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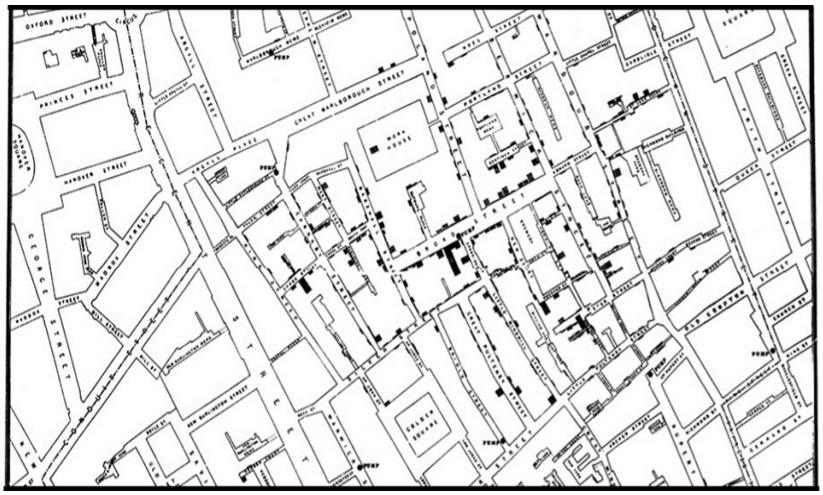


Cognitive Dissonance

Surgery is painful, which is why humans have experimented with various forms of anesthesia for millennia. Herbal remedies and alcohol were probably used in pre-history, opium was cultivated by the Sumerians 4,500 years ago, and Peruvians were chewing on coca leaves 8,000 years ago (their use was probably not limited to anesthesia).[2]

Ether[3] was a recreational drug in the early 19th century until Crawford Long, a surgeon in rural Georgia, used it as an anesthesia in 1842. Unfortunately, he didn't publish his work till 1849, so when dentist William Thomas Green Morton gave a demonstration at Massachusetts General Hospital in October 1846, it was the first public recognition of ether's value as an anesthetic. The following year, Scottish obstetrician James Young Simpson was the first to use chloroform[4] as an anesthesia, and soon both ether and chloroform became the preferred anesthetics. However, both compounds are volatile and hazardous, requiring great care in administering: ether is highly inflammable and chloroform disables the central nervous system. Those first surgeons could only guess at dosage, and most patients either woke up in the middle of surgery (too little) or never woke up at all (too much).

1 Map of cholera cases in Soho, London, 1854. Source: Wikimedia Commons.

2 Chinese legend has Bian Que (扁鹊) using anesthesia to perform a double heart transplant 2500 years ago. Who knows?

3 Diethyl ether is an organic compound with the formula $(C_2H_5)_2O$.

4 Trichloromethane, and organic compound with the formula $CHCl_3$.

John Snow was the oldest of nine children born to a coal worker in York, England in 1813. He was unusually quick with numbers, and at the age of 14 was apprenticed to a surgeon in Newcastle. He became a surgeon on his own in 1838 and set up practice in London.[5]

He witnessed the first demonstrations of anesthesia in England, not all successfully administered, and set out to understand the properties of both ether and chloroform. He discovered that ether dosage could be controlled by temperature, and Snow designed and built equipment to deliver ether safely by regulating its heat. He also devised a safety mask to regulate the inhalation of chloroform. He published his studies, experiments and equipment in *The Lancet*, then and now, one of the preeminent medical journals in the world. He soon became the most prominent anesthesiologist in England. The use of anesthesia was seen as unethical by the Church of England, and many physicians counseled against its use because of its dangers. But Queen Victoria overruled the Church[6] and her physicians, and requested that John Snow give her chloroform during the birth of her eighth child.[7] The Queen survived (of course), and said she was quite pleased with the experience.

John Snow did more to advance the widespread adoption of anesthesia than any single person. His meticulous, detailed studies of how to regulate the conditions and amounts of anesthesia were the first of their kind, and both his manuals on usage and his specialized equipment were soon adopted by physicians everywhere. Snow did not seek any patents for his work, he simply wanted to see anesthesia used safely. Anyone who has undergone surgery in the past 150 years has John Snow to thank.

John Snow's contribution to anesthesiology, as important as it was, is not how he is remembered. It was his work as the founder of modern epidemiology, during one of the worst public health crises in England's history, that he is celebrated today. During his lifetime, his prominence in anesthesiology was acknowledged and heralded, whereas his contribution to epidemiology was ridiculed, ignored and dismissed. His work would eventually prevent the deaths of millions of people, and that work serves as a guide to us as we navigate our own crises, public or private, health or otherwise.

