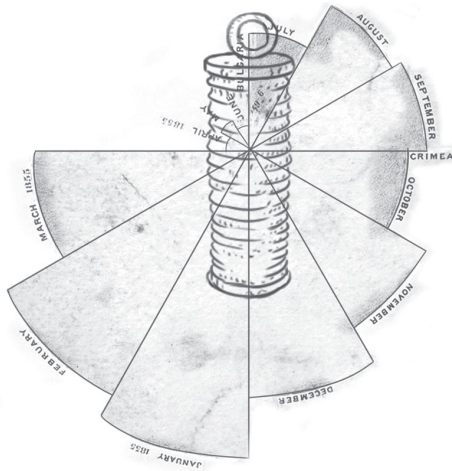


Mathematical Lives

Florence Nightingale

The Lady with the Diagrams



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Prologue

The Lady with the Lamp

It was August 1856, and Great Britain was celebrating victory in the Crimean War. Two and a half years earlier, the British had joined forces with France and the Ottoman Empire (present-day Turkey) against the Russian Empire on the Crimean peninsula. The allies had prevailed, but their triumph had come at a high cost. Britain hadn't fought a large conflict since the defeat of Napoleon Bonaparte in 1815, and military leaders had been unprepared for the changes in warfare since that time. Officers on both sides had made bad decisions that dragged out the struggle and worsened the suffering that people had to endure.

It was also the first major conflict after the invention of the telegraph. For the first time, reporters were able to gather news close to the battlefield and send it back to their home offices in real time, giving their readers more information on what was happening than they'd ever had before. For the first time, readers didn't just hear about the great generals; they also read about the common soldiers, as well as non-soldiers who had other roles in the war effort. When the war ended, the British people weren't interested in the

incompetent officers who had gotten so many of their men killed. Instead, they welcomed an entirely new set of heroes.

On August 17, citizens of Southampton turned out to greet the steamship *Argo* as it pulled into port. They were hoping to catch a glimpse of the war's biggest hero arriving back on their shores. But all they saw was the Russian-made carriage that the hero had used to travel around the war zone—a wooden vehicle with waterproof canvas lining the interior, a full-length canopy on top, and curtains on each side. The hero the people were expecting was nowhere to be found. In fact, that hero had already returned to Britain ten days earlier, slipping in anonymously and, by some accounts, walking the last mile and a half of the journey home.

That hero was Florence Nightingale, the “Lady with the Lamp” who had taken a team of nurses to the main British military hospital in the Ottoman city of Scutari. Before her arrival, infection and disease were killing soldiers in the hospital faster than gunfire killed them on the battlefield. By the end of the war, and despite interference by military leaders who saw her as a meddler, she had transformed the hospital system and had dramatically reduced the death rate. British newspapers were filled with stories from wounded soldiers describing the hope and comfort they felt at seeing Nightingale make her rounds every night, carrying a lamp from bed to bed as she checked on each patient.

The stories of Florence Nightingale's work in Crimea and her revolutionary impact on the nursing profession are well known, but there is another story that most people have not heard. When Nightingale came home, she was determined

to take the lessons she had learned in Crimea and use them to improve hospital care throughout the British Empire. But how could she convince doctors, hospital administrators, and government officials to listen to her? How could she persuade them to put her ideas into practice?

She found her answer in statistics. Nightingale was a skilled mathematician and had enthusiastically followed the work of statistical pioneers and innovators. When the time came to present her ideas for improving hospital care, she drew on that work and took it a step further. Instead of simply writing up tables of numbers, she presented her results graphically, with diagrams that let decision makers understand her results at a glance. Then she took those same diagrams to the general public, who had never seen anything like them.

Today, it is common for governments, businesses, and individuals to use statistics to make decisions and to evaluate their performance. We're used to seeing graphs of all shapes and sizes. But not many people know that the "Lady with the Lamp" was an important pioneer of these techniques. This is her story.

Chapter One

Misfit in an English Lady's World

William Nightingale and his wife Frances—better known as “Fanny”—were on a much-extended honeymoon when their two daughters were born. They had married in London on June 1, 1818, and had set off for the European continent not long thereafter. Traveling across Europe was popular among British citizens with the money to do so. Napoleon Bonaparte had been defeated at the Battle of Waterloo just three years earlier, so it was finally safe to visit Europe’s great cities again.

