

The history of 'probability'

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Probability

probability [from *probable*]

The quality or fact of being probable; the appearance of truth, or likelihood of being realized, which any statement or event bears in the light of present evidence.

1736 (Butler) *Probability is the very Guide of Life.*

probable [from Latin *probabilis* that may be proved; from *probare* to try, test, approve, make good; from *probus* good]

1 Capable of being proved; demonstrable, provable. 1548 (Hall) *It is probable by an inuincible reason and an argument infallible.*

2 Worthy of acceptance or belief. 1593 (Shakespeare) *It cannot be but he was murdered heere, The least of all these signes were probable.*

3 Having an appearance of truth. 1606 (Shakespeare) *Most probable That so she dyed.*

4 Likely to be; relating to or indicating probability. 1736 (Butler) *Probable Evidence is essentially distinguished from demonstrative by this, that it admits of Degrees.*

Bayesian v. Frequentist

A coin is tossed 1000 times, yielding 800 heads and 200 tails. Let $p = \mathbb{P}(\text{heads})$ be the bias of the coin. What is p ?

Bayesian

- Represent belief about p by a distribution π , say the uniform distribution

$$\pi(p) = 1.$$

- Modify π in the light of the data x :

$$\pi(p|x) \approx p^{800}(1-p)^{200}$$

- This represents our new beliefs about the system

Frequentist

- Let p be fixed and unknown
- Find a *random* estimator $\hat{p} = 0.8$ and a *random* confidence interval $C \approx (0.774, 0.826)$ such that

$$\mathbb{P}(C \text{ contains } p) = 95\%$$

Probability and Etymology

The idea of probability is subtle and confusing — statisticians cannot even agree what it is.

The idea of probability is also surprisingly *modern*. The ancients could not even frame the concept — they lacked the words to do so.

Let us therefore investigate the history of words for probability. This will teach us about the history of the *idea*.

Stochastic

stochastic [from Greek *στοχαστικός*, from *στοχαζεσθαι* to aim at a mark or target, from *στοχος* an aim or guess]

1 Pertaining to conjecture. 1662 (J. Owen)
But yet there wanted not some beams of light to guide men in the exercise of their Stocastick faculty.

2 Randomly determined; that follows some random pattern, so that its behaviour may be analysed statistically but not predicted precisely.

Random

random [from Old French *randir* to run fast, gallop]

1 Not sent or guided in a special direction; having no definite aim or purpose; impetuous. 1655 (Fuller) *In vain do staid heads make serious comments on light mens random expressions.* 1827 (Roberts) *The random and ill-directed fire of the Spaniards*

2 Of movements etc.: seeming to be without purpose or direct relationship to a stimulus, giving way to directed action as learning takes place.

3 Governed by or involving equal chances for each of the actual or hypothetical members of a population (therefore completely unpredictable in detail)

Aleatory

aleatory [from Latin *aleatorius*, from *aleator* a dice player, from *alea* the dice]

Dependent on the throw of a die; hence, dependent on uncertain contingencies. 1693 (Urquhart)

So continually fortunate in that aleatory way of deciding Law Debates. 1879 (Motley)

Such an aleatory process seemed an unworthy method in arbitrations.

Hazard

hazard [A type of dice game. According to William of Tyre, the game took its name from a castle called *Hasart* or *Asart* in Palestine, during the siege of which it was invented. The true Arab name of this castle appears to have been *Ain Zarba*]

1 A game at dice in which the chances are complicated by a number of arbitrary rules. 1380 (Wyclif) *Thei fallen to nyse pleies, at tables, chees and hasard.*

2 A chance or venture. 1594 (Shakespeare) *Slaue, I haue set my life vpon a cast, And I will stand the hazard of the Dye.*

3 Risk of loss or harm.

4 **at hazard** by chance, fortuitously, without design or plan. 1640 (Sedgwicke) *He did let and suffer his spirituall estate to run on at hazards.*

Haphazard

haphazard [from Old Norse *happ* chance, good luck, fortune, fate, +HAZARD. Literally 'hazard of chance']

Mere chance or accident; fortuity; without design. 1576 (Fleming) *Happe hasarde it is, if you be not prest out for a souldier.*

Chance

chance [from late Latin *cadentia* falling, from Latin *cadere* to fall]

1 The falling out or happening of events; the way in which things fall out. 1528 (More) *As he would haue made ye contrary choyse, if he had foresene in them the contrary chaunce.*

2 A happening or occurrence of things in a particular way; a casual or fortuitous circumstance. 1375 (Barbour) *Fesnyng of frendschip and of pess, That neur for na chanss suld cess.*

3 A possibility or probability of anything happening: as distinct from a certainty.

Summary

Words associated with probability derive from Latin, Greek, French, Norse, Arabic. Their meanings relate to

- lack of direction (random)
- aiming in a given direction (stochastic);

- the most obvious outcome (probable);
- arbitrary outcomes, as in dice (aleatory, hazard)

- good fortune (hap)
- indifferent fortune (chance)
- bad fortune (hazard).

References

The Oxford English Dictionary, 2nd edition.

The Emergence of Probability. Ian Hacking, CUP (1984).