A Short History of Probability

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French Society in the 1650’s

- Gambling was popular and fashionable
- Not restricted by law
- As the games became more complicated and the stakes became larger there was a need for mathematical methods for computing chances.
Enter the Mathematicians

- A well-known gambler, the chevalier De Mere consulted Blaise Pascal in Paris about a some questions about some games of chance.
- Pascal began to correspond with his friend Pierre Fermat about these problems.
Classical Probability

- The correspondence between Pascal and Fermat is the origin of the mathematical study of probability.
- The method they developed is now called the classical approach to computing probabilities.
- The method: Suppose a game has $n$ equally likely outcomes, of which $m$ outcomes correspond to winning. Then the probability of winning is $m/n$. 
Problems with the Classical Method

- The classical method requires a game to be broken down into equally likely outcomes.
  - It is not always possible to do this.
  - It is not always clear when possibilities are equally likely.
Experience

- Another method, known as the frequency method had also been used for some time.
- This method consists of repeating a game a large number of times under the same conditions. The probability of winning is then approximately equal to the proportion of wins in the repeats.
- This method was used by Pascal and Fermat to verify results obtained by the classical method.
Early Generalizations

James Bernoulli proved that the frequency method and the classical method are consistent with one another in his book *Ars Conjectandi* in 1713.
Early Generalizations

- Abraham De Moivre provided many tools to make the classical method more useful, including the multiplication rule, in his book *The Doctrine of Chances* in 1718.
- The book was popular, eventually going through three editions.
From Games to Science

Throughout the 18th century, the application of probability moved from games of chance to scientific problems:

- Mathematical theory of life insurance - life tables.
- Biological problems - what is the probability of being born female or male?
Pierre-Simon Laplace presented a mathematical theory of probability with an emphasis on scientific applications in his 1812 book *Theorie Analytique des Probabilities*.

Unfortunately, Laplace only considered the classical method, leaving no indication on how the method was to be applied to general problems.
Stagnation the Frustration

- After the publication of Laplace’s book, the mathematical development of probability stagnated for many years.

- By 1850, many mathematicians found the classical method to be unrealistic for general use and were attempting to redefine probability in terms of the frequency method.

- These attempts were never fully accepted and the stagnation continued.
Axiomatic Development

- Andrey Kolmogorov developed the first rigorous approach to probability in his 1933 monograph Grundbegriffe der Wahrscheinlichkeitsrechnun.

- He built up probability theory from fundamental axioms in a way comparable with Euclid's treatment of geometry.
Probability Today

- Modern research in probability theory is closely related to the mathematical field of measure theory.

- Modern innovators in the field include Patrick Billingsley (University of Chicago), Yuan Shih Chow (Columbia), Kai Lai Chung (Stanford), Samuel Karlin (Stanford), Rolf-Dieter Reiss, Sheldon Ross (Berkeley), Henry Teicher (Rutgers) and many many more…