The Nightingales were traveling throughout Europe for reasons that went beyond a simple desire to tour the Continent. First, they didn’t have a house in England. William had inherited a fortune from his bachelor great-uncle, a man known to his neighbors as “Mad Peter” Nightingale. (One of Peter’s eccentricities was riding in steeplechases—horse races that involve jumping the horses over fences and ditches—in the middle of the night. His will included a requirement that William change his last name to Nightingale—he had been born in 1794 as William Shore.) The inheritance included a manor in Derbyshire County,

but its rundown condition made it unacceptable to Fanny. William would either have to have it repaired or find another home for the family. Meanwhile, just a few months after the wedding, Fanny's father, William Smith, suffered financial ruin when his grocery business collapsed. All in all, England was not someplace where the Nightingales wanted to be.

And so the couple was in Naples, Italy, when their first daughter was born on April 19, 1819, and in Florence, Italy, when their second daughter was born on May 12, 1820. Fanny decided to name both girls after the cities where they had come into the world. She named her older daughter Parthenope, the ancient Greek name for Naples, and her younger daughter Florence. Throughout their childhoods, Parthenope was known as "Parthe" or "Pop," while Florence was known as "Flo."



Florence (seated) and Parthenope as teenagers

In early 1821, the family headed back to England, but it would be several more years before they were settled. William, who considered himself an amateur architect, began enlarging and upgrading the manor house on the property he had inherited, which came to be called Lea Hurst, after the nearby village of Lea. But Fanny thought that Derbyshire was too cold in the winter and too remote for the busy social life she wanted, so in 1825 William bought another house called Embley Park in Hampshire, almost 200 miles to the south and much closer to England's upper-class social circles. Throughout Florence's childhood, she spent summers at Lea Hurst and the rest of each year at Embley Park, except for trips to London in the spring and fall. Embley Park was active and lively, but both Florence and her father preferred the quieter seclusion of Lea Hurst. The villagers of Lea liked them in return, always greeting the family with the local band playing at the entrance to the estate when they arrived for their annual stay.

Her childhood may have been filled with the privileges that came with her family's wealth, but that didn't spare Florence from a string of childhood illnesses. Her first winter in England resulted in the first of many long bronchial infections and sore throats. She later claimed that one illness, at age six, lasted an entire year. As she grew, she developed weakness in her hands and ankles. Learning to write was difficult, and she had to wear steel-lined boots until she was a teenager. Some historians speculate that her condition was the result of lead poisoning from the nearby smelting plant—the same one that provided her family's fortune—but there is no evidence to support that idea.

Florence could be strong-willed and stubborn, often insisting on being the leader when she played with Parthenope or their many cousins. Around new people, though, she could be “shy to misery” and reluctant to engage. From about the age of six or seven, she began to feel as though she was different from the people around her, and she worried that her behavior was somehow wrong. For a time, she refused to eat dinner with any guests who came to visit for fear that she might do something strange with her knife and fork. The feeling that she didn’t fit in began to affect the way she saw the world around her, giving her the sense that life as a woman in the British upper class was not what she wanted.

Fortunately, there were people she did feel comfortable around. She had a large extended family, thanks to her mother’s many brothers and sisters. By the time she was a teenager, she had nearly two dozen aunts and uncles and twenty-seven first cousins. But her favorite relative was William’s only sibling, his younger sister Mary, or “Aunt Mai,” a frequent visitor to Lea Hurst. Fanny didn’t think much of Mai’s fashion sense and remarked that Mai had “an oddness like nobody else,” but Mai and Florence were close nonetheless.

Florence’s relationship with Aunt Mai ran into some trouble in 1827 when Mai became engaged to one of Fanny’s brothers, Samuel Smith. Seven-year-old Florence did not like her Uncle Sam and loudly declared her opposition to the marriage. When the wedding day arrived, she knelt down between the couple at the altar in an attempt to keep them apart. But all was forgiven by 1831 and the birth of Mai’s

second child and only son, William Shore Smith, who was called Shore. On the day he was first placed into Florence's arms, she proclaimed him "my boy Shore" and dedicated herself to his wellbeing. Their relationship would become one of the closest in either of their lives.

During these years, the other important person in Florence's life was her governess, a young woman named Sara Christie. Christie was responsible for the Nightingale girls' education, which amounted to only two to three hours a day in subjects that were considered suitable for future ladies of the upper class. The lessons focused heavily on music—both singing and piano—and art, only touching on other subjects, primarily as they related to the Bible or religion. The girls were not given any formal mathematics lessons.

As the sisters grew up, it was increasingly clear that they had quite different personalities. Parthenope was a carefree child who developed a talent for drawing and watercolors. Florence, on the other hand, was more focused and methodical. She developed a love for languages, and despite her struggles learning to write, she began keeping a journal and writing letters to her many relatives. Once, when she and Parthenope were separated, she challenged her sister to a game in which they took a word and tried to make other words from its letters. "I took 'breath' and I made forty words," she claimed.

