seminal work consolidated, apart from many combinatorial topics, many central ideas in probability theory, such as the very first version of the law of large numbers: indeed, it is widely regarded as the founding work of that subject. It also addressed problems that today are In 1684, Jacob Bernoulli married Judith Stupanus ; together they had tow children, a son, named after Jacob's father, Nicolaus, and daughter. In 1676 Bernoulli moved to Geneva where he worked as a tutor. Bernoulli moved back to Switzerland in 1687 and was appointed the professor of mathematics at the University in Basil. Jacob Bernoulli's Mathematical Contributions.Â Bernoulli, Jakob, and Edith Dudley Sylla. The art of conjecturing, together with Letter to a friend on sets in court tennis. Baltimore, Md.: Johns Hopkins University Press, 2006. by Jakob Bernoulli. 0 Ratings. 2 Want to read. 0 Currently reading. 0 Have read. This edition was published in 2006 by Johns Hopkins University Press in Baltimore. Written in English.Â Edition Notes. Includes bibliographical references and index. Genre. Early works to 1800. Classifications. Dewey Decimal Class. Jacob conceived to write about the art of conjecturing in 1685. His first published evidence of this interest is in the Journal des Scavans for August 26, 1685 where he presents a problem concerning the throwing of dice and proposes the question as to the ratios of their lot. There is also evidence of his interest in probability found in his research journal Meditationes, and from letters that he wrote; among them Letter to a friend on sets in court tennis, which is included at the end of the book The Art of Conjecturing. In fact, in one of his public disputations given in competition for prof