Cognitive biases were first studied fifty years ago by Israeli psychologists Amos Tversky and Daniel Kahneman as they examined how decisions diverge from rational optimization. Rational choice theory holds that all decisions are made through a cost-benefit analysis and the optimal course of action is chosen. Tversky and Kahneman recognized that certain psychological traits led to inherent biases that inhibited acting through rational optimization.

One such trait is cognitive dissonance, when contradictory ideas or beliefs are held simultaneously, causing psychological discomfort or stress. The experience is untenable, and the contradiction needs to be resolved, the stress relieved, in one of two ways: rationalization or denial.[8] Rationalization occurs either by reframing the cognition ("this doughnut is not on my diet but it's okay to cheat occasionally") or by justifying the cognition ("I'll exercise longer to offset eating this doughnut").

[5] Back then, surgeons ranked just above apothecaries in the medical profession. Physician was the ultimate rank, and after additional study at the University of London, Snow was admitted to the Royal College of Physicians in 1850.

[6] She was the head of it, after all.

[7] Prince Leopold, in 1853. He sadly died of hemophilia in 1884.

[8] There is a third option, acknowledgement of the contradiction and resolving it through rational analysis. This rarely happens.

The second way a contradiction can be resolved is denial ("this doughnut isn't really that bad").[9] Tversky and Kahneman categorized numerous cognitive biases, but the one they identified as related to cognitive dissonance they called *confirmation bias*, interpreting, or seeking, information that conforms with preconceived beliefs.

Tversky and Kahneman were the first to study these biases systematically, but hardly the first to observe them. Thucydides noted 2500 years ago, "it is a habit of mankind to entrust to careless hope what they long for, and to use sovereign reason to thrust aside what they do not fancy."[10] Tolstoy perhaps said it most clearly when he wrote,

"I know that most men—not only those considered clever, but even those who are very clever, and capable of understanding most difficult scientific, mathematical, or philosophic problems—can very seldom discern even the simplest and most obvious truth if it be such as to oblige them to admit the falsity of conclusions they have formed, perhaps with much difficulty—conclusions of which they are proud, which they have taught to others, and on which they have built their lives."[11]

Confirmation bias is not limited to the nattering nabobs of Fox News or MSNBC (depending on your perspective); we see evidence abound in investing. In a 1993 paper,[12] Gene Fama and Ken French demonstrated certain historical "anomalies" wherein cheap ("value") stocks[13] outperformed expensive ("growth") stocks. They also found that small capitalization stocks outperformed large capitalization stocks. This research led to an entire institutional investment industry adopting value and small cap tilts in their portfolios. Nearly thirty years later, these biases are still present in many portfolios despite not working for years.

Value trailed Growth meaningfully in the late 1990s, but that was the Internet bubble, and when it popped in 2000, Value saw significant outperformance over Growth through 2007. It's been all downhill for Value since then (Chart 1). Perhaps this Value rebound that began at the end of 2020 is the start of a new multi-year upcycle for Value. We'll see.

Chart 1 **MSCI World Value vs. Growth Index, Ratio, 1997-2021, Monthly**

Source: Bloomberg, L.P.

[9] Sorry to pick on doughnuts.
[10] *The Peloponnesian War* .
[11] *What is Art?*, 1897.
[12] Fama, Eugene F.; French, Kenneth R. (1993). "Common Risk Factors in the Returns on Stocks and Bonds". Journal of Financial Economics. 33 (1): 3–56.
[13] Defined as stocks with high Book/Market ratios.

Chart 2 Russel 2000 vs. S&P 500 Index, Ratio, 1979-2021, Monthly

Source: Bloomberg, L.P.

Chart 3 MSCI US vs. World ex-US Index, Ration, 1988-2021, Monthly

Source: Bloomberg, L.P.

Small cap stocks outperformed large cap stocks in the 1970s, underperformed in the 1980s, rebounded, but then faltered in the 1990s, saw strong outperformance in the 2000s and fell dramatically over the past four years, only to rebound sharply in the past four months (Chart 2).

Likewise, most investors exhibit "home bias" in portfolios,[14] whereby investors hold the vast majority of their assets in their home country. This works out well if your home country outperforms, as it has for US investors for the past decade. The opposite was the case in the previous decade, though, but it was flipped before that (Chart 3). What the future holds in unknown.

[14] First documented by Grubel, Herbert G., 1968, *Internationally diversified portfolios*, American Economic Review 58, 1299-1314.

Confirmation bias leads investors to believe that value stocks *should* outperform growth stocks, that small cap stocks *should* outperform large cap ones, and investors *should* always have more assets in their home country than invested globally. As these charts show, none of this is true. Yet investor behavior is slow to adapt to the facts when those facts contradict long-held beliefs.

