

MANTEL UNHYPHENATED

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A biologist friend once asked me about the ‘Hansel and Gretel’ test in statistics. In a flash my SAT training came back – Hansel is to Gretel as ... Mantel is to Haenszel; once you hear the first half the rest attaches by hyphenation. How did this child of immigrants, who grew up poor on the Lower East Side of New York City, develop into the creative force whose work has become an integral part of the tool chest of applied statistics? The Mantel–Haenszel test along with its estimator of the common odds ratio for sets of fourfold tables,¹ the Mantel–Bryan approach to safety testing,² and the logrank test for survival data³ are methods so standard that it seems as if our armamentarium of statistics has always included them. But these methods did not arise *ab ovo*; instead they, and many other techniques that are part of statisticians’ shared knowledge, sprang from the insight, imagination and intuition of Nathan Mantel.

The next two articles in this issue will describe specific contributions that Nathan has made to the statistical literature; this article traces Nathan’s early background in order to provide a window into some influences that helped shape his ability to see the world flexibly and with originality.

Nathan’s sister, Anne Smith, says she has no idea how Nathan developed his creative genius. Characterizing their childhood as ‘bleak’, she marvels that Nathan’s genius ‘came from nowhere’. She remembers him as always very serious about life, very driven in his work, and very devoted to her in his brotherly role. Certain themes do emerge from his memories of his childhood and early adult life: a tradition of intellectual pursuits, closeness to several remarkably accomplished women, a set of influential teachers, and a series of serendipitous events from which he was able to weave insights.

Born in 1919 in the Lower East Side of Manhattan, the son of a mother from that part of Hungary that later became Czechoslovakia and a father from that part of Austria that later became Poland, Mantel was a member of a remarkable group of second-generation New York Jews who helped forge modern American science and mathematics. Nathan’s mother, née Steinberg, the eldest of 12 sisters, was the only member of her immediate family to emigrate to the United States. Her parents and all her 11 sisters were killed in the Holocaust. When Nathan was growing up, his mother read the Yiddish daily paper, *The Forward*, which was influential in acculturating Jews from Eastern Europe to their new country.

From his father’s side came the name ‘Mantel’ – ‘mirror’ in Flemish and ‘cloak’ in many other European languages. In Dutch as well as English, a ‘mantel’ is a ‘cloak for the fireplace’.

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Presumably, Nathan's paternal side had been in the glass and mirror business in Europe. (An interesting aside is that the apparently different name 'Glazier' and its variants are related to 'Mantel'. On the other hand, 'Mandel' and similar names come from an entirely different root meaning 'almond', as in 'mandelbrot' or 'almond bread'.) Nathan's father Hyman (known as Nehemya) was born in Galicia in 1887. He served in the Austrian army and emigrated to the United States in 1914, just before the outbreak of World War I. The first in his family to arrive in America, he helped other members of his family emigrate. One brother moved to Cleveland; a brother who remained in Poland was killed in the Holocaust. All four sisters emigrated; one married a butcher, another a postal worker in Brooklyn, the third a grocer, and the fourth a waiter. By profession, Nathan's father was a glazier. He kept pigeons at his place of work. In the community, he was highly respected for his knowledge of Torah and religious writings. His 'shul', or synagogue, did not occupy a separate building, but rather a poorly lit loft in a commercial building. He was an active member of the Strelisker Society, a fraternal burial society.

Nathan remembers his paternal grandfather, who died at the age of 101, spending all his time in prayer. Nathan's paternal grandmother, the breadwinner of the family, sold dry goods from a stand on Hester Street in New York. This family structure – a pious husband who studied and prayed and a wife who served as breadwinner – was common among Jews in Eastern Europe and among the first generation of immigrants to the United States in the early part of this century.⁴

The Lower East Side (Figure 1) teemed not only with the religious fervour of the generation of immigrants, but with much progressive social experimentation. Nathan was a product of that duality; he grew up in a family with a religious background on his father's side, coupled with his mother's determination to enter the modern world of the country to which she had immigrated.

By all reports, Nathan was a beautiful infant. His parents, like parents of other beautiful babies in the same cultural milieu, loaned him to sleep with pregnant women so that his lovely visage would help mould the appearance of their unborn children.

