دانشگاه صنعتی اصفهان
دانشکده علوم ریاضی

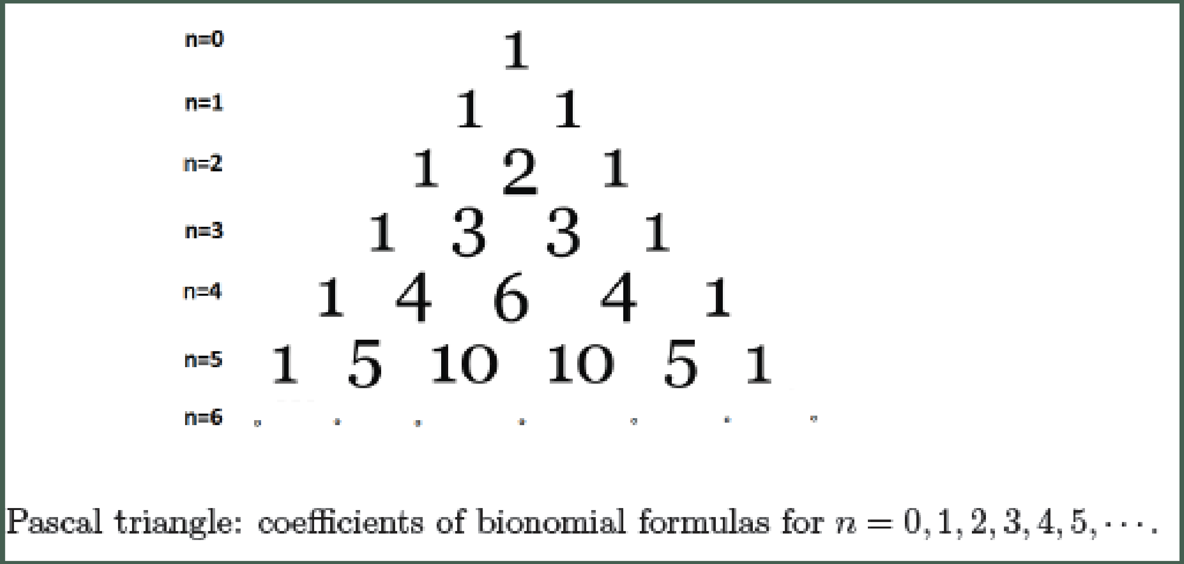
داستان احتمال

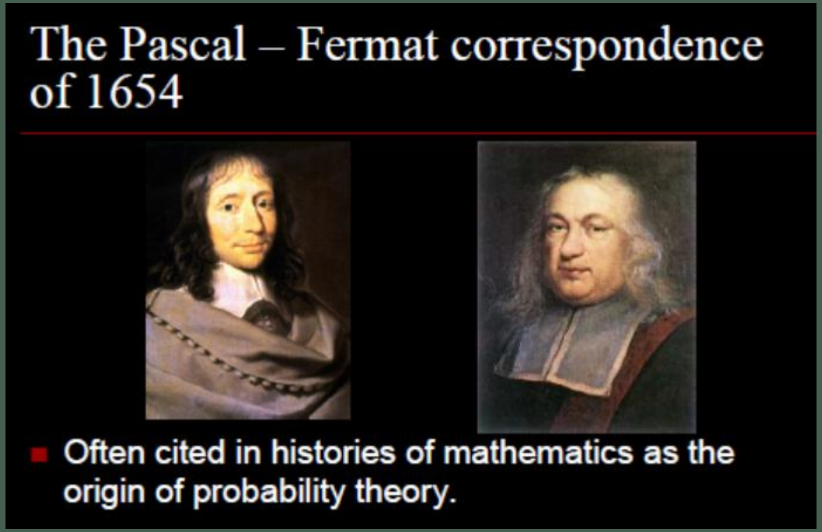
البته که تصادف بخشی از تجربه انسانی برای مدت زمان طولانی بوده است، اما مدل‌بندی ریاضی و تحلیل رویدادهای تصادفی به عنوان یک رشته علمی نسبتاً جدید است.