Unfortunately, Florence often came across as arrogant, and she sometimes looked down on her easygoing older sister. She even went so far as to tell Christie, "Parthe and I are so

different, that we require different treatment.” As it turned out, “different treatment” is exactly what they got. Christie allowed Parthenope to go her own way but disciplined Florence strictly. In one journal entry, Florence reported that she had been required to “sit still by Miss Christie till I had the spirit of obedience.” Later, as an adult, Florence looked back at those days and concluded that Christie “was just and well intentioned, but she did not understand children.”

With her shyness, her sense that she didn’t fit in, and the stern treatment of her governess all pressing down on her, Florence began to withdraw from the real world and take refuge in daydreams and fantasies. Relatives began to notice that when the girls visited, Parthenope enjoyed all of the things that had been prepared for them, but Florence paid no attention. She continued “dreaming” well into her twenties, and it became such a powerful habit that at times she worried it would overwhelm her.

Things changed in the spring of 1831 when Christie left the Nightingale household to get married and William decided to take over educating his daughters himself. Florence could not have asked for better. William had studied at Trinity College, Cambridge, although he had been unable to earn a degree because he was a “dissenter”—a member of a Protestant church rather than the Church of England (specifically, he was a Unitarian). He believed that girls deserved just as much education as boys, and he was determined to live out that belief in his own family.

Gone were the days with only two or three hours of formal schooling. A new governess was hired to continue

the lessons in music and drawing, while William taught his daughters Greek, Latin, history, and philosophy. By the time Florence was sixteen, he had added grammar and composition, along with basic lessons in geography, chemistry, physics, and astronomy—but only an elementary level of mathematics.

Florence plunged headlong into the challenge. “For seven years of my life,” she later wrote, “I thought of little else but cultivating my intellect.” The day always began with the girls reciting their lessons from the previous day over breakfast, for which Florence would get up as early as three in the morning to prepare. She excelled in Latin and Greek, and by her mid-teens she was translating ancient classics by Homer and Plato. Before long she was mastering French and Italian as well.

But the change in instruction did not work out so well for Parthenope. She could not keep up with the volume of learning that William demanded, and she could not match Florence’s powers of concentration and discipline. Her father—not the most tactful of instructors—eventually concluded that she didn’t have “the means or the energy” to study science and told her frankly that she struggled with languages because her grammar “came off very short.”

The truth was that Parthenope was not interested in subjects like Greek or philosophy. She much preferred poetry, painting, and other subjects that were considered “ladylike” at the time. But she still wanted her father’s attention, and she was jealous of Florence’s successes. After a few years, she wrote to William while he was away, protesting the

situation. He replied with a promise to find other subjects that he could teach her that would bring them closer. Even with different subjects, however, Parthenope still could not apply herself to the degree that he wanted. She grew bored and resentful, and he was angry with her in return.

And so, as the girls passed through their teen years, the household interests and activities became divided. Florence spent her days in the family library, reading and studying as her father taught from behind a tall, specially made desk that allowed him to work standing up. Parthenope, meanwhile, joined her mother in the drawing room, where they worked on flower arrangements, planned parties and other visits from their friends, and wrote letters to their relatives.

Florence loved her life of learning, but as she grew up, she began to grow restless. She wanted to *do* something with her education. Women in her social class were expected to live the kind of life her mother did—one that Parthenope was readily embracing. Florence considered that kind of life to be “frittering time away on useless trifles” and wanted something more meaningful. Over time, this created friction with her father, who valued education more for its own sake. Apart from a failed run for Parliament in 1835 (lost in large part because he opposed the common practice of bribing voters), he lived the life of an English country gentleman, spending his days reading or standing at his desk contemplating deep philosophical questions. Florence loved him dearly, but watching him live aimlessly couldn’t help but disappoint her. It was hard for her to watch him

refuse the kind of purposeful life she longed for but was not supposed to have.

By 1836 the time was approaching for the girls to be presented formally as young ladies in society. Lea Hurst was too remote for the event, but Fanny considered Embley Park too small. She proposed that the family go on another extended trip while a new extension was built. William, eager to repeat the success of his upgrade at Lea Hurst, got to work on some new designs, not just for the house, but also for an oversized carriage to take them on their journey. The family made plans to leave in September of 1837.

But then, seven months before their departure, something happened. As Florence's own notes record, "On February 7th, 1837, God spoke to me and called me to His service."

Florence's religious upbringing had not placed much emphasis on mystical experiences. The Nightingale family was Unitarian, although both girls had been baptized into the Church of England. Florence had developed her own set of beliefs that combined elements of both, as well as other philosophies, but they were always more practical in nature, shunning the supernatural. Nevertheless, on that day in February, she fully believed that God had spoken to her. She was far less certain, though, about what God was calling her to do.