His public education encouraged intellectual achievement and assimilation into the society at large. At the age of two, Nathan (Naftoolyah, a.k.a. Sonny) and his two sisters, Ray (Rifka, born 1917) and Anne (Channa, born 1920), began 'school' at the Clark House, a charitable organization providing care for preschool children in order to allow their mothers the opportunity to work or to participate in activities in the city. This modern concept helped assimilate the newcomers into the United States. Nathan's family spoke Yiddish at home; the children learned English at the Clark House. When Nathan was four, he entered PS 88 as a kindergarten student and he remained there for several years of elementary school.

Because Nathan was a sickly child, he missed many days of school. When he was young, his family believed he had a weak heart. At times he was placed in a convalescent home because he was so tiny. Always the skinniest in his class, he weighed 80 pounds when he graduated from high school and about 90 pounds on graduation from college.

His family was poor. His first home was a three room railroad apartment in a tenement building on Cannon Street in the Lower East Side. Railroad apartments were so named because the rooms attached one to another without corridors separating them (Figure 2). Nathan recalls rats entering the tenement from the walls and then roosting on the pipes. The family shared their hall toilet with another family that lived on the same floor. Light came from gas jets even though other buildings had electric lights. The washtub in the kitchen served as a bathtub. In this apartment he once put a bead in his ear where it remained for 15 years until during his examination for the military draft a physician pulled the bead from Nathan's ear.



Figure 1. Map of Manhattan

While he was still in elementary school, his family moved to a nicer apartment. Although this apartment had primitive electric lights made by wrapping wire around a ceramic cone, Nathan's family never had a radio or telephone. On Saturday mornings, the Mantel children and their friends attended religious services. In the afternoon, despite the religious proscription against viewing movies on the Sabbath, they attended double feature movies, two for a nickel. Nathan's only toys were a 10-cent wind-up car and marbles. As was common in those days, the family had a roomer who lived with them. As a consequence of the move, Nathan changed elementary schools to PS 15. He remembers that his sixth grade teacher influenced him considerably. A member of his sixth grade class was Harry Proschansky, whose brother Frank Proschan and nephew Michael Proschan have both become well known statisticians.

Soon after they had moved to their new apartment, his mother and father separated. The family moved again. Once the Home Relief Company, a social service agency, brought a ham in an effort to help the family. Products from pigs were forbidden in kosher homes, but this ham arrived when Nathan and his sisters were alone in the apartment. The three hungry children very gingerly ate a few small slices of it.

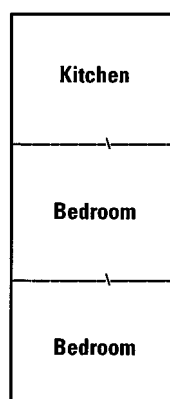


Figure 2. Nathan's three-room railroad apartment

Nathan attended JHS 64, the Henry P. O'Neill Junior High School 10th Street and Avenue B. As part of his education, he, like many of his classmates, also attended the Downtown Talmud Torah from elementary school to the first years of junior high school. Here he learned Hebrew well enough to read fairy tales in modern Hebrew. Had life proceeded as planned, he would have become a Bar Mitzvah when he reached 13 years old in the Orthodox shul his father attended. True to tradition, the men and women sat in separate sections of the synagogue and all had covered heads during the service.

Everything changed just before his 13th birthday, the age when he was to become a Bar Mitzvah. In the last semester of junior high school, as a consequence of the financial pressures caused by his parents' separation and his father's failure to support the family, his mother sent her three children to live at the Hebrew Orphan Asylum at 137th Street and Amsterdam Avenue. Suddenly, this skinny, shy, child who had never before ventured outside the confines of the Lower East Side was forced to commute the entire length of Manhattan by subway to attend school. Manhattan's German Jewry, the aristocracy of American Jews at the time, had established the Asylum for the benefit of Eastern European Jews.⁵ The children, most of whose first language was Yiddish, were permitted to speak only English. The religious services were conducted in the newly developed liturgy of German Reform Judaism. Girls and boys sat together during the services; no one wore hats. The services themselves were short; much of the language was neither Hebrew nor Aramaic, as in the Orthodox tradition, but English. Thus Nathan became a Bar Mitzvah in the very Reform setting of the Asylum. The dissonance Nathan felt between the Orthodox tradition with which he had grown up and the Reform service of the Asylum led him to sever completely his connection with formal Jewish education. He remained at the Home for a year and a half; his sisters stayed longer.