Miasma is the ancient Greek word for pollution. The famous physician, Hippocrates,[15] advance the theory that miasma, or bad air, was the cause of many diseases. This makes sense, as the odor of rotting sewage, garbage or flesh is repugnant. For more than 2,000 years, the miasma theory of disease, whereby diseases spread through the bad air, was widely accepted. More than accepted; it was a deeply entrenched "fact" in the medical community.

Hamburg, Germany saw an outbreak of cholera in 1848. A ship from Hamburg docked in London and a sailor carrying the disease disembarked and took a room in a boardinghouse. Two days later he was dead. Another sailor rented that same room the next day, and he, too, soon died of cholera. The next victims lived a few doors down, and over the following year, 50,000 people in London died of cholera.

Everyone assumed the disease spread through the air, but John Snow noted that the third and fourth victims had never come in contact with the first two sailors. He also noticed that the people who lived in the Thomas Street flats all shared the same well water and most died, but those next door in the Truscott's Court flats used a different well and no one died. In the midst of the epidemic, he publicly announced that it was contaminated water that spread the disease, not bad air. His warning was ignored, and no remedy was taken.

In fact, the opposite occurred. Edwin Chadwick, the most prominent public health official in London, considered to be the founder of public health policy, sought to clear the air of foul odors that spread disease and ordered sewers to be built that would drain the cesspools along the streets of London into the Thames. He may have cleared the air, but he fouled the drinking water. This first act of public health would later be the source of the next epidemic of cholera.

Soho, at the time, was the densest part of London with 432 people per acre.[16] On 28 August 1854, the six-month old daughter[17] of Thomas and Sarah Lewis fell ill, vomiting and excreting green stools. Sarah washed her diapers in a bucket and tossed the dirty water outside her flat in the cesspool than ran along Broad Street. Cholera quickly spread in the densely-packed Soho, killing hundreds within a few days.

Cholera is a bacterium, *Vibrio Cholerae*. It must be ingested into the small intestines where it injects a toxin into the intestinal cells that disrupts the regulation of water in the body. The small intestines absorb more water than is secreted, but the toxin reverses this, resulting in the expulsion of water from the body, as much as 30% of body weight in a matter of hours. This causes a reduction in blood flow volume, requiring the heart to pump faster to maintain blood pressure. Kidneys soon fail and waste accumulates in the blood (uremia). All vital organs shut down. In essence, the victim dies of dehydration.

[15] The "father of medicine," he of the Hippocratic oath, lived in the fourth century BCE.

[16] By contrast, Manhattan today has around 100 people per acre.

[17] She had not yet been baptized with a name.

Snow took meticulous notes on every death in Soho, plotting them on a map. He noticed that the homes supplied by the Southwark and Vauxhall Waterworks Company, which took water from the sewage-polluted section of the Thames, had fourteen times the death rate of homes supplied by the Lambeth Waterworks Company, which drew water from the Thames upstream from the sewage discharge. He noted further that the Broad Street pump was the likely source of the polluted water, tracing deaths to those who drew their water from that pump, whereas those who obtained water from a different source, even those who lived near the Broad Street pump, were not infected.

Local officials were at a loss what to do about the outbreak when Snow recommended the handle be removed from the Broad Street pump. Officials were skeptical, but had no other options. Seven hundred people had been killed within 250 yards of the Broad Street pump, and so officials ordered the handle removed. The outbreak stopped. This was the first act of public health based on science. It would not be repeated soon.

After this cholera outbreak, Parliament established a Cholera Commission to investigate the cause of the epidemic. Snow presented his detailed notes and compelling evidence, but his data were rejected in favor of the long-established miasma theory. John Snow died in 1858, discredited. His obituary in *The Lancet* was short: "Dr John Snow: This well-known physician died at noon, on the 16th instant, at his house in Sackville Street, from an attack of apoplexy. His researches on chloroform and other anaesthetics were appreciated by the profession."

Another cholera outbreak occurred in London in 1866. Still at a loss how to stop it, the medical profession reexamined Snow's data and concluded he might be right. They ordered residents not to drink their water. The outbreak ended. Snow was finally vindicated.

Source: https://www.ph.ucla.edu/epi/snow/snowpub.html

A pub is the only business remaining on Broad Street[18] that was there in 1854. It has been renamed *The John Snow*, and it is the venue for the annual Pumphandle Lecture by a leading public health official. *The Lancet* eventually got around (in 2013) to apologize for its original obituary:

"*The Lancet* wishes to correct, after an unduly prolonged period of reflection, an impression that it may have given in its obituary of Dr. John Snow on June 26, 1858.

[18] Now called Broadwick Street .

