

CYBERSECURITY FIRST PRINCIPLES

A REBOOT OF STRATEGY & TACTICS

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Bayes Success Stories (Summarized from Sharon McGrayne's Book: "The Theory that Would Not Die")

Mathematician **Joseph Louis François Bertrand** reformed Bayes' thesis for artillery trajectory tables that had to consider a host of uncertainties: enemy location; air density; wind direction; cannon types, and projectile variations. For the next 60 years, between the 1880s and the Second World War, French and Russian artillery officers fired their weapons according to Bertrand's textbook.

French **General Jean Baptiste Eugène Estienne** created Bayesian tables to efficiently test scarce ammunition during WWI.

In the United States between 1911 and 1920, all but eight states passed laws protecting workers against occupational injuries and illness. **Albert Wurts Whitney**, a specialist in insurance mathematics from Berkeley, used Bayes to set the first casualty fire and workers' compensation insurance premiums where no actuary data existed yet.

Edward C. Molina, an AT&T engineer, used Bayes to redesign the collapsing Bell Telephone system in 1907.

Harold Jeffreys, between the 1930s and 1940s, used Bayes to forecast earthquake epicenters combining inaccurate seismic readings (like Bayes' billiard table)

French mathematician and physicist, **Henri Poincaré**, used Bayes' thesis to refute some quackery statistics from Alphonse Bertillon, a police criminologist, on the conviction of French Jew Alfred Dreyfus in 1894 falsely accused and imprisoned for being a German spy. [Note from my editor John Petrik: Bertillon was quacky, and he was mainstream enough in the 1930s and 1940s that Batman used to consult the Gotham PD's "Bertillion Files."]

In 1925, **Egon Pearson** published an exploration of Bayesian methods using priors for a series of whimsical experiments calculating: the fraction of London taxi cabs with LX license plates, men smoking pipes on Euston Road, horse-drawn vehicles on Gower Street, chestnut colts born to bay mares, and hounds with fawn-spotted coats.

In 1936, **Lowell J. Reed**, a medical researcher at Johns Hopkins University, used Bayes to determine the X-ray dosages that would kill cancerous tumors but leave patients unharmed when no precise exposure records existed.

Alan Turing developed Bayes to break Enigma during WWII.

During WWII, mathematician **Bernard Osgood Koopman** of Columbia University used Bayes to find German u-boats.

In the 1950s, **US Department of Defense researchers** used Bayes to predict the reliability of the new intercontinental ballistic missiles.

In 1958, **Albert Madansky**, working for the Rand Corporation, used Bayes to predict the likelihood of a “conspicuous” atomic bomb accident was rising, and it was in the military’s interest to make its nuclear arsenal safer. The impact was that General Curtis LeMay and President John Kennedy ordered significant upgrades to nuclear arsenal safety procedures to include two-man control.

In 1962 **Jerome Cornfield** used Bayes to identify the most critical risk factors for cardiovascular disease that resulted in the drop of fatalities between 1960 and 1996 by 60% (621,000 fatalities).

In 1964, the **U.S. surgeon general** concluded that “cigarette smoking is causally related to lung cancer in men,” citing the Bayesian studies of Jerome Cornfield.

In 1964, **Frederick Mosteller** of Harvard University and David Wallace, from the University of Chicago, used Bayes to prove that James Madison wrote 12 of the previously unattributed 85 Federalist Papers instead of Alexander Hamilton.

Late 1960s, Coast Guard rescue coordinator **Joseph Discenza** used Bayes to find lost ships.

1974, **Norman Carl Rasmussen** used Bayes to predict that the probability of core damage to nuclear commercial power was higher than expected, but the consequences would not always be catastrophic presciently two months before the three-mile island accident.

In 1983, A U.S. Air Force contractor (**Teledyne Energy Systems**) used Bayes to analyze the risk of a Challenger space shuttle accident and predicted the probability of a rocket booster failure at 1 in 35. On January 28, 1986, during the shuttle’s twenty-fifth launch, the Challenger exploded, killing all seven crew members aboard.

In 1996 **Bill Gates**, cofounder of Microsoft, announced that Microsoft’s competitive advantage lay in its expertise in Bayesian networks.

Susan Holmes and **Daphne Koller**, both of Stanford University, use Bayes to crack the genetic code on amino acids.