While her children were living at the Asylum, Nathan's mother opened a restaurant, The Rose Restaurant, on St. Mark's Place. She sold it a few years later for \$1000 and began to work as a chef in restaurants owned by others. During the summer, she worked in Jewish hotels in the Catskills. At times she was the chef for caterers who serviced very large weddings and Bar Mitzvahs. When she was older, she remembered distinctly, but clearly incorrectly, that she helped cater Mickey Mantle's Bar Mitzvah.

For high school, Nathan attended Stuyvesant High School, a public school on 15th Street and 1st Avenue. He thrived academically at Stuyvesant, which was then, as now, a school that excelled in science and mathematics. In those days Stuyvesant had two sessions. The morning session, designed for the academically gifted, lasted from 8.00 am to 12.30 pm. For those like Nathan who attended this morning session, afternoon was reserved for extracurricular activities. Stuyvesant required each student to take four semester of shop over the course of their schooling. Each shop semester lasted two periods every day, five days each week. Nathan took woodturning, house-building, foundry and mechanical drawing. The last had a permanent effect, for Nathan has printed letters as small and large capitals ever since. (As another aside, the lathe-turned wooden jewellery box my father made in his woodturning class at Stuyvesant now sits on my bureau, its top still fitting perfectly onto the box after all these years.)

Nathan has warm memories of his teachers and their influence upon him. His English teacher, Mr. Megaro, was devoted to Bette Davis. Mr. Megaro won a slogan contest for Kotex with the words. 'If it's not the best thing in the world, at least it's next to it'. In those days, however, risqué was unacceptable, and the award was taken away. Another English teacher, Joseph Shipley, was a prolific author of books on literature (for example, references 6 and 7). The head of the English department, Mr. Mostow, encouraged Nathan to publish a composition he wrote about chess in *The Caliper*, Stuyvesant's literary magazine.

Nathan joined the math team, but recalls being a 'stringer' rather than one of the strongest members. While on the team, he did derive a way to solve the Diophantine equation $ax - by = c$, which he published later in the *American Mathematical Monthly*.⁸ He recalls some exploits of other members of his team. One member had a BB gun which he used to shoot out light bulbs in the hall of apartment buildings. Another used to 'borrow' mathematics textbooks permanently from the Stuyvesant library, for he said that he would put the books to better use than the library would. In high school, *plus ça change ...*

Nathan says he never learned how to study at Stuyvesant. Instead he would listen to his teacher's lessons in class and then extrapolate intuitively to other situations. His teachers often granted him extra credit for the originality of his solutions. He received medals as the best student in plane geometry, in intermediate algebra, in second year Spanish, and in fourth year French. (His French teacher also taught mathematics.) In solid geometry, he received a perfect score on the test that was to determine who would receive the medal, but since he was already winning the French medal and someone else had also received a perfect score in solid geometry, his teachers gave Nathan the medal in French and the other person received the solid geometry medal. His Spanish teacher thought that Nathan would become a Spanish teacher. He spent an extra semester at Stuyvesant in order to graduate in June rather than in January. At the end of high school, he received a New York State Regent's scholarship of \$100 each year; this money allowed him to attend college.

The second major change in his life was his entrance to City College. Again, the rules turned suddenly upside-down. No longer did novel solutions receive extra credit; the professors expected their students to study and to regurgitate the lessons written in the textbooks. Studying was not Nathan's forté; he had succeeded at Stuyvesant by dint of his ability to solve problems quickly without ever learning previous solutions. In his first semester at City College he received five Cs and one D. The D was in his math course – analytic geometry and differential calculus! His professor – whose name Nathan remembers as Professor Ferkins – required the students to memorize formulae. Later, his grades improved, but to this day he views City in those years as a place that quashed innovation and Stuyvesant as an institution that encouraged it. He majored

in 'statistics', which he viewed as 'math for something'. The professor who taught most of the statistics courses was John Firestone. Marvin Schneiderman, Seymour Jablon, Joseph Steinberg, Manny Landau, Myron Greenwald, Norman Itzkowitz (later Lawrence), Bernie Greenberg, and Ed Goldfeld all attended statistics classes with Nathan. Several later had distinguished careers at the Census Bureau. Mantel and Schneiderman eventually ended up together at the National Cancer Institute and Greenberg became the chairman of biostatistics at the University of North Carolina at Chapel Hill. Many years later, Firestone contacted Nathan to aid on a consulting project.