در جوامع ابتدایی، شانس به‌عنوان نیرویی برابرکننده تلقی می‌شد که به هیچ‌کس یا هیچ چیزی برتری نمی‌داد. از این رو، آن‌ها از ابزارهای تصادفی مانند چرخنده‌ها، تاس‌ها، سکه‌ها و بازی‌ها برای دخالت‌های ماوراءالطبیعه استفاده می‌کردند — برای تضمین انصاف، جلوگیری از درگیری یا درخواست راهنمایی الهی.

Probability is the most important concept in modern science, especially as nobody has the slightest notion what it means. – Attributed to Bertrand Russell

پیر دو فرما (۱۶۰۱-۱۶۶۵)





- **Geronimo Cardano (1501-1576)**

کاردانو

- **Blaise Pascal (1623-1662)**

پاسکال

- **Pierre de Fermat (1601-1665)**

فرما

- **Christian Huygens (1629-1695),** The father of the theory of probability

هویگنس

Simon-Pierre de Laplace in the 19th century indicated that "Probability theory is nothing but common sense reduced to calculation."

Huygens introduced the definition of probability of an event as a quotient of favorable cases by all possible cases. He also reintroduced the concept of mathematical expectation (or mean) and elaborated Cardano’s idea of expected value (or mean) of random variables.

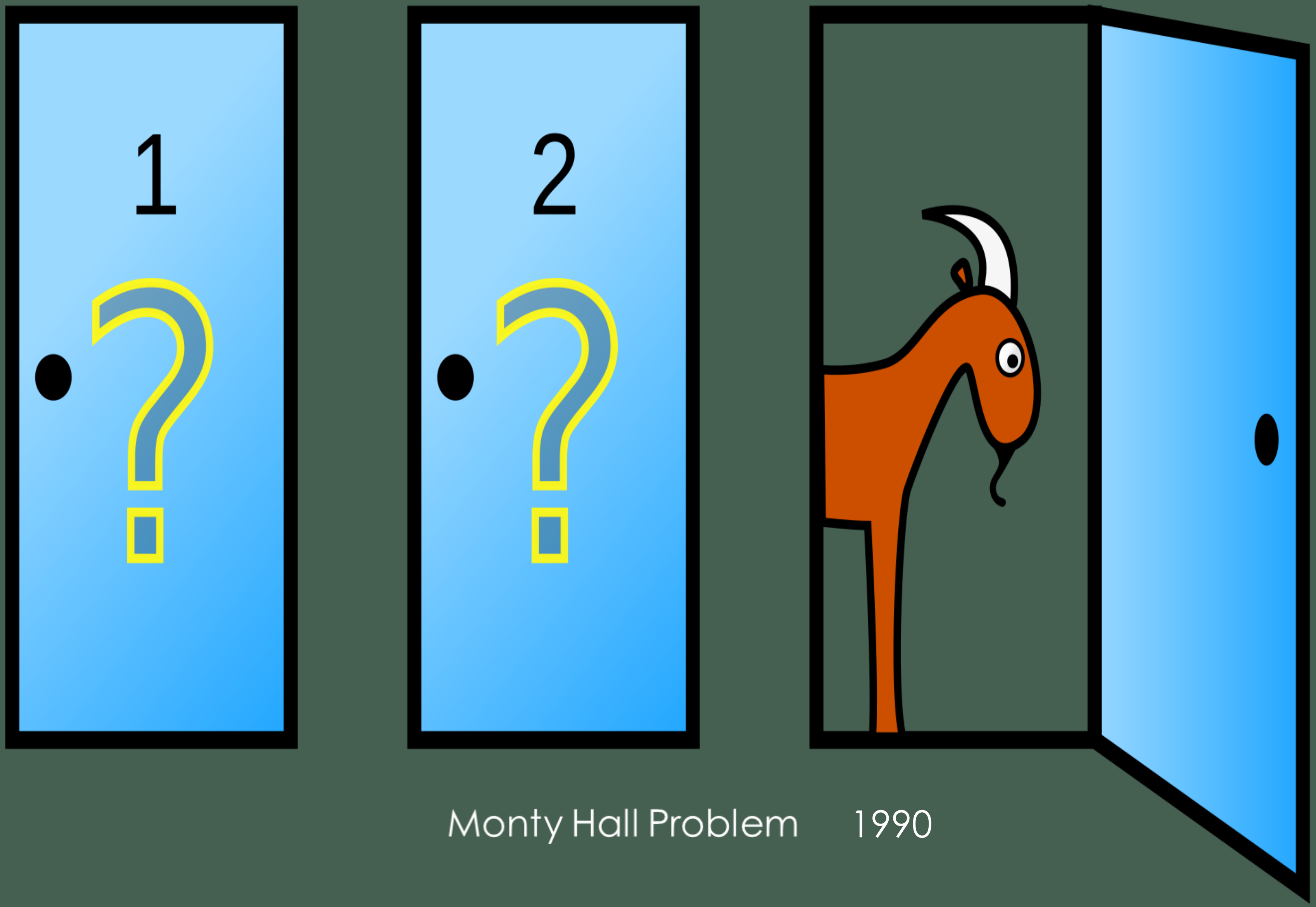
Though I would like to believe, that if someone studies these things a little more closely, then he will almost certainly come to the conclusion that it is not just a game which has been treated here, but that the principles and the Foundations are laid of a very nice and very deep speculation. -