The journal accepts that some readers may wrongly have inferred that *The Lancet* failed to recognise Dr Snow's remarkable achievements in the field of epidemiology and, in particular, his visionary work in deducing the mode of transmission of epidemic cholera.

Even allowing for *Lancet* founding Editor Thomas Wakley's surprising contempt for Snow, the obituary was extraordinary in its brevity and its failure even to mention cholera."

https://www.ph.ucla.edu/epi/snow/snowpub.html

Better late than never.

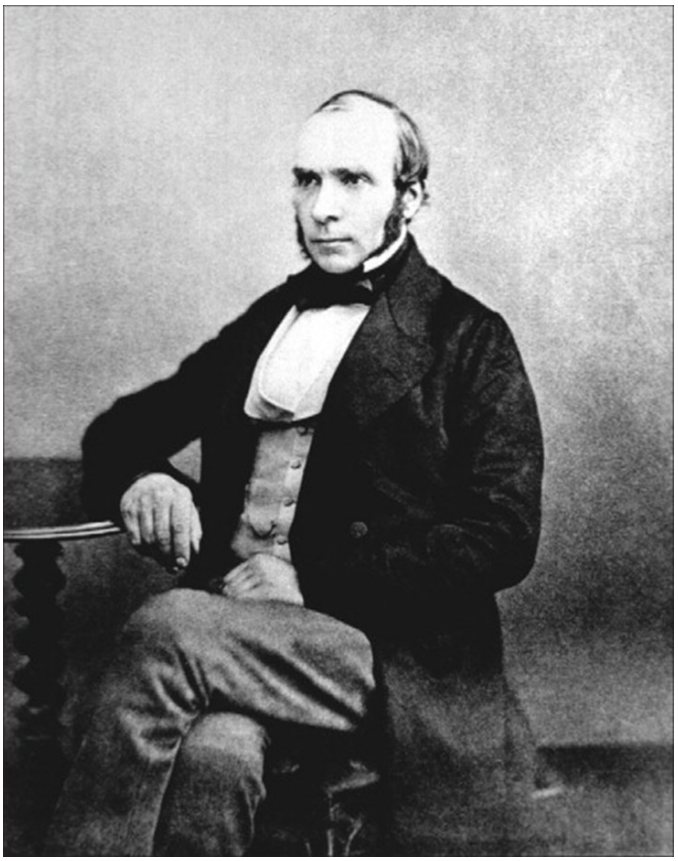
The cure for cholera is quite simple: rehydration. Drink enough clean water and the disease disappears.[19] Still, the World Health Organization estimates there are up to four million cases of cholera each year, with more than 100,000 deaths annually. Tuberculosis has killed approximately one billion people over the past two centuries, and as much as one-third of the world population is infected with the disease.[20] There are ten million new cases each year, and nearly two million deaths. Malaria inflects 229 million people each year and kills half a million. A form of encephalitis[21] spread around the world between 1915 and 1926, responsible for a million deaths. HIV leads to AIDS and has taken 700,000 lives since the early 1980s. Influenza A killed 50-100 million people in 1918-19, and its variants killed more than a million people in 1957 and between one and four million people in 1968.[22] Influenza kills 250,000 people annually outside these epidemic outbreaks.

There is no vaccine for cholera, tuberculosis, malaria, encephalitis, HIV or Influenza A. There are treatments with varying degrees of effectiveness. We are fortunate to have vaccines for smallpox and polio, deadly diseases that have been largely eradicated, but these are the exceptions; most transmittable diseases have no cure.

Great progress can be made in limiting the spread of communicable diseases thorough smart public health measures, centered around clean air and water, and with simple precautions, such as netting where malaria is common or condoms to stop the spread of HIV and other sexually transmitted diseases. There is no magic bullet to cure most diseases, but there are effective preventative measures and treatments.

[19] Hospital treatment is simply an I.V. of saline solution and electrolytes.
[20] Nearly all in dormant form, thankfully.
[21] Encephalitis lethargica.
[22] The 1918 virus was H1N1, the 1957 virus H2N2, and the 1968 virus H3N2, all variants of Influenza A.

The life of John Snow connects to the investment world in two ways. First, there is no magic formula for success. Confirmation biases keep many investors mired in the past, clinging to discredited beliefs. Secondly, investment success requires (demands) a curiosity and openness to new facts. John Snow clearly demonstrated how to prevent cholera from spreading, but his data contradicted established beliefs about how the world (at least disease) worked. He died shunned and ignored. But eventually, the facts prevailed, and we recognize John Snow today, not only as the man who most advanced anesthesiology, and as the father of epidemiology, but as the exemplar in the pursuit of the truth, no matter the cost to his reputation or standing in the community.



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