His years at City College connect Nathan to my family, a fact that I learned many years later. My great aunt, Fanny Turk Gerber, was a highly successful dentist who ran an unusual household⁹ with the dental office as a part of the apartment. Patients and friends used Fanny's living room as a combination salon and waiting room. Fanny's son, Leon, and Nathan became close friends at City College. Like so many others, Nathan, Leon, and their friends spent hours at Fanny's house. One of these friends was Jerry Grebanier, whose mother Frances Winwar (a literal translation of her original Italian name 'Vinciguerra') was an award-winning author of many books including *Poor Splendid Wings*.¹⁰ My grandfather, also a dentist, but as unsuccessful at his profession as his sister was successful, played cards at his sister Fanny's house. Nathan remembers long rounds of casino and some game called Misery. My grandfather gave the students puzzles to solve in mathematics and logic. Nathan recalls a fire always burning in the fireplace and Fanny encouraging the boys to throw her old furniture into the fire when she decided she no longer liked a piece. (My father, a few years older than Nathan, insists that Fanny used the fireplace only for garbage, not for furniture.)

Before entering college, Nathan embarked on an adventure. His high school classmate Lester Newhouse had a brother Ed who served as a sports editor for the *Daily Worker*. Ed had written a book that described his experience as a hobo travelling through the United States by refrigerator car.¹¹ In 1935 Nathan and Lester decided to ride the trains to St. Louis because the Browns had captured the National League baseball pennant in 1934 and went on to win the World Series. Moreover, Lester wanted to follow in his brother's footsteps. Nathan and Lester hitch-hiked to the railroad yards in Baltimore. They slept in the aisle of a passenger coach. In the morning, they continued to hitch-hike. Eventually they hopped onto a moving freight train and sat on a ledge between cars. To this day, Nathan remembers the experience as frightening. They took another train from Wheeling, West Virginia to Benwood, West Virginia and walked across the bridge to Bellaire, Ohio, where Lester caught poison ivy. That ended the trip and they returned by bus to New York.

Nathan's first job after graduating from college was as a station clerk at the New York City Department of Sanitation; his annual salary was \$840. After taking the Civil Service examination for Junior Statistician in 1939, he was offered a job in Washington DC as an 'Assistant Messenger' for the Securities and Exchange Commission at an annual salary of \$1080. A few months later, he accepted a temporary position (January to June 1940) as a statistical clerk in the General Land Office of the Department of Interior in Washington DC.

His next job was as a skilled labourer for the night shift (8.00 pm to 4.30 am) at the Government Printing Office. He was offered the night shift which paid 75 cents an hour instead of the day rate of only 66 cents. Within six months, Robert Nathan of the Advisory Commission to the Council of National Defense, which later was incorporated into the War Production Board, recruited him to work on a problem with estimating civilian requirements for strategic and critical materials. There he used the Ezekiel-Bean method of graphical correlations. Later the Board began to

emphasize the efficiency of plant utilization of machine tools to see if they were being used a high proportion of hours a week.