HUYGENS. 1657

Randomness

The applied mathematician Simon-Pierre de Laplace in the 19th century indicated that “Probability theory is nothing but common sense reduced to calculation."

Tversky and Kahneman



Monty Hall Problem 1990

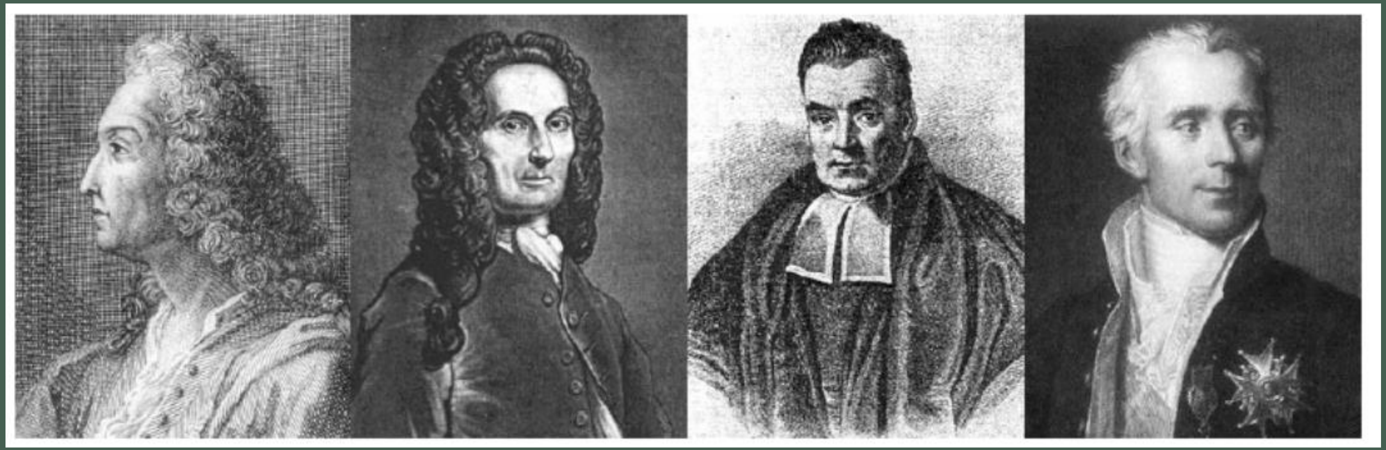
- **Jakob Bernoulli (1654-1705)** "The Art of Conjecturing"

It would be useful, accordingly, if definite limits for moral certainty were established by the authority of the magistracy. For instance, it might be determined whether 99/100 of certainty suffices or whether 999/1000 is required. Then a judge would not be able to favor one side, but would have a reference point to keep in mind in pronouncing a judgment

To conjecture about something is to measure its probability. The Art of Conjecturing or the Stochastic Art is therefore defined as the art of measuring as exactly as possible the probabilities of things so that in our judgments and actions we can always choose or follow that which seems to be better, more satisfactory, safer and more considered. In this alone consists all the wisdom of the Philosopher and the prudence of the Statesman. **--JAKOB BERNOULLI, 1713**

- **Abraham de Moivre (1667-1754),** *The Doctrine of Chance,* Miscellanea Analytica

... probability owes more to de Moivre than any other mathematician, with the single exception of Laplace.