Next came service in the military from October 1942 to January 1946. He began in the 55th Armored Infantry Regiment of the 11th Armored Division at Camp Polk, Louisiana. He was then recruited to work with the Statistical Control Office in Wright Field outside Dayton, Ohio. Coincidentally, Schneiderman was also working there, but he and Nathan did not meet then. At Wright, an Air Force facility, Nathan's work remained focused on efficiency, but now the problem related to the efficiency of labour utilization as measured in terms of pounds of airplane frames, engines and propellers produced per man-hour of work. The method took into account the fact that the larger the plane, the more pounds of production were possible per man-hour because production was a function of surface area. He used a $2/3$ rule to evaluate efficiency. Weight varies with cubic dimension, but surface area varies by the square. He also incorporated the fact that the more experience people had with a specific model of a plane, the more pounds they could produce. Thus, he incorporated learning in his analysis. He credits his work at Wright Field for his lifelong ability to think about efficiency. Later, he applied the same principle concerning surface area to different species. The same dose per unit weight that is effective for a mouse will kill an elephant, for the tolerance to drug per unit weight decreases as the species gets larger. Since the action of most agents is on surfaces, not on the whole organism, Nathan used the principle that generalizing from species to species required estimating relative surface area by $(\text{weight})^{2/3}$.

A series of transfers followed. He spent time in a weather station at the Air Force field near Orlando, Florida. His next assignment was the Bureau of Entomology and Plant Quarantine of Department of Agriculture, where the group was studying synergists for DDT to protect soldiers against disease-bearing insects. Although his official title was 'Clerk, Non-typist', he assumed the role of statistician. Nathan, working in a laboratory with his supervisor Jack Williams, exposed flies and mosquitoes to various chemicals, especially pyrethrums, and examined them to see how many were killed. Some of Nathan's ideas about the statistical analysis of synergy stem from his early work on DDT.

Then the Air Force needed a 'Clerk, Non-typist' in Hawaii. Since all others with that job title were on leave, Nathan was selected to go. The Air Force shipped Nathan from Texas to Utah to Seattle, back to Texas, and finally to Virginia, but he never reached Hawaii. Instead, the Air Force sent him to a separation centre in New York to receive a discharge that marked the end of his military service.

By now it was 1946, and the war had ended. Nathan returned to the War Production Board which had been renamed the Civilian Production Administration. Just when he was to be promoted to GS-13, the Board terminated his job. Out of work, he began receiving unemployment benefits. Fortunately for the field of biostatistics, Nathan was sent in 1947 to the National Cancer Institute (NCI) to interview with Harold Dorn who was then heading a small statistics group of which Jerry Cornfield was a member. Nathan started working with Jerry immediately. Nathan assumed that Jerry had been at the NCI for many years, but he learned much later that Jerry had arrived only about one month before Nathan. Sam Greenhouse and Marvin Schneiderman joined the group one year later. Nathan remembers talk about animals, for Dorn used to keep bees and Cornfield used to keep goats. Jerry and Nathan published their first joint work in 1950 on a method for probit analysis.¹² The primary importance of the paper was not the method it introduced but rather its explicit recognition that sometimes using a model allows one to handle problems effectively even if the model is not exactly right. In this case, even if the probit model were not correct, its use gave reasonable graduations of the data.

Nathan's arrival at the NCI occurred by chance. He brought with him no particular knowledge about cancer but instead insights from many experiences and an uncanny ability to perceive connections between seemingly unrelated problems.

As a final note, a little story, Nathan and my family had lost touch with each other over the decades after the 1930s. I first met Nathan in 1970, when I was a research assistant in Bethesda, Maryland, for Jerry Cornfield. Nathan, who had remained a close colleague of Jerry's from their days at NCI, was a frequent visitor to the office. Because I was young and he was famous, we rarely spoke. Moreover, because my name was Wittes and the family names he knew were Gerber and Turk, he did not connect me to his past. I did overhear many heated conversations between Nathan and Jerry. Oddly, when I once tried to describe Nathan to my husband, I said that Nathan reminded me of my grandfather because they shared a complete disregard for convention and outward appearance, an intense interest in solving problems, and a seeming obliviousness to the fact that the rest of the world saw women as intellectually less capable than men. In 1970, after I had moved to New York City, Jerry gave Nathan my curriculum vitae on which was listed a paper co-authored with Amos Turk. Nathan called me at home. 'How long have you known Amos Turk?' 'Thirty years,' I replied instantly. Long pause, the second longest pause I have ever experienced with Nathan. 'How old are you?' he demanded. 'Thirty,' I answered. And now the longest pause came, followed by an almost timid, 'How do you know Amos Turk?' My answer: 'He is my father.' And that is how the families reconnected.

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