- **Jakob Bernoulli (1654-1705)** "The Art of Conjecturing" برنولی
- **Abraham de Moivre (1667-1754),** *The Doctrine of Chance*, Miscellanea Analytica دموآور
- **Pierre-Simon de Laplace (1749-1827)** Analytic Theory of Probability لاپلاس
- **Carl Friedrich Gauss (1777-1855)** —the Prince of Mathematics گوس

De Moiver: The approximation to the binomial distribution by the normal distribution in case of a large number of trials.

Georg Polya: .. the appearance of the Gaussian probability density can be explained by the same limit theorem which plays a central role in probability theory.

$$B(r;n,p) = \binom{n}{r} p^r q^{n-r},$$

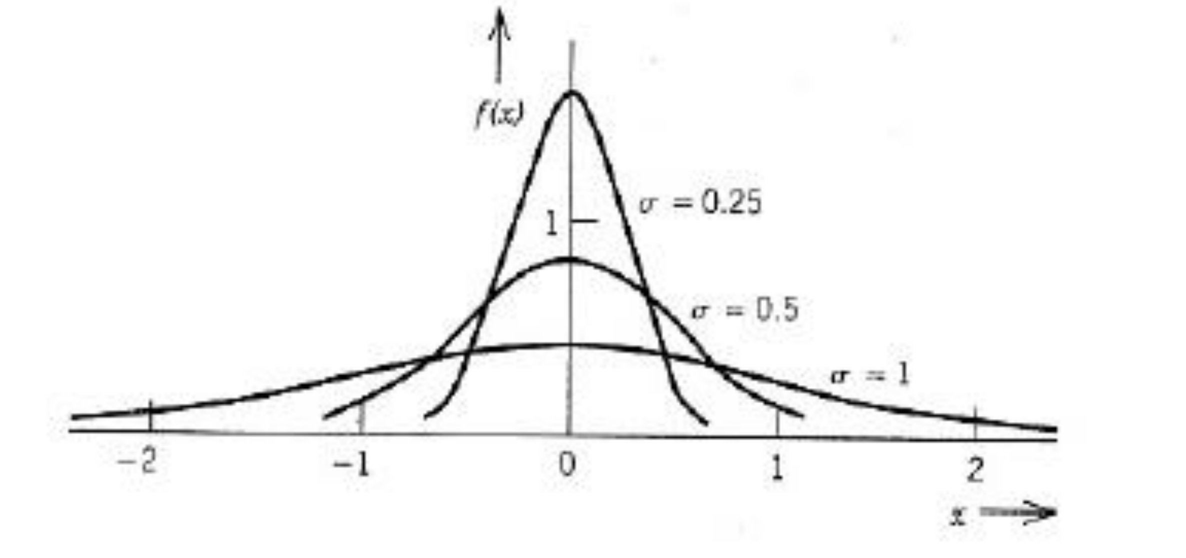
$$n! \sim \sqrt{2\pi n}\, n^{n+\frac{1}{2}} e^{-n} \left(1 + \frac{1}{12}\right)$$

$$r = np + x \text{ and } n - r = nq - x$$

$$\log B = \log n! + (np+x)\log p + (nq-x)\log q - \log(np+x)! - \log(nq-x)!$$
$$= -\frac{1}{2}\log(2\pi nq) - \frac{1}{2n}\left(\frac{x^2 + x(1-2p)}{pq}\right).$$

$$B \approx \frac{1}{\sqrt{2\pi npq}} \exp\left[-\frac{1}{2n}\left\{\frac{x^2 + x(1-2p)}{pq}\right\}\right].$$

$$B(x) = \frac{1}{\sqrt{2\pi npq}} \exp\left(-\frac{x^2}{2npq}\right) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{x^2}{2\sigma^2}\right),$$



- **Andrey Nikolaevich Kolmogorov (1903-1987), Foundations of the Theory of Probability** کلموگروف

- **Norbert Wiener (1894 -1964)** وینر

- **Claude Elwood Shannon (1916 -2001)** شانون

References:

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- Debnath L. and Basu K., (2015) A Short History of Probability Theory and Its Applications, International Journal of Mathematical Education In Science & Technology , DOI: 10.1080/0020739X.2014.936975.
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- Wolfgang Schwarz, (2018) No Interpretation of Probability, Erkenn, 83:1195–1212, DOI: 10.1007/s10670-017